2025

VOLUME II – UWMP APPENDICES

URBAN WATER MANAGEMENT PLAN



PREPARED BY

CIVILTEC engineering inc.

JUNE 2026

VOLUME II – UWMP APPENDICES

2025 URBAN WATER MANAGEMENT PLAN

ADOPTED BY THE BOARD:

JUNE 2026

PREPARED FOR:

City of Corona
755 Public Safety Way
Corona, CA 92878
Phone: 951.736.2234

PREPARED BY:

Civiltec Engineering, Inc.

Appendix A - Urban Water Management Planning Act

Appendix A
California Water Code—Urban Water Management Planning

This material is for informational purposes only and is not to be used in place of official California Water Code.

This appendix presents updated sections of California Water Code (Water Code) as of the publication of this Guidebook and as compiled by California Department of Water Resources (DWR) staff. The selection here focuses on the portions of Water Code directly relevant to preparation of an Urban Water Management Plan (UWMP), and sections of Water Code that are contextually relevant to urban water suppliers and DWR.

Water Code published here also concerns the Urban Water Management Planning Act, the Water Conservation Act of 2009 (SB X7-7), which covers sustainable water use and demand reduction, and more. Further legislative information is available on the California Legislative Information website.

Contents

Water Conservation Act of 2009 (SB X7-7) **A-3**

- Chapter 1. General Declarations and Policy, Sections 10608–10608.8 ..... A-3
- Chapter 2. Definitions, Section 10608.12 ..... A-5
- Chapter 2.5. Nonfunctional Turf A-9
- Chapter 3. Urban Retail Water Suppliers, Sections 10608.16–10608.44 ..... A-11
- Chapter 5. Sustainable Water Management, Section 10608.50 ..... A-21
- Chapter 6. Standardized Data Collection, Section 10608.52 ..... A-22
- Chapter 7. Funding Provisions, Sections 10608.56–10608.60 ..... A-23
- Chapter 9. Urban Water Use Objectives and Water Use Reporting, Sections 10609–10609.38 ..... A-24

Urban Water Management Planning Act **A-39**

- Chapter 1. General Declaration and Policy, Sections 10610–10610.4 ..... A-39
- Chapter 2. Definitions, Sections 10611–10618 ..... A-40
- Chapter 3. Urban Water Management Plans A-42
  - Article 1. General Provisions, Sections 10620–10621 ..... A-42
  - Article 2. Contents of Plans, Sections 10630–10634 ..... A-44

Article 2.5. Water Service Reliability, Section 10635 ..... A-54
Article 3. Adoption and Implementation of Plans, Sections 10640–10645 ..... A-55
Chapter 4. Miscellaneous Provisions, Sections 10650–10657 ..... A-58

Water Conservation Act of 2009 (SB X7-7)

This section contains information extracted from Water Code Division 6, *Conservation, Development, and Utilization of State Water Resources*, Part 2.55, *Sustainable Water Use And Demand Reduction*. Click on any section header below to read Water Code directly at the California Legislative Information website.

Chapter 1. General Declarations and Policy, Sections 10608–10608.8

Section 10608.

The Legislature finds and declares all of the following:

(a) Water is a public resource that the California Constitution protects against waste and unreasonable use.

(b) Growing population, climate change, and the need to protect and grow California's economy while protecting and restoring our fish and wildlife habitats make it essential that the state manage its water resources as efficiently as possible.

(c) Diverse regional water supply portfolios will increase water supply reliability and reduce dependence on the Delta.

(d) Reduced water use through conservation provides significant energy and environmental benefits, and can help protect water quality, improve streamflows, and reduce greenhouse gas emissions.

(e) The success of state and local water conservation programs to increase efficiency of water use is best determined on the basis of measurable outcomes related to water use or efficiency.

(f) Improvements in technology and management practices offer the potential for increasing water efficiency in California over time, providing an essential water management tool to meet the need for water for urban, agricultural, and environmental uses.

(g) The Governor has called for a 20 percent per capita reduction in urban water use statewide by 2020.

(h) The factors used to formulate water use efficiency targets can vary significantly from location to location based on factors including weather, patterns of urban and suburban development, and past efforts to enhance water use efficiency.

(i) Per capita water use is a valid measure of a water provider's efforts to reduce urban water use within its service area. However, per capita water use is less

useful for measuring relative water use efficiency between different water providers. Differences in weather, historical patterns of urban and suburban development, and density of housing in a particular location need to be considered when assessing per capita water use as a measure of efficiency.

Section 10608.4.

It is the intent of the Legislature, by the enactment of this part, to do all of the following:

(a) Require all water suppliers to increase the efficiency of use of this essential resource.

(b) Establish a framework to meet the state targets for urban water conservation identified in this part and called for by the Governor.

(c) Measure increased efficiency of urban water use on a per capita basis.

(d) Establish a method or methods for urban retail water suppliers to determine targets for achieving increased water use efficiency by the year 2020, in accordance with the Governor's goal of a 20- percent reduction.

(e) Establish consistent water use efficiency planning and implementation standards for urban water suppliers and agricultural water suppliers.

(f) Promote urban water conservation standards that are consistent with the California Urban Water Conservation Council's adopted best management practices and the requirements for demand management in Section 10631.

(g) Establish standards that recognize and provide credit to water suppliers that made substantial capital investments in urban water conservation since the drought of the early 1990s.

(h) Recognize and account for the investment of urban retail water suppliers in providing recycled water for beneficial uses.

(i) Require implementation of specified efficient water management practices for agricultural water suppliers.

(k) Support the economic productivity of California's agricultural, commercial, and industrial sectors.

(l) Advance regional water resources management.

Section 10608.8.

(a)

(1) Water use efficiency measures adopted and implemented pursuant to this part or Part 2.8 (commencing with Section 10800) are water conservation measures subject to the protections provided under Section 1011.

(2) Because an urban agency is not required to meet its urban water use target until 2020 pursuant to subdivision (b) of Section 10608.24, an urban retail water supplier's failure to meet those targets shall not establish a violation of law for purposes of any state administrative or judicial proceeding prior to January 1, 2021. Nothing in this paragraph limits the use of data reported to the department or the board in litigation or an administrative proceeding. This paragraph shall become inoperative on January 1, 2021.

(3) To the extent feasible, the department and the board shall provide for the use of water conservation reports required under this part to meet the requirements of Section 1011 for water conservation reporting.

(b) This part does not limit or otherwise affect the application of Chapter 3.5 commencing with Section 11340), Chapter 4 (commencing with Section 11370), Chapter 4.5 (commencing with Section 11400), and Chapter 5 (commencing with Section 11500) of Part 1 of Division 3 of Title 2 of the Government Code.

(c) This part does not require a reduction in the total water used in the agricultural or urban sectors, because other factors, including, but not limited to, changes in agricultural economics or population growth may have greater effects on water use. This part does not limit the economic productivity of California's agricultural, commercial, or industrial sectors.

(d) The requirements of this part do not apply to an agricultural water supplier that is a party to the Quantification Settlement Agreement, as defined in subdivision (a) of Section 1 of Chapter 617 of the Statutes of 2002, during the period within which the Quantification Settlement Agreement remains in effect. After the expiration of the Quantification Settlement Agreement, to the extent conservation water projects implemented as part of the Quantification Settlement Agreement remain in effect, the conserved water created as part of those projects shall be credited against the obligations of the agricultural water supplier pursuant to this part.

Chapter 2. Definitions, Section 10608.12

Section 10608.12.

Unless the context otherwise requires, the following definitions govern the construction of this part:

(a) "Affordable housing" has the same meaning as defined in Section 34191.30 of the Health and Safety Code.

(b) "Agricultural water supplier" means a water supplier, either publicly or privately owned, providing water to 10,000 or more irrigated acres, excluding recycled water. "Agricultural water supplier" includes a supplier or contractor

for water, regardless of the basis of right, that distributes or sells water for ultimate resale to customers. "Agricultural water supplier" does not include the department.

(c) "Base daily per capita water use" means any of the following:

(1) The urban retail water supplier's estimate of its average gross water use, reported in gallons per capita per day and calculated over a continuous 10-year period ending no earlier than December 31, 2004, and no later than December 31, 2010.

(2) For an urban retail water supplier that meets at least 10 percent of its 2008 measured retail water demand through recycled water that is delivered within the service area of an urban retail water supplier or its urban wholesale water supplier, the urban retail water supplier may extend the

(3) calculation described in paragraph (1) up to an additional five years to a maximum of a continuous 15-year period ending no earlier than December 31, 2004, and no later than December 31, 2010.

(4) For the purposes of Section 10608.22, the urban retail water supplier's estimate of its average gross water use, reported in gallons per capita per day and calculated over a continuous five-year period ending no earlier than December 31, 2007, and no later than December 31, 2010.

(d) Baseline commercial, industrial, and institutional water use" means an urban retail water supplier's base daily per capita water use for commercial, industrial, and institutional users.

(e) "CII water use" means water used by commercial water users, industrial water users, institutional water users, and large landscape water users.

(f) "Commercial water user" means a water user that provides or distributes a product or service.

(g) "Common area" means that portion of a common interest development or of a property owned or managed by a homeowners' association or a community service organization or similar entity that is not assigned or allocated to the exclusive use of the occupants of an individual dwelling unit within the property.

(h) "Common interest development" has the same meaning as in Section 4100 of the Civil Code.

(i) "Community service organization or similar entity" has the same meaning as in Section 4110 of the Civil Code.

(j) "Community space" means an area designated by a property owner or a governmental agency to accommodate human foot traffic for civic, ceremonial, or other community events or social gatherings

(k) Compliance daily per capita water use" means the gross water use during the final year of the reporting period, reported in gallons per capita per day.

(l) "Disadvantaged community" means a community with an annual median household income that is less than 80 percent of the statewide annual median household income.

(m) "Functional turf" means a ground cover surface of turf located in a recreational use area or community space. Turf enclosed by fencing or other barriers to permanently preclude human access for recreation or assembly is not functional turf.

(n) "Gross water use" means the total volume of water, whether treated or untreated, entering the distribution system of an urban retail water supplier, excluding all of the following:

(1) Recycled water that is delivered within the service area of an urban retail water supplier or its urban wholesale water supplier.

(2) The net volume of water that the urban retail water supplier places into long-term storage.

(3) The volume of water the urban retail water supplier conveys for use by another urban water supplier.

(4) The volume of water delivered for agricultural use, except as otherwise provided in subdivision (f) of Section 10608.24.

(o) "Homeowners' association" means an "association" as defined in Section 4080 of the Civil Code.

(p) "Industrial water user" means a water user that is primarily a manufacturer or processor of materials as defined by the North American Industry Classification System code sectors 31 to 33, inclusive, or an entity that is a water user primarily engaged in research and development.

(q) "Institutional water user" means a water user dedicated to public service. This type of user includes, among other users, higher education institutions, schools, courts, churches, hospitals, government facilities, and nonprofit research institutions.

(r) "Interim urban water use target" means the midpoint between the urban retail water supplier's base daily per capita water use and the urban retail water supplier's urban water use target for 2020.

(s) "Large landscape" means a nonresidential landscape as described in the performance measures for CII water use adopted pursuant to Section 10609.10.

(t) "Locally cost effective" means that the present value of the local benefits of implementing an agricultural efficiency water management practice is greater

than or equal to the present value of the local cost of implementing that measure.

(u) "Nonfunctional turf" means any turf that is not functional turf, and includes turf located within street rights-of-way and parking lots.

(v) "Performance measures" means actions to be taken by urban retail water suppliers that will result in increased water use efficiency by CII water users. Performance measures may include, but are not limited to, educating CII water users on best management practices, conducting water use audits, and preparing water management plans. Performance measures do not include process water.

(w) "Potable reuse" means direct potable reuse, indirect potable reuse for groundwater recharge, and reservoir water augmentation as those terms are defined in Section 13561.

(x) "Potable water" means water that is suitable for human consumption.

(y) "Process water" means water used by industrial water users for producing a product or product content or water used for research and development. Process water includes, but is not limited to, continuous manufacturing processes, and water used for testing, cleaning, and maintaining equipment. Water used to cool machinery or buildings used in the manufacturing process or necessary to maintain product quality or chemical characteristics for product manufacturing or control rooms, data centers, laboratories, clean rooms, and other industrial facility units that are integral to the manufacturing or research and development process is process water. Water used in the manufacturing process that is necessary for complying with local, state, and federal health and safety laws, and is not incidental water, is process water. Process water does not mean incidental water uses.

(z) "Public water system" has the same meaning as defined in Section 116275 of the Health and Safety Code.

(aa) "Recreational use area" means an area designated by a property owner or a governmental agency to accommodate human foot traffic for recreation, including, but not limited to, sports fields, golf courses, playgrounds, picnic grounds, or pet exercise areas. This recreation may be either formal or informal.

(ab) "Recycled water" means recycled water, as defined in subdivision (n) of Section 13050.

(ac) "Regional water resources management" means sources of supply resulting from watershed-based planning for sustainable local water reliability or any of the following alternative sources of water:

(1) The capture and reuse of stormwater or rainwater.

(2) The use of recycled water.

(3) The desalination of brackish groundwater.

(4) The conjunctive use of surface water and groundwater in a manner that is consistent with the safe yield of the groundwater basin.

(ad) "Reporting period" means the years for which an urban retail water supplier reports compliance with the urban water use targets.

(ae) "Turf" has the same meaning as defined in Section 491 of Title 23 of the California Code of Regulations

(af) "Urban retail water supplier" means a water supplier, either publicly or privately owned, that directly provides potable municipal water to more than 3,000 end users or that supplies more than 3,000 acre-feet of potable water annually at retail for municipal purposes.

(ag) "Urban water supplier" has the same meaning as defined in Section 10617.

(ah) "Urban water use objective" means an estimate of aggregate efficient water use for the previous year based on adopted water use efficiency standards and local service area characteristics for that year, as described in Section 10609.20.

(ai) "Urban water use target" means the urban retail water supplier's targeted future daily per capita water use.

(aj) "Urban wholesale water supplier" means a water supplier, either publicly or privately owned, that provides more than 3,000 acre- feet of water annually at wholesale for potable municipal purposes.

Chapter 2.5. Nonfunctional Turf

Section 10608.14.

(a) The use of potable water for the irrigation of nonfunctional turf located on commercial, industrial, and institutional properties, other than a cemetery, and on properties of homeowners' associations, common interest developments, and community service organizations or similar entities is prohibited as of the following dates:

(1) All properties owned by the Department of General Services, beginning January 1, 2027.

(2) All properties owned by local governments, local or regional public agencies, and public water systems, except those specified in paragraph (5), beginning January 1, 2027.

(3) All other institutional properties and all commercial and industrial properties, beginning January 1, 2028.

(4) All common areas of properties of homeowners' associations, common interest developments, and community service organizations or similar entities, beginning January 1, 2029.

(5) All properties owned by local governments, local public agencies, and public water systems in a disadvantaged community, beginning January 1, 2031, or the date upon which a state funding source is made available to fund conversion of nonfunctional turf on these properties to climate-appropriate landscapes, whichever is later.

(b) Notwithstanding subdivision (a), the use of potable water is not prohibited by this section to the extent necessary to ensure the health of trees and other perennial nonturf plantings, or to the extent necessary to address an immediate health and safety need.

(c) The board may, upon a showing of good cause for reasons including economic hardship, critical business need, and potential impacts to human health or safety, postpone a compliance deadline in subdivision (a) by up to three years for certain persons, institutions, and businesses, and may create a form to be used for compliance certification to the board by property owners.

(d) Public water systems shall, by no later than January 1, 2027, revise their regulations, ordinances, or policies governing water service to include the requirements of subdivisions (a) and (b), as revised by the board pursuant to subdivision (c), and shall communicate the requirements to their customers on or before that date.

(e)

(1) An owner of commercial, industrial, or institutional property with more than 5,000 square feet of irrigated area other than a cemetery shall certify to the board, commencing June 30, 2030, and every three years thereafter through 2039, that their property is in compliance with the requirements of this chapter.

(2) An owner of a property with more than 5,000 square feet of irrigated common area that is a homeowners' association, common interest development, or community service organization or similar entity shall certify to the board, commencing June 30, 2031, and every three years thereafter through 2040, that their property is in compliance with the requirements of this chapter.

(f) Noncompliance by a person or entity with this chapter or regulations adopted thereunder shall be subject to civil liability and penalties set forth in Section 1846, or to civil liability and penalties imposed by an urban retail water supplier pursuant to a locally adopted ordinance or policy.

(g)

(1) A public water system, city, county, or city and county may enforce the provisions of this chapter.

(2) To avoid duplication of enforcement, any entity identified in paragraph (1) that is not a retail public water system shall notify the retail public water system 30 days prior to enforcement of the provisions of this chapter against a property served by such system.

(3) Nothing in paragraph (2) shall preclude enforcement by any entity identified in paragraph (1) once adequate notice is given.

(h) The department shall, when using funds appropriated for water conservation for turf replacement, prioritize financial assistance for nonfunctional turf replacement to public water systems serving disadvantaged communities and to owners of affordable housing.

(i) The department shall utilize the saveourwater.com internet website and outreach campaign to provide information and resources on converting nonfunctional turf to native vegetation.

(j) The Governor's Office of Business and Economic Development shall support small and minority-owned businesses that provide services that advance compliance with this chapter.

Chapter 3. Urban Retail Water Suppliers, Sections 10608.16–10608.44

Section 10608.16.

(a) The state shall achieve a 20-percent reduction in urban per capita water use in California on or before December 31, 2020.

(1) The state shall make incremental progress towards the state target specified in subdivision (a) by reducing urban per capita water use by at least 10 percent on or before December 31, 2015.

Section 10608.20.

(a)

(1) Each urban retail water supplier shall develop urban water use targets and an interim urban water use target by July 1, 2011. Urban retail water suppliers may elect to determine and report progress toward achieving these targets on an individual or regional basis, as provided in subdivision (a) of Section 10608.28, and may determine the targets on a fiscal year or calendar year basis.

(2) It is the intent of the Legislature that the urban water use targets described in paragraph (1) cumulatively result in a 20-percent reduction from the baseline daily per capita water use by December 31, 2020.

(b) An urban retail water supplier shall adopt one of the following methods for determining its urban water use target pursuant to subdivision (a):

(1) Eighty percent of the urban retail water supplier's baseline per capita daily water use.

(2) The per capita daily water use that is estimated using the sum of the following performance standards:

(A) For indoor residential water use, 55 gallons per capita daily water use as a provisional standard. Upon completion of the department's 2017 report to the Legislature pursuant to Section 10608.42, this standard may be adjusted by the Legislature by statute.

(B) For landscape irrigated through dedicated or residential meters or connections, water efficiency equivalent to the standards of the Model Water Efficient Landscape Ordinance set forth in Chapter 2.7 (commencing with Section 490) of Division 2 of Title 23 of the California Code of Regulations, as in effect the later of the year of the landscape's installation or 1992. An urban retail water supplier using the approach specified in this subparagraph shall use satellite imagery, site visits, or other best available technology to develop an accurate estimate of landscaped areas.

(C) For commercial, industrial, and institutional uses, a 10- percent reduction in water use from the baseline commercial, industrial, and institutional water use by 2020.

(3) Ninety-five percent of the applicable state hydrologic region target, as set forth in the state's draft 20x2020 Water Conservation Plan (dated April 30, 2009). If the service area of an urban water supplier includes more than one hydrologic region, the supplier shall apportion its service area to each region based on population or area.

(4) A method that shall be identified and developed by the department, through a public process, and reported to the Legislature no later than December 31, 2010. The method developed by the department shall identify per capita targets that cumulatively result in a statewide 20-percent reduction in urban daily per capita water use by December 31, 2020. In developing urban daily per capita water use targets, the department shall do all of the following:

(A) Consider climatic differences within the state.

(B) Consider population density differences within the state.

(C) Provide flexibility to communities and regions in meeting the targets.

(D) Consider different levels of per capita water use according to plant water needs in different regions.

(E) Consider different levels of commercial, industrial, and institutional water use in different regions of the state.

(F) Avoid placing an undue hardship on communities that have implemented conservation measures or taken actions to keep per capita water use low.

(c) If the department adopts a regulation pursuant to paragraph (4) of subdivision (b) that results in a requirement that an urban retail water supplier achieve a reduction in daily per capita water use that is greater than 20 percent by December 31, 2020, an urban retail water supplier that adopted the method described in paragraph (4) of subdivision (b) may limit its urban water use target to a reduction of not more than 20 percent by December 31, 2020, by adopting the method described in paragraph (1) of subdivision (b).

(d) The department shall update the method described in paragraph (4) of subdivision (b) and report to the Legislature by December 31, 2014. An urban retail water supplier that adopted the method described in paragraph (4) of subdivision (b) may adopt a new urban daily per capita water use target pursuant to this updated method.

(e) An urban retail water supplier shall include in its urban water management plan due in 2010 pursuant to Part 2.6 (commencing with Section 10610) the baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.

(f) When calculating per capita values for the purposes of this chapter, an urban retail water supplier shall determine population using federal, state, and local population reports and projections.

(g) An urban retail water supplier may update its 2020 urban water use target in its 2015 urban water management plan required pursuant to Part 2.6 (commencing with Section 10610).

(h)

(1) The department, through a public process and in consultation with the California Urban Water Conservation Council, shall develop technical methodologies and criteria for the consistent implementation of this part, including, but not limited to, both of the following:

(A) Methodologies for calculating base daily per capita water use, baseline commercial, industrial, and institutional water use, compliance daily per capita water use, gross water use, service area

population, indoor residential water use, and landscaped area water use.

(B) Criteria for adjustments pursuant to subdivisions (d) and (e) of Section 10608.24.

(2) The department shall post the methodologies and criteria developed pursuant to this subdivision on its internet website, and make written copies available, by October 1, 2010. An urban retail water supplier shall use the methods developed by the department in compliance with this part.

(h)

(1) The department shall adopt regulations for implementation of the provisions relating to process water in accordance with Section 10608.12, subdivision (e) of Section 10608.24, and subdivision (d) of Section 10608.26.

(2) The initial adoption of a regulation authorized by this subdivision is deemed to address an emergency, for purposes of Sections 11346.1 and 11349.6 of the Government Code, and the department is hereby exempted for that purpose from the requirements of subdivision (b) of Section 11346.1 of the Government Code. After the initial adoption of an emergency regulation pursuant to this subdivision, the department shall not request approval from the Office of Administrative Law to readopt the regulation as an emergency regulation pursuant to Section 11346.1 of the Government Code.

(j)

(1) An urban retail water supplier is granted an extension to July 1, 2011, for adoption of an urban water management plan pursuant to Part 2.6 (commencing with Section 10610) due in 2010 to allow the use of technical methodologies developed by the department pursuant to paragraph (4) of subdivision (b) and subdivision (h). An urban retail water supplier that adopts an urban water management plan due in 2010 that does not use the methodologies developed by the department pursuant to subdivision (h) shall amend the plan by July 1, 2011, to comply with this part.

(2) An urban wholesale water supplier whose urban water management plan prepared pursuant to Part 2.6 (commencing with Section 10610) was due and not submitted in 2010 is granted an extension to July 1, 2011, to permit coordination between an urban wholesale water supplier and urban retail water suppliers.

Section 10608.22.

Notwithstanding the method adopted by an urban retail water supplier pursuant to Section 10608.20, an urban retail water supplier's per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use as defined in paragraph (3) of subdivision (c) of Section 10608.12. This section does not apply to an urban retail water supplier with a base daily per capita water use at or below 100 gallons per capita per day.

Section 10608.24.

(a) Each urban retail water supplier shall meet its interim urban water use target by December 31, 2015.

(b) Each urban retail water supplier shall meet its urban water use target by December 31, 2020.

(c) An urban retail water supplier's compliance daily per capita water use shall be the measure of progress toward achievement of its urban water use target.

(d)

(1) When determining compliance daily per capita water use, an urban retail water supplier may consider the following factors:

(A) Differences in evapotranspiration and rainfall in the baseline period compared to the compliance reporting period.

(B) Substantial changes to commercial or industrial water use resulting from increased business output and economic development that have occurred during the reporting period.

(C) Substantial changes to institutional water use resulting from fire suppression services or other extraordinary events, or from new or expanded operations, that have occurred during the reporting period.

(2) If the urban retail water supplier elects to adjust its estimate of compliance daily per capita water use due to one or more of the factors described in paragraph (1), it shall provide the basis for, and data supporting, the adjustment in the report required by Section 10608.40.

(e) When developing the urban water use target pursuant to Section 10608.20, an urban retail water supplier that has a substantial percentage of industrial water use in its service area may exclude process water from the calculation of gross water use to avoid a disproportionate burden on another customer sector.

(f)

(1) An urban retail water supplier that includes agricultural water use in an urban water management plan pursuant to Part 2.6 (commencing with Section 10610) may include the agricultural water use in determining

gross water use. An urban retail water supplier that includes agricultural water use in determining gross water use and develops its urban water use target pursuant to paragraph (2) of subdivision (b) of Section 10608.20 shall use a water efficient standard for agricultural irrigation of 100 percent of reference evapotranspiration multiplied by the crop coefficient for irrigated acres.

(2) An urban retail water supplier, that is also an agricultural water supplier, is not subject to the requirements of Chapter 4 (commencing with Section 10608.48), if the agricultural water use is incorporated into its urban water use target pursuant to paragraph (1).

Section 10608.26.

(a) In complying with this part, an urban retail water supplier shall conduct at least one public hearing to accomplish all of the following:

(1) Allow community input regarding the urban retail water supplier's implementation plan for complying with this part.

(2) Consider the economic impacts of the urban retail water supplier's implementation plan for complying with this part.

(3) Adopt a method, pursuant to subdivision (b) of Section 10608.20, for determining its urban water use target.

(b) In complying with this part, an urban retail water supplier may meet its urban water use target through efficiency improvements in any combination among its customer sectors. An urban retail water supplier shall avoid placing a disproportionate burden on any customer sector.

(c) For an urban retail water supplier that supplies water to a United States Department of Defense military installation, the urban retail water supplier's implementation plan for complying with this part shall consider the conservation of that military installation under federal Executive Order 13514.

(d)

(1) Any ordinance or resolution adopted by an urban retail water supplier after the effective date of this section shall not require existing customers as of the effective date of this section, to undertake changes in product formulation, operations, or equipment that would reduce process water use, but may provide technical assistance and financial incentives to those customers to implement efficiency measures for process water. This section shall not limit an ordinance or resolution adopted pursuant to a declaration of drought emergency by an urban retail water supplier.

(2) This part shall not be construed or enforced so as to interfere with the requirements of Chapter 4 (commencing with Section 113980) to Chapter 13 (commencing with Section 114380), inclusive, of Part 7 of

Division 104 of the Health and Safety Code, or any requirement or standard for the protection of public health, public safety, or worker safety established by federal, state, or local government or recommended by recognized standard setting organizations or trade associations.

Section 10608.28.

(a) An urban retail water supplier may meet its urban water use target within its retail service area, or through mutual agreement, by any of the following:

(1) Through an urban wholesale water supplier.

(2) Through a regional agency authorized to plan and implement water conservation, including, but not limited to, an agency established under the Bay Area Water Supply and Conservation Agency Act (Division 31 (commencing with Section 81300)).

(3) Through a regional water management group as defined in Section 10537.

(4) By an integrated regional water management funding area.

(5) By hydrologic region.

(6) Through other appropriate geographic scales for which computation methods have been developed by the department.

(b) A regional water management group, with the written consent of its member agencies, may undertake any or all planning, reporting, and implementation functions under this chapter for the member agencies that consent to those activities. Any data or reports shall provide information both for the regional water management group and separately for each consenting urban retail water supplier and urban wholesale water supplier.

Section 10608.32.

All costs incurred pursuant to this part by a water utility regulated by the Public Utilities Commission may be recoverable in rates subject to review and approval by the Public Utilities Commission, and may be recorded in a memorandum account and reviewed for reasonableness by the Public Utilities Commission.

Section 10608.34.

(a)

(1) On or before January 1, 2017, the department shall adopt rules for all of the following:

(A) The conduct of standardized water loss audits by urban retail water suppliers in accordance with the method adopted by the American Water Works Association in the third edition of Water Audits and Loss

Control Programs, Manual M36 and in the Free Water Audit Software, version 5.0.

(B) The process for validating a water loss audit report prior to submitting the report to the department. For the purposes of this section, "validating" is a process whereby an urban retail water supplier uses a technical expert to confirm the basis of all data entries in the urban retail water supplier's water loss audit report and to appropriately characterize the quality of the reported data. The validation process shall follow the principles and terminology laid out by the American Water Works Association in the third edition of Water Audits and Loss Control Programs, Manual M36 and in the Free Water Audit Software, version 5.0. A validated water loss audit report shall include the name and technical qualifications of the person engaged for validation.

(C) The technical qualifications required of a person to engage in validation, as described in subparagraph (B).

(D) The certification requirements for a person selected by an urban retail water supplier to provide validation of its own water loss audit report.

(E) The method of submitting a water loss audit report to the department.

(2) The department shall update rules adopted pursuant to paragraph (1) no later than six months after the release of subsequent editions of the American Water Works Association's Water Audits and Loss Control Programs, Manual M36. Except as provided by the department, until the department adopts updated rules pursuant to this paragraph, an urban retail water supplier may rely upon a subsequent edition of the American Water Works Association's Water Audits and Loss Control Programs, Manual M36 or the Free Water Audit Software.

(b)

(1) On or before October 1 of each year until October 1, 2023, each urban retail water supplier reporting on a calendar year basis shall submit a completed and validated water loss audit report for the previous calendar year or the previous fiscal year as prescribed by the department pursuant to subdivision (a).

(2) On or before January 1 of each year until January 1, 2024, each urban retail water supplier reporting on a fiscal year basis shall submit a completed and validated water loss audit report for the previous fiscal year as prescribed by the department pursuant to subdivision (a).

(3) On or before January 1, 2024, and on or before January 1 of each year thereafter, each urban retail water supplier shall submit a completed and

validated water loss audit report for the previous calendar year or previous fiscal year as part of the report submitted to the department pursuant to subdivision (a) of Section 10609.24 and as prescribed by the department pursuant to subdivision (a).

(4) Water loss audit reports submitted on or before October 1, 2017, may be completed and validated with assistance as described in subdivision (c).

(c) Using funds available for the 2016–17 fiscal year, the board shall contribute up to four hundred thousand dollars ($400,000) towards procuring water loss audit report validation assistance for urban retail water suppliers.

(d) Each water loss audit report submitted to the department shall be accompanied by information, in a form specified by the department, identifying steps taken in the preceding year to increase the validity of data entered into the final audit, reduce the volume of apparent losses, and reduce the volume of real losses.

(e) At least one of the following employees of an urban retail water supplier shall attest to each water loss audit report submitted to the department:

(1) The chief financial officer.

(2) The chief engineer.

(3) The general manager.

(f) The department shall deem incomplete and return to the urban retail water supplier any final water loss audit report found by the department to be incomplete, not validated, unattested, or incongruent with known characteristics of water system operations. A water supplier shall resubmit a completed water loss audit report within 90 days of an audit being returned by the department.

(g) The department shall post all validated water loss audit reports on its internet website in a manner that allows for comparisons across water suppliers. The department shall make the validated water loss audit reports available for public viewing in a timely manner after their receipt.

(h) Using available funds, the department shall provide technical assistance to guide urban retail water suppliers' water loss detection programs, including, but not limited to, metering techniques, pressure management techniques, condition-based assessment techniques for transmission and distribution pipelines, and utilization of portable and permanent water loss detection devices.

(i) No earlier than January 1, 2019, and no later than July 1, 2020, the board shall adopt rules requiring urban retail water suppliers to meet performance standards for the volume of water losses. In adopting these rules, the board shall employ full life-cycle cost accounting to evaluate the costs of meeting the performance standards. The board may consider establishing a minimum

allowable water loss threshold that, if reached and maintained by an urban water supplier, would exempt the urban water supplier from further water loss reduction requirements.

Section 10608.35.

(a) The department, in coordination with the board, shall conduct necessary studies and investigations and make a recommendation to the Legislature, by January 1, 2020, on the feasibility of developing and enacting water loss reporting requirements for urban wholesale water suppliers.

(b) The studies and investigations shall include an evaluation of the suitability of applying the processes and requirements of Section 10608.34 to urban wholesale water suppliers.

(c) In conducting necessary studies and investigations and developing its recommendation, the department shall solicit broad public participation from stakeholders and other interested persons.

Section 10608.36.

Urban wholesale water suppliers shall include in the urban water management plans required pursuant to Part 2.6 (commencing with Section 10610) an assessment of their present and proposed future measures, programs, and policies to help achieve the water use reductions required by this part.

Section 10608.40.

Urban water retail suppliers shall report to the department on their progress in meeting their urban water use targets as part of their urban water management plans submitted pursuant to Section 10631. The data shall be reported using a standardized form developed pursuant to Section 10608.52.

Section 10608.42.

(a) The department shall review the 2015 urban water management plans and report to the Legislature by July 1, 2017, on progress towards achieving a 20-percent reduction in urban water use by December 31, 2020. The report shall include recommendations on changes to water efficiency standards or urban water use targets to achieve the 20- percent reduction and to reflect updated efficiency information and technology changes.

(b) A report to be submitted pursuant to subdivision (a) shall be submitted in compliance with Section 9795 of the Government Code.

Section 10608.43.

The department, in conjunction with the California Urban Water Conservation Council, by April 1, 2010, shall convene a representative task force consisting of academic experts, urban retail water suppliers, environmental organizations, commercial water users, industrial water users, and institutional water users to develop alternative best management practices for commercial, industrial, and institutional users and an assessment of the potential statewide water use efficiency improvement in the commercial, industrial, and institutional sectors that would result from implementation of these best management practices. The taskforce, in conjunction with the department, shall submit a report to the Legislature by April 1, 2012, that shall include a review of multiple sectors within commercial, industrial, and institutional users and that shall recommend water use efficiency standards for commercial, industrial, and institutional users among various sectors of water use. The report shall include, but not be limited to, the following:

(a) Appropriate metrics for evaluating commercial, industrial, and institutional water use.

(b) Evaluation of water demands for manufacturing processes, goods, and cooling.

(c) Evaluation of public infrastructure necessary for delivery of recycled water to the commercial, industrial, and institutional sectors.

(d) Evaluation of institutional and economic barriers to increased recycled water use within the commercial, industrial, and institutional sectors.

(e) Identification of technical feasibility and cost of the best management practices to achieve more efficient water use statewide in the commercial, industrial, and institutional sectors that is consistent with the public interest and reflects past investments in water use efficiency.

Section 10608.44.

Each state agency shall reduce water use at facilities it operates to support urban retail water suppliers in meeting the target identified in Section 10608.16.

Chapter 5. Sustainable Water Management, Section 10608.50

Section 10608.50.

(a) The department, in consultation with the board, shall promote implementation of regional water resources management practices through increased incentives and removal of barriers consistent with state and federal law. Potential changes may include, but are not limited to, all of the following:

(1) Revisions to the requirements for urban and agricultural water management plans.

(2) Revisions to the requirements for integrated regional water management plans.

(3) Revisions to the eligibility for state water management grants and loans.

(4) Revisions to state or local permitting requirements that increase water supply opportunities, but do not weaken water quality protection under state and federal law.

(5) Increased funding for research, feasibility studies, and project construction.

(6) Expanding technical and educational support for local land use and water management agencies.

(b) No later than January 1, 2011, and updated as part of the California Water Plan, the department, in consultation with the board, and with public input, shall propose new statewide targets, or review and update existing statewide targets, for regional water resources management practices, including, but not limited to, recycled water, brackish groundwater desalination, and infiltration and direct use of urban stormwater runoff.

Chapter 6. Standardized Data Collection, Section 10608.52

Section 10608.52.

(a) The department, in consultation with the board, the California Bay-Delta Authority or its successor agency, the State Department of Public Health, and the Public Utilities Commission, shall develop a single standardized water use reporting form to meet the water use information needs of each agency, including the needs of urban water suppliers that elect to determine and report progress toward achieving targets on a regional basis as provided in subdivision (a) of Section 10608.28.

(b) At a minimum, the form shall be developed to accommodate information sufficient to assess an urban water supplier's compliance with conservation targets pursuant to Section 10608.24 and an agricultural water supplier's compliance with implementation of efficient water management practices pursuant to subdivision (a) of Section 10608.48. The form shall accommodate reporting by urban water suppliers on an individual or regional basis as provided in subdivision (a) of Section 10608.28.

Chapter 7. Funding Provisions, Sections 10608.56–10608.60

Section 10608.56.

(a) On and after July 1, 2016, an urban retail water supplier is not eligible for a water grant or loan awarded or administered by the state unless the supplier complies with this part.

(b) On and after July 1, 2013, an agricultural water supplier is not eligible for a water grant or loan awarded or administered by the state unless the supplier complies with this part.

(c) Notwithstanding subdivision (a), the department shall determine that an urban retail water supplier is eligible for a water grant or loan even though the supplier has not met the per capita reductions required pursuant to Section 10608.24, if the urban retail water supplier has submitted to the department for approval a schedule, financing plan, and budget, to be included in the grant or loan agreement, for achieving the per capita reductions. The supplier may request grant or loan funds to achieve the per capita reductions to the extent the request is consistent with the eligibility requirements applicable to the water funds.

(d) Notwithstanding subdivision (b), the department shall determine that an agricultural water supplier is eligible for a water grant or loan even though the supplier is not implementing all of the efficient water management practices described in Section 10608.48, if the agricultural water supplier has submitted to the department for approval a schedule, financing plan, and budget, to be included in the grant or loan agreement, for implementation of the efficient water management practices. The supplier may request grant or loan funds to implement the efficient water management practices to the extent the request is consistent with the eligibility requirements applicable to the water funds.

(e) Notwithstanding subdivision (a), the department shall determine that an urban retail water supplier is eligible for a water grant or loan even though the supplier has not met the per capita reductions required pursuant to Section 10608.24, if the urban retail water supplier has submitted to the department for approval documentation demonstrating that its entire service area qualifies as a disadvantaged community.

(f) The department shall not deny eligibility to an urban retail water supplier or agricultural water supplier in compliance with the requirements of this part and Part 2.8 (commencing with Section 10800), that is participating in a multiagency water project, or an integrated regional water management plan, developed pursuant to Section 75026 of the Public Resources Code, solely on the basis that one or more of the agencies participating in the project or plan

is not implementing all of the requirements of this part or Part 2.8 (commencing with Section 10800).

Section 10608.60.

(a) It is the intent of the Legislature that funds made available by Section 75026 of the Public Resources Code should be expended, consistent with Division 43 (commencing with Section 75001) of the Public Resources Code and upon appropriation by the Legislature, for grants to implement this part. In the allocation of funding, it is the intent of the Legislature that the department give consideration to disadvantaged communities to assist in implementing the requirements of this part.

(b) It is the intent of the Legislature that funds made available by Section 75041 of the Public Resources Code, should be expended, consistent with Division 43 (commencing with Section 75001) of the Public Resources Code and upon appropriation by the Legislature, for direct expenditures to implement this part.

Chapter 9. Urban Water Use Objectives and Water Use Reporting, Sections 10609–10609.38

Section 10609.

(a) The Legislature finds and declares that this chapter establishes a method to estimate the aggregate amount of water that would have been delivered the previous year by an urban retail water supplier if all that water had been used efficiently. This estimated aggregate water use is the urban retail water supplier's urban water use objective. The method is based on water use efficiency standards and local service area characteristics for that year. By comparing the amount of water actually used in the previous year with the urban water use objective, local urban water suppliers will be in a better position to help eliminate unnecessary use of water; that is, water used in excess of that needed to accomplish the intended beneficial use.

(b) The Legislature further finds and declares all of the following:

(1) This chapter establishes standards and practices for the following water uses:

(A) Indoor residential use.

(B) Outdoor residential use.

(C) CII water use.

(D) Water losses.

(E) Other unique local uses and situations that can have a material effect on an urban water supplier's total water use.

(2) This chapter further does all of the following:

(A) Establishes a method to calculate each urban water use objective.

(B) Considers recycled water quality in establishing efficient irrigation standards.

(C) Requires the department to provide or otherwise identify data regarding the unique local conditions to support the calculation of an urban water use objective.

(D) Provides for the use of alternative sources of data if alternative sources are shown to be as accurate as, or more accurate than, the data provided by the department.

(E) Requires annual reporting of the previous year's water use with the urban water use objective.

(F) Provides a bonus incentive for the amount of potable recycled water used the previous year when comparing the previous year's water use with the urban water use objective, of up to 10 percent of the urban water use objective.

(3) This chapter requires the department and the board to solicit broad public participation from stakeholders and other interested persons in the development of the standards and the adoption of regulations pursuant to this chapter.

(4) This chapter preserves the Legislature's authority over long- term water use efficiency target setting and ensures appropriate legislative oversight of the implementation of this chapter by doing all of the following:

(A) Requiring the Legislative Analyst to conduct a review of the implementation of this chapter, including compliance with the adopted standards and regulations, accuracy of the data, use of alternate data, and other issues the Legislative Analyst deems appropriate.

(B) Stating legislative intent that the director of the department and the chairperson of the board appear before the appropriate Senate and Assembly policy committees to report on progress in implementing this chapter.

(C) Providing one-time-only authority to the department and board to adopt water use efficiency standards, except as explicitly provided in this chapter. Authorization to update the standards shall require separate legislation.

(c) It is the intent of the Legislature that the following principles apply to the development and implementation of long-term standards and urban water use objectives:

(1) Local urban retail water suppliers should have primary responsibility for meeting standards-based water use targets, and they shall retain the flexibility to develop their water supply portfolios, design and implement water conservation strategies, educate their customers, and enforce their rules.

(2) Long-term standards and urban water use objectives should advance the state's goals to mitigate and adapt to climate change.

(3) Long-term standards and urban water use objectives should acknowledge the shade, air quality, and heat-island reduction benefits provided to communities by trees through the support of water-efficient irrigation practices that keep trees healthy.

(4) The state should identify opportunities for streamlined reporting, eliminate redundant data submissions, and incentivize open access to data collected by urban and agricultural water suppliers.

Section 10609.2.

(a) The board, in coordination with the department, shall adopt long-term standards for the efficient use of water pursuant to this chapter on or before June 30, 2022.

(b) Standards shall be adopted for all of the following:

(1) Outdoor residential water use.

(2) Outdoor irrigation of landscape areas with dedicated irrigation meters in connection with CII water use.

(3) A volume for water loss.

(c) When adopting the standards under this section, the board shall consider the policies of this chapter and the proposed efficiency standards' effects on local wastewater management, developed and natural parklands, and urban tree health. The standards and potential effects shall be identified by May 30, 2022. The board shall allow for public comment on potential effects identified by the board under this subdivision.

(d) The long-term standards shall be set at a level designed so that the water use objectives, together with other demands excluded from the long-term standards such as CII indoor water use and CII outdoor water use not connected to a dedicated landscape meter, would exceed the statewide conservation targets required pursuant to Chapter 3 (commencing with Section 10608.16).

(e) The board, in coordination with the department, shall adopt by regulation variances recommended by the department pursuant to Section 10609.14 and guidelines and methodologies pertaining to the calculation of an urban retail water supplier's urban water use objective recommended by the department pursuant to Section 10609.16.

Section 10609.4.

(a)

(1) Until January 1, 2025, the standard for indoor residential water use shall be 55 gallons per capita daily.

(2) Beginning January 1, 2025, and until January 1, 2030, the standard for indoor residential water use shall be 47 gallons per capita daily.

(3) Beginning January 1, 2030, the standard for indoor residential water use shall be 42 gallons per capita daily.

(b)

(1) The department, in coordination with the board, shall conduct necessary studies and investigations to assess and quantify the economic benefits and impacts of the 2030 indoor residential use standard on water, wastewater, and recycled water systems and shall include saturation end-use studies. The studies and investigations shall build on the standards and potential effects identified pursuant to subdivision (c) of Section 10609.2 and shall also consider, and as appropriate incorporate, other regional and statewide studies that quantify the impacts on water, wastewater, and recycled water systems, and evaluate the long-term effects of telework. To facilitate these studies and investigations, the board may request necessary and relevant information from wastewater agencies, including monthly influent flow, actions taken to reassess treatment processes, and the impact of the implementation of this chapter on wastewater operations, maintenance, and capital investment. The department, in coordination with the board, shall summarize the findings of these studies and investigations in a report to the Legislature on or before October 1, 2028. The report shall be submitted in compliance with Section 9795 of the Government Code.

(2) If the department, in coordination with the board, determines that the 2030 indoor residential use standard is likely to unduly impact affordability of water and wastewater services, the department and the board may jointly recommend to the Legislature an alternate date on which the 2030 indoor residential use standard shall take effect. This determination shall be made using at least two years of data reflecting application of the 2025 indoor residential use standard.

(3) Based upon the studies and investigations conducted pursuant to paragraph (1), the department shall consider whether to recommend, for adoption by the board, additional variances to accommodate unique challenges related to residential indoor water use pursuant to Section 10609.2. Variance options may include, but are not limited to, stranded assets, impacts on disadvantaged communities, impacts to environmental flows, or adverse impacts to wastewater or recycled water operations.

(4) The studies, investigations, and report described in paragraph (1) shall include timely and inclusive collaboration with, and input from, a broad group of stakeholders, including, but not limited to, environmental groups, experts in indoor plumbing, water, wastewater, and recycled water agencies.

(c) An urban retail water supplier shall not be subject to enforcement pursuant to this chapter solely for failing to meet the indoor residential use standard.

Section 10609.6.

(a)

(1) The department, in coordination with the board, shall conduct necessary studies and investigations and recommend, no later than October 1, 2021, standards for outdoor residential use for adoption by the board in accordance with this chapter.

(2)

(A) The standards shall incorporate the principles of the model water efficient landscape ordinance adopted by the department pursuant to the Water Conservation in Landscaping Act (Article 10.8 (commencing with Section 65591) of Chapter 3 of Division 1 of Title 7 of the Government Code).

(B) The standards shall apply to irrigable lands.

(C) The standards shall include provisions for swimming pools, spas, and other water features. Ornamental water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, shall be analyzed separately from swimming pools and spas.

(b) The department shall, by January 1, 2021, provide each urban retail water supplier with data regarding the area of residential irrigable lands in a manner that can reasonably be applied to the standards adopted pursuant to this section.

(c) The department shall not recommend standards pursuant to this section until it has conducted pilot projects or studies, or some combination of the two, to ensure that the data provided to local agencies are reasonably accurate for the

data's intended uses, taking into consideration California's diverse landscapes and community characteristics.

Section 10609.8.

(a) The department, in coordination with the board, shall conduct necessary studies and investigations and recommend, no later than October 1, 2021, standards for outdoor irrigation of landscape areas with dedicated irrigation meters or other means of calculating outdoor irrigation use in connection with CII water use for adoption by the board in accordance with this chapter.

(b) The standards shall incorporate the principles of the model water efficient landscape ordinance adopted by the department pursuant to the Water Conservation in Landscaping Act (Article 10.8 (commencing with Section 65591) of Chapter 3 of Division 1 of Title 7 of the Government Code).

(c) The standards shall include an exclusion for water for commercial agricultural use meeting the definition of subdivision (b) of Section 51201 of the Government Code.

Section 10609.9.

For purposes of Sections 10609.6 and 10609.8, "principles of the model water efficient landscape ordinance" means those provisions of the model water efficient landscape ordinance applicable to the establishment or determination of the amount of water necessary to efficiently irrigate both new and existing landscapes. These provisions include, but are not limited to, all of the following:

(a) Evapotranspiration adjustment factors, as applicable.

(b) Landscape area.

(c) Maximum applied water allowance.

(d) Reference evapotranspiration.

(e) Special landscape areas, including provisions governing evapotranspiration adjustment factors for different types of water used for irrigating the landscape.

Section 10609.10.

(a) The department, in coordination with the board, shall conduct necessary studies and investigations and recommend, no later than October 1, 2021, performance measures for CII water use for adoption by the board in accordance with this chapter.

(b) Prior to recommending performance measures for CII water use, the department shall solicit broad public participation from stakeholders and other interested persons relating to all of the following:

(1) Recommendations for a CII water use classification system for California that address significant uses of water.

(2) Recommendations for setting minimum size thresholds for converting mixed CII meters to dedicated irrigation meters, and evaluation of, and recommendations for, technologies that could be used in lieu of requiring dedicated irrigation meters.

(3) Recommendations for CII water use best management practices, which may include, but are not limited to, water audits and water management plans for those CII customers that exceed a recommended size, volume of water use, or other threshold.

(c) Recommendations of appropriate performance measures for CII water use shall be consistent with the October 21, 2013, report to the Legislature by the Commercial, Industrial, and Institutional Task Force entitled "Water Use Best Management Practices," including the technical and financial feasibility recommendations provided in that report, and shall support the economic productivity of California's commercial, industrial, and institutional sectors.

(b)

(1) The board, in coordination with the department, shall adopt performance measures for CII water use on or before June 30, 2022.

(2) Each urban retail water supplier shall implement the performance measures adopted by the board pursuant to paragraph (1).

Section 10609.12.

The standards for water loss for urban retail water suppliers shall be the standards adopted by the board pursuant to subdivision (i) of Section 10608.34.

Section 10609.14.

(a) The department, in coordination with the board, shall conduct necessary studies and investigations and, no later than October 1, 2021, recommend for adoption by the board in accordance with this chapter appropriate variances for unique uses that can have a material effect on an urban retail water supplier's urban water use objective.

(b) Appropriate variances may include, but are not limited to, allowances for the following:

(1) Significant use of evaporative coolers.

(2) Significant populations of horses and other livestock.

(3) Significant fluctuations in seasonal populations.

(4) Significant landscaped areas irrigated with recycled water having high levels of total dissolved solids.

(5) Significant use of water for soil compaction and dust control.

(6) Significant use of water to supplement ponds and lakes to sustain wildlife.

(7) Significant use of water to irrigate vegetation for fire protection.

(8) Significant use of water for commercial or noncommercial agricultural use.

(d) The department, in recommending variances for adoption by the board, shall also recommend a threshold of significance for each recommended variance.

(e) Before including any specific variance in calculating an urban retail water supplier's water use objective, the urban retail water supplier shall request and receive approval by the board for the inclusion of that variance.

(f) The board shall post on its Internet Web site all of the following:

(1) A list of all urban retail water suppliers with approved variances.

(2) The specific variance or variances approved for each urban retail water supplier.

(3) The data supporting approval of each variance.

Section 10609.15.

To help streamline water data reporting, the department and the board shall do all of the following:

(a) Identify urban water reporting requirements shared by both agencies, and post on each agency's Internet Web site how the data is used for planning, regulatory, or other purposes.

(b) Analyze opportunities for more efficient publication of urban water reporting requirements within each agency, and analyze how each agency can integrate various data sets in a publicly accessible location, identify priority actions, and implement priority actions identified in the analysis.

(c) Make appropriate data pertaining to the urban water reporting requirements that are collected by either agency available to the public according to the principles and requirements of the Open and Transparent Water Data Act (Part 4.9 (commencing with Section 12400)).

Section 10609.16.

The department, in coordination with the board, shall conduct necessary studies and investigations and recommend, no later than October 1, 2021, guidelines and methodologies for the board to adopt that identify how an urban retail water supplier calculates its urban water use objective. The guidelines and methodologies shall address, as necessary, all of the following:

(a) Determining the irrigable lands within the urban retail water supplier's service area.

(b) Updating and revising methodologies described pursuant to subparagraph (A) of paragraph (1) of subdivision (h) of Section 10608.20, as appropriate, including methodologies for calculating the population in an urban retail water supplier's service area.

(c) Using landscape area data provided by the department or alternative data.

(d) Incorporating precipitation data and climate data into estimates of a urban retail water supplier's outdoor irrigation budget for its urban water use objective.

(e) Estimating changes in outdoor landscape area and population, and calculating the urban water use objective, for years when updated landscape imagery is not available from the department.

(f) Determining acceptable levels of accuracy for the supporting data, the urban water use objective, and compliance with the urban water use objective.

Section 10609.18.

The department and the board shall solicit broad public participation from stakeholders and other interested persons in the development of the standards and the adoption of regulations pursuant to this chapter. The board shall hold at least one public meeting before taking any action on any standard or variance recommended by the department.

Section 10609.20.

(a) Each urban retail water supplier shall calculate its urban water use objective no later than January 1, 2024, and by January 1 every year thereafter.

(b) The calculation shall be based on the urban retail water supplier's water use conditions for the previous calendar or fiscal year.

(c) Each urban water supplier's urban water use objective shall be composed of the sum of the following:

(1) Aggregate estimated efficient indoor residential water use.

(2) Aggregate estimated efficient outdoor residential water use.

(3) Aggregate estimated efficient outdoor irrigation of landscape areas with dedicated irrigation meters or equivalent technology in connection with CII water use.

(4) Aggregate estimated efficient water losses.

(5) Aggregate estimated water use in accordance with variances, as appropriate.

(d)

(1) An urban retail water supplier that delivers water from a groundwater basin, reservoir, or other source that is augmented by potable reuse water may adjust its urban water use objective by a bonus incentive calculated pursuant to this subdivision.

(2) The water use objective bonus incentive shall be the volume of its potable reuse delivered to residential water users and to landscape areas with dedicated irrigation meters in connection with CII water use, on an acre-foot basis.

(3) The bonus incentive pursuant to paragraph (1) shall be limited in accordance with one of the following:

(A) The bonus incentive shall not exceed 15 percent of the urban water supplier's water use objective for any potable reuse water produced at an existing facility.

(B) The bonus incentive shall not exceed 10 percent of the urban water supplier's water use objective for any potable reuse water produced at any facility that is not an existing facility.

(4) For purposes of this subdivision, "existing facility" means a facility that meets all of the following:

(A) The facility has a certified environmental impact report, mitigated negative declaration, or negative declaration on or before January 1, 2019.

(B) The facility begins producing and delivering potable reuse water on or before January 1, 2022.

(C) The facility uses microfiltration and reverse osmosis technologies to produce the potable reuse water.

(e)

(1) The calculation of the urban water use objective shall be made using landscape area and other data provided by the department and pursuant to the standards, guidelines, and methodologies adopted by the board. The department shall provide data to the urban water supplier at a level of detail sufficient to allow the urban water supplier to verify its accuracy at the parcel level.

(2) Notwithstanding paragraph (1), an urban retail water supplier may use alternative data in calculating the urban water use objective if the supplier demonstrates to the department that the alternative data are equivalent, or superior, in quality and accuracy to the data provided by the department. The department may provide technical assistance to an

urban retail water supplier in evaluating whether the alternative data are appropriate for use in calculating the supplier's urban water use objective.

Section 10609.21.

(a) For purposes of Section 10609.20, and notwithstanding paragraph (4) of subdivision (d) of Section 10609.20, "existing facility" also includes the North City Project, phase one of the Pure Water San Diego Program, for which an environmental impact report was certified on April 10, 2018.

(b) This section shall become operative on January 1, 2019.

Section 10609.22.

(a) An urban retail water supplier shall calculate its actual urban water use no later than January 1, 2024, and by January 1 every year thereafter.

(b) The calculation shall be based on the urban retail water supplier's water use for the previous calendar or fiscal year.

(c) Each urban water supplier's urban water use shall be composed of the sum of the following:

(1) Aggregate residential water use.

(2) Aggregate outdoor irrigation of landscape areas with dedicated irrigation meters in connection with CII water use.

(3) Aggregate water losses.

Section 10609.24.

(a) An urban retail water supplier shall submit a report to the department no later than January 1, 2024, and by January 1 every year thereafter. The report shall include all of the following:

(1) The urban water use objective calculated pursuant to Section 10609.20 along with relevant supporting data.

(2) The actual urban water use calculated pursuant to Section 10609.22 along with relevant supporting data.

(3) Documentation of the implementation of the performance measures for CII water use.

(4) A description of the progress made towards meeting the urban water use objective.

(5) The validated water loss audit report conducted pursuant to Section 10608.34.

(b) The department shall post the reports and information on its internet website.

(c) The board may issue an information order or conservation order to, or impose civil liability on, an entity or individual for failure to submit a report required by this section.

Section 10609.25.

As part of the first report submitted to the department by an urban retail water supplier no later than January 1, 2024, pursuant to subdivision (a) of Section 10609.24, each urban retail water supplier shall provide a narrative that describes the water demand management measures that the supplier plans to implement to achieve its urban water use objective by January 1, 2027.

Section 10609.26.

(a)

(1) On and after January 1, 2024, the board may issue informational orders pertaining to water production, water use, and water conservation to an urban retail water supplier that does not meet its urban water use objective required by this chapter. Informational orders are intended to obtain information on supplier activities, water production, and conservation efforts in order to identify technical assistance needs and assist urban water suppliers in meeting their urban water use objectives.

(2) In determining whether to issue an informational order, the board shall consider the degree to which the urban retail water supplier is not meeting its urban water use objective, information provided in the report required by Section 10609.24, and actions the urban retail water supplier has implemented or will implement in order to help meet the urban water use objective.

(3) The board shall share information received pursuant to this subdivision with the department.

(4) An urban water supplier may request technical assistance from the department. The technical assistance may, to the extent available, include guidance documents, tools, and data.

(b) On and after January 1, 2025, the board may issue a written notice to an urban retail water supplier that does not meet its urban water use objective required by this chapter. The written notice may warn the urban retail water supplier that it is not meeting its urban water use objective described in Section 10609.20 and is not making adequate progress in meeting the urban water use objective, and may request that the urban retail water supplier address areas of concern in its next annual report required by Section 10609.24. In deciding whether to issue a written notice, the board may consider whether the urban retail water supplier has received an informational order, the degree to which the urban retail water supplier is not

meeting its urban water use objective, information provided in the report required by Section 10609.24, and actions the urban retail water supplier has implemented or will implement in order to help meet its urban water use objective.

(1) On and after January 1, 2026, the board may issue a conservation order to an urban retail water supplier that does not meet its urban water use objective. A conservation order may consist of, but is not limited to, referral to the department for technical assistance, requirements for education and outreach, requirements for local enforcement, and other efforts to assist urban retail water suppliers in meeting their urban water use objective.

(2) In issuing a conservation order, the board shall identify specific deficiencies in an urban retail water supplier's progress towards meeting its urban water use objective, and identify specific actions to address the deficiencies.

(3) The board may request that the department provide an urban retail water supplier with technical assistance to support the urban retail water supplier's actions to remedy the deficiencies.

(c) A conservation order issued in accordance with this chapter may include requiring actions intended to increase water-use efficiency, but shall not curtail or otherwise limit the exercise of a water right, nor shall it require the imposition of civil liability pursuant to Section 377.

Section 10609.27.

Notwithstanding Section 10609.26, the board shall not issue an information order, written notice, or conservation order pursuant to Section 10609.26 if both of the following conditions are met:

(a) The board determines that the urban retail water supplier is not meeting its urban water use objective solely because the volume of water loss exceeds the urban retail water supplier's standard for water loss.

(b) Pursuant to Section 10608.34, the board is taking enforcement action against the urban retail water supplier for not meeting the performance standards for the volume of water losses.

Section 10609.28.

The board may issue a regulation or informational order requiring a wholesale water supplier, an urban retail water supplier, or a distributor of a public water supply, as that term is used in Section 350, to provide a monthly report relating to water production, water use, or water conservation.

Section 10609.30.

On or before January 10, 2024, the Legislative Analyst shall provide to the appropriate policy committees of both houses of the Legislature and the public a report evaluating the implementation of the water use efficiency standards and water use reporting pursuant to this chapter. The board and the department shall provide the Legislative Analyst with the available data to complete this report.

(a) The report shall describe all of the following:

(1) The rate at which urban retail water users are complying with the standards, and factors that might facilitate or impede their compliance.

(2) The accuracy of the data and estimates being used to calculate urban water use objectives.

(3) Indications of the economic impacts, if any, of the implementation of this chapter on urban water suppliers and urban water users, including CII water users.

(4) The frequency of use of the bonus incentive, the volume of water associated with the bonus incentive, value to urban water suppliers of the bonus incentive, and any implications of the use of the bonus incentive on water use efficiency.

(5) The early indications of how implementing this chapter might impact the efficiency of statewide urban water use.

6) Recommendations, if any, for improving statewide urban water use efficiency and the standards and practices described in this chapter.

(7) Any other issues the Legislative Analyst deems appropriate.

Section 10609.32.

It is the intent of the Legislature that the chairperson of the board and the director of the department appear before the appropriate policy committees of both houses of the Legislature on or around January 1, 2026, and report on the implementation of the water use efficiency standards and water use reporting pursuant to this chapter. It is the intent of the Legislature that the topics to be covered include all of the following:

(a) The rate at which urban retail water suppliers are complying with the standards, and factors that might facilitate or impede their compliance.

(b) What enforcement actions have been taken, if any.

(c) The accuracy of the data and estimates being used to calculate urban water use objectives.

(d) Indications of the economic impacts, if any, of the implementation of this chapter on urban water suppliers and urban water users, including CII water users.

(e) The frequency of use of the bonus incentive, the volume of water associated with the bonus incentive, value to urban water suppliers of the bonus incentive, and any implications of the use of the bonus incentive on water use efficiency.

(f) An assessment of how implementing this chapter is affecting the efficiency of statewide urban water use.

Section 10609.34.

Notwithstanding Section 15300.2 of Title 14 of the California Code of Regulations, an action of the board taken under this chapter shall be deemed to be a Class 8 action, within the meaning of Section 15308 of Title 14 of the California Code of Regulations, provided that the action does not involve relaxation of existing water conservation or water use standards.

Section 10609.36.

(a) Nothing in this chapter shall be construed to determine or alter water rights. Sections 1010 and 1011 apply to water conserved through implementation of this chapter.

(b) Nothing in this chapter shall be construed to authorize the board to update or revise water use efficiency standards authorized by this chapter except as explicitly provided in this chapter. Authorization to update the standards beyond that explicitly provided in this chapter shall require separate legislation.

(c) Nothing in this chapter shall be construed to limit or otherwise affect the use of recycled water as seawater barriers for groundwater salinity management.

Section 10609.38.

The board may waive the requirements of this chapter for a period of up to five years for any urban retail water supplier whose water deliveries are significantly affected by changes in water use as a result of damage from a disaster such as an earthquake or fire. In establishing the period of a waiver, the board shall take into consideration the breadth of the damage and the time necessary for the damaged areas to recover from the disaster.

Urban Water Management Planning Act

This section contains information extracted from Water Code Division 6, *Conservation, Development, and Utilization of State Water Resources*, Part 2.6, *Urban Water Management Planning*. Click on any section header below to read Water Code directly at the California Legislative Information website.

Chapter 1. General Declaration and Policy, Sections 10610–10610.4

Section 10610.

This part shall be known and may be cited as the "Urban Water Management Planning Act."

Section 10610.2.

(a) The Legislature finds and declares all of the following:

(1) The waters of the state are a limited and renewable resource subject to ever-increasing demands.

(2) The conservation and efficient use of urban water supplies are of statewide concern; however, the planning for that use and the implementation of those plans can best be accomplished at the local level.

(3) A long-term, reliable supply of water is essential to protect the productivity of California's businesses and economic climate, and increasing long-term water conservation among Californians, improving water use efficiency within the state's communities and agricultural production, and strengthening local and regional drought planning are critical to California's resilience to drought and climate change.

(4) As part of its long-range planning activities, every urban water supplier should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry water years now and into the foreseeable future, and every urban water supplier should collaborate closely with local land-use authorities to ensure water demand forecasts are consistent with current land-use planning.

(5) Public health issues have been raised over a number of contaminants that have been identified in certain local and imported water supplies.

(6) Implementing effective water management strategies, including groundwater storage projects and recycled water projects, may require

specific water quality and salinity targets for meeting groundwater basins water quality objectives and promoting beneficial use of recycled water.

(7) Water quality regulations are becoming an increasingly important factor in water agencies' selection of raw water sources, treatment alternatives, and modifications to existing treatment facilities.

(8) Changes in drinking water quality standards may also impact the usefulness of water supplies and may ultimately impact supply reliability.

(9) The quality of source supplies can have a significant impact on water management strategies and supply reliability.

(b) This part is intended to provide assistance to water agencies in carrying out their long-term resource planning responsibilities to ensure adequate water supplies to meet existing and future demands for water.

Section 10610.4.

The Legislature finds and declares that it is the policy of the state as follows:

(a) The management of urban water demands and efficient use of water shall be actively pursued to protect both the people of the state and their water resources.

(b) The management of urban water demands and efficient use of urban water supplies shall be a guiding criterion in public decisions.

(c) Urban water suppliers shall be required to develop water management plans to achieve the efficient use of available supplies and strengthen local drought planning.

Chapter 2. Definitions, Sections 10611–10618

Section 10611.

Unless the context otherwise requires, the definitions of this chapter govern the construction of this part.

Section 10611.3.

"Customer" means a purchaser of water from a water supplier who uses the water for municipal purposes, including residential, commercial, governmental, and industrial uses.

Section 10611.5.

"Demand management" means those water conservation measures, programs, and incentives that prevent the waste of water and promote the reasonable and efficient use and reuse of available supplies.

Section 10612.

"Drought risk assessment" means a method that examines water shortage risks based on the driest five-year historic sequence for the agency's water supply, as described in subdivision (b) of Section 10635.

Section 10613.

"Efficient use" means those management measures that result in the most effective use of water so as to prevent its waste or unreasonable use or unreasonable method of use.

Section 10614.

"Person" means any individual, firm, association, organization, partnership, business, trust, corporation, company, public agency, or any agency of such an entity.

Section 10615.

"Plan" means an urban water management plan prepared pursuant to this part. A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities. The components of the plan may vary according to an individual community or area's characteristics and its capabilities to efficiently use and conserve water. The plan shall address measures for residential, commercial, governmental, and industrial water demand management as set forth in Article 2 (commencing with Section 10630) of Chapter 3. In addition, a strategy and time schedule for implementation shall be included in the plan.

Section 10616.

"Public agency" means any board, commission, county, city and county, city, regional agency, district, or other public entity.

Section 10616.5.

"Recycled water" means the reclamation and reuse of wastewater for beneficial use.

Section 10617.

"Urban water supplier" means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers. This part applies only to water supplied from public water systems subject to Chapter 4 (commencing with Section 116275) of Part 12 of Division 104 of the Health and Safety Code.

Section 10617.5.

"Water shortage contingency plan" means a document that incorporates the provisions detailed in subdivision (a) of Section 10632 and is subsequently adopted by an urban water supplier pursuant to this article.

Section 10618.

"Water supply and demand assessment" means a method that looks at current year and one or more dry year supplies and demands for determining water shortage risks, as described in Section 10632.1.

Chapter 3. Urban Water Management Plans

Article 1. General Provisions, Sections 10620–10621

Section 10620.

(a) Every urban water supplier shall prepare and adopt an urban water management plan in the manner set forth in Article 3 (commencing with Section 10640).

(b) Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.

(c) An urban water supplier indirectly providing water shall not include planning elements in its water management plan as provided in Article 2 (commencing with Section 10630) that would be applicable to urban water suppliers or public agencies directly providing water, or to their customers, without the consent of those suppliers or public agencies.

(d)

(1) An urban water supplier may satisfy the requirements of this part by participation in areawide, regional, watershed, or basinwide urban water

management planning where those plans will reduce preparation costs and contribute to the achievement of conservation, efficient water use, and improved local drought resilience.

(2) Notwithstanding paragraph (1), each urban water supplier shall develop its own water shortage contingency plan, but an urban water supplier may incorporate, collaborate, and otherwise share information with other urban water suppliers or other governing entities participating in an areawide, regional, watershed, or basinwide urban water management plan, an agricultural management plan, or groundwater sustainability plan development.

(3) Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.

(e) The urban water supplier may prepare the plan with its own staff, by contract, or in cooperation with other governmental agencies.

(f) An urban water supplier shall describe in the plan water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions.

Section 10621.

(a) Each urban water supplier shall update its plan at least once every five years on or before July 1, in years ending in six and one, incorporating updated and new information from the five years preceding each update.

(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. The urban water supplier may consult with, and obtain comments from, any city or county that receives notice pursuant to this subdivision.

(c) An urban water supplier regulated by the Public Utilities Commission shall include its most recent plan and water shortage contingency plan as part of the supplier's general rate case filings.

(d) The amendments to, or changes in, the plan shall be adopted and filed in the manner set forth in Article 3 (commencing with Section 10640).

(e) Each urban water supplier shall update and submit its 2015 plan to the department by July 1, 2016.

(f) Each urban water supplier shall update and submit its 2020 plan to the department by July 1, 2021.

Article 2. Contents of Plans, Sections 10630–10634

Section 10630.

It is the intention of the Legislature, in enacting this part, to permit levels of water management planning commensurate with the numbers of customers served and the volume of water supplied, while accounting for impacts from climate change.

Section 10630.5.

Each plan shall include a simple lay description of how much water the agency has on a reliable basis, how much it needs for the foreseeable future, what the agency's strategy is for meeting its water needs, the challenges facing the agency, and any other information necessary to provide a general understanding of the agency's plan.

Section 10631.

A plan shall be adopted in accordance with this chapter that shall do all of the following:

(a) Describe the service area of the supplier, including current and projected population, climate, and other social, economic, and demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available. The description shall include the current and projected land uses within the existing or anticipated service area affecting the supplier's water management planning. Urban water suppliers shall coordinate with local or regional land use authorities to determine the most appropriate land use information, including, where appropriate, land use information obtained from local or regional land use authorities, as developed pursuant to Article 5 (commencing with Section 65300) of Chapter 3 of Division 1 of Title 7 of the Government Code.

(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments described in subdivision (a), providing supporting and related information, including all of the following:

(1) A detailed discussion of anticipated supply availability under a normal water year, single dry year, and droughts lasting at least five years, as well as more frequent and severe periods of drought, as described in the

drought risk assessment. For each source of water supply, consider any information pertinent to the reliability analysis conducted pursuant to Section 10635, including changes in supply due to climate change.

(2) When multiple sources of water supply are identified, a description of the management of each supply in correlation with the other identified supplies.

(3) For any planned sources of water supply, a description of the measures that are being undertaken to acquire and develop those water supplies.

(4) If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information:

(A) The current version of any groundwater sustainability plan or alternative adopted pursuant to Part 2.74 (commencing with Section 10720), any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management for basins underlying the urban water supplier's service area.

(B) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater.

(C) For basins that a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For a basin that has not been adjudicated, information as to whether the department has identified the basin as a high- or medium-priority basin in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to coordinate with groundwater sustainability agencies or groundwater management agencies listed in subdivision (c) of Section 10723 to maintain or achieve sustainable groundwater conditions in accordance with a groundwater sustainability plan or alternative adopted pursuant to Part 2.74 (commencing with Section 10720).

(D) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(E) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water

supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(c) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.

(d)

(1) For an urban retail water supplier, quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, based upon information developed pursuant to subdivision (a), identifying the uses among water use sectors, including, but not necessarily limited to, all of the following:

(A) Single-family residential.

(B) Multifamily.

(C) Commercial.

(D) Industrial.

(E) Institutional and governmental.

(F) Landscape.

(G) Sales to other agencies.

(H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.

(I) Agricultural.

(J) Distribution system water loss.

(2) The water use projections shall be in the same five-year increments described in subdivision (a).

(3)

(A) The distribution system water loss shall be quantified for each of the five years preceding the plan update, in accordance with rules adopted pursuant to Section 10608.34.

(B) The distribution system water loss quantification shall be reported in accordance with a worksheet approved or developed by the department through a public process. The water loss quantification worksheet shall be based on the water system balance methodology developed by the American Water Works Association.

(C) In the plan due July 1, 2021, and in each update thereafter, data shall be included to show whether the urban retail water supplier met

the distribution loss standards enacted by the board pursuant to Section 10608.34.

(4)

(A) Water use projections, where available, shall display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans identified by the urban water supplier, as applicable to the service area.

(B) To the extent that an urban water supplier reports the information described in subparagraph (A), an urban water supplier shall do both of the following:

(i) Provide citations of the various codes, standards, ordinances, or transportation and land use plans utilized in making the projections.

(ii) Indicate the extent that the water use projections consider savings from codes, standards, ordinances, or transportation and land use plans. Water use projections that do not account for these water savings shall be noted of that fact.

(a) Provide a description of the supplier's water demand management measures. This description shall include all of the following:

(1)

(A) For an urban retail water supplier, as defined in Section 10608.12, a narrative description that addresses the nature and extent of each water demand management measure implemented over the past five years. The narrative shall describe the water demand management measures that the supplier plans to implement to achieve its water use targets pursuant to Section 10608.20.

(B) The narrative pursuant to this paragraph shall include descriptions of the following water demand management measures:

(i) Water waste prevention ordinances.

(ii) Metering.

(iii) Conservation pricing.

(iv) Public education and outreach.

(v) Programs to assess and manage distribution system real loss.

(vi) Water conservation program coordination and staffing support.

(vii) Other demand management measures that have a significant impact on water use as measured in gallons per capita per day, including innovative measures, if implemented.

(2) For an urban wholesale water supplier, as defined in Section 10608.12, a narrative description of the items in clauses (ii), (iv), (vi), and (vii) of subparagraph (B) of paragraph (1), and a narrative description of its distribution system asset management and wholesale supplier assistance programs.

(f) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use, as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in normal and single-dry water years and for a period of drought lasting five consecutive water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.

(g) Describe the opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply.

(h) An urban water supplier that relies upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five- year increments, and during various water-year types in accordance with subdivision (f). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (f).

Section 10631.1.

(a) The water use projections required by Section 10631 shall include projected water use for single-family and multifamily residential housing needed for lower income households, as defined in Section 50079.5 of the Health and Safety Code, as identified in the housing element of any city, county, or city and county in the service area of the supplier.

(b) It is the intent of the Legislature that the identification of projected water use for single-family and multifamily residential housing for lower income households will assist a supplier in complying with the requirement under

Section 65589.7 of the Government Code to grant a priority for the provision of service to housing units affordable to lower income households.

Section 10631.2.

(a) In addition to the requirements of Section 10631, an urban water management plan shall include any of the following information that the urban water supplier can readily obtain:

(1) An estimate of the amount of energy used to extract or divert water supplies.

(2) An estimate of the amount of energy used to convey water supplies to the water treatment plants or distribution systems.

(3) An estimate of the amount of energy used to treat water supplies.

(4) An estimate of the amount of energy used to distribute water supplies through its distribution systems.

(5) An estimate of the amount of energy used for treated water supplies in comparison to the amount used for nontreated water supplies.

(6) An estimate of the amount of energy used to place water into or withdraw from storage.

(7) Any other energy-related information the urban water supplier deems appropriate.

(b) The department shall include in its guidance for the preparation of urban water management plans a methodology for the voluntary calculation or estimation of the energy intensity of urban water systems. The department may consider studies and calculations conducted by the Public Utilities Commission in developing the methodology.

(c) The Legislature finds and declares that energy use is only one factor in water supply planning and shall not be considered independently of other factors.

Section 10632.

(a) Every urban water supplier shall prepare and adopt a water shortage contingency plan as part of its urban water management plan that consists of each of the following elements:

(1) The analysis of water supply reliability conducted pursuant to Section 10635.

(2) The procedures used in conducting an annual water supply and demand assessment that include, at a minimum, both of the following:

(A) The written decision making process that an urban water supplier will use each year to determine its water supply reliability.

(B) The key data inputs and assessment methodology used to evaluate the urban water supplier's water supply reliability for the current year and one dry year, including all of the following:

(i) Current year unconstrained demand, considering weather, growth, and other influencing factors, such as policies to manage current supplies to meet demand objectives in future years, as applicable.

(ii) Current year available supply, considering hydrological and regulatory conditions in the current year and one dry year. The annual supply and demand assessment may consider more than one dry year solely at the discretion of the urban water supplier.

(iii) Existing infrastructure capabilities and plausible constraints.

(iv) A defined set of locally applicable evaluation criteria that are consistently relied upon for each annual water supply and demand assessment.

(v) A description and quantification of each source of water supply.

(3)

(A) Six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage. Urban water suppliers shall define these shortage levels based on the suppliers' water supply conditions, including percentage reductions in water supply, changes in groundwater levels, changes in surface elevation or level of subsidence, or other changes in hydrological or other local conditions indicative of the water supply available for use. Shortage levels shall also apply to catastrophic interruption of water supplies, including, but not limited to, a regional power outage, an earthquake, and other potential emergency events.

(B) An urban water supplier with an existing water shortage contingency plan that uses different water shortage levels may comply with the requirement in subparagraph (A) by developing and including a cross- reference relating its existing categories to the six standard water shortage levels.

(4) Shortage response actions that align with the defined shortage levels and include, at a minimum, all of the following:

(A) Locally appropriate supply augmentation actions.

(B) Locally appropriate demand reduction actions to adequately respond to shortages.

(C) Locally appropriate operational changes.

(D) Additional, mandatory prohibitions against specific water use practices that are in addition to state- mandated prohibitions and appropriate to the local conditions.

(E) For each action, an estimate of the extent to which the gap between supplies and demand will be reduced by implementation of the action.

(5) Communication protocols and procedures to inform customers, the public, interested parties, and local, regional, and state governments, regarding, at a minimum, all of the following:

(A) Any current or predicted shortages as determined by the annual water supply and demand assessment described pursuant to Section 10632.1.

(B) Any shortage response actions triggered or anticipated to be triggered by the annual water supply and demand assessment described pursuant to Section 10632.1.

(C) Any other relevant communications.

(6) For an urban retail water supplier, customer compliance, enforcement, appeal, and exemption procedures for triggered shortage response actions as determined pursuant to Section 10632.2.

(7)

(A) A description of the legal authorities that empower the urban water supplier to implement and enforce its shortage response actions specified in paragraph (4) that may include, but are not limited to, statutory authorities, ordinances, resolutions, and contract provisions.

(B) A statement that an urban water supplier shall declare a water shortage emergency in accordance with Chapter 3 (commencing with Section 350) of Division 1.

(C) A statement that an urban water supplier shall coordinate with any city or county within which it provides water supply services for the possible proclamation of a local emergency, as defined in Section 8558 of the Government Code.

(8) A description of the financial consequences of, and responses for, drought conditions, including, but not limited to, all of the following:

(A) A description of potential revenue reductions and expense increases associated with activated shortage response actions described in paragraph (4).

(B) A description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage response actions described in paragraph (4).

(C) A description of the cost of compliance with Chapter 3.3 (commencing with Section 365) of Division 1.

(9) For an urban retail water supplier, monitoring and reporting requirements and procedures that ensure appropriate data is collected, tracked, and analyzed for purposes of monitoring customer compliance and to meet state reporting requirements.

(10) Reevaluation and improvement procedures for systematically monitoring and evaluating the functionality of the water shortage contingency plan in order to ensure shortage risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented as needed.

(b) For purposes of developing the water shortage contingency plan pursuant to subdivision (a), an urban water supplier shall analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas, as defined in subdivision (a) of Section 115921 of the Health and Safety Code.

(c) The urban water supplier shall make available the water shortage contingency plan prepared pursuant to this article to its customers and any city or county within which it provides water supplies no later than 30 days after adoption of the water shortage contingency plan.

Section 10632.1.

An urban water supplier shall conduct an annual water supply and demand assessment pursuant to subdivision (a) of Section 10632 and, on or before July 1 of each year, submit an annual water shortage assessment report to the department with information for anticipated shortage, triggered shortage response actions, compliance and enforcement actions, and communication actions consistent with the supplier's water shortage contingency plan. An urban water supplier that relies on imported water from the State Water Project or the Bureau of Reclamation shall submit its annual water supply and demand assessment within 14 days of receiving its final allocations, or by July 1 of each year, whichever is later.

Section 10632.2.

An urban water supplier shall follow, where feasible and appropriate, the prescribed procedures and implement determined shortage response actions in its water shortage contingency plan, as identified in subdivision (a) of Section 10632, or reasonable alternative actions, provided that descriptions of the alternative actions are submitted with the annual water shortage assessment report pursuant to Section 10632.1. Nothing in this section prohibits an urban water supplier from

taking actions not specified in its water shortage contingency plan, if needed, without having to formally amend its urban water management plan or water shortage contingency plan.

Section 10632.3.

It is the intent of the Legislature that, upon proclamation by the Governor of a state of emergency under the California Emergency Services Act (Chapter 7 (commencing with Section 8550) of Division 1 of Title 2 of the Government Code) based on drought conditions, the board defer to implementation of locally adopted water shortage contingency plans to the extent practicable.

Section 10632.5.

(a) In addition to the requirements of paragraph (3) of subdivision of Section 10632, beginning January 1, 2020, the plan shall include a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities.

(b) An urban water supplier shall update the seismic risk assessment and mitigation plan when updating its urban water management plan as required by Section 10621.

(c) An urban water supplier may comply with this section by submitting, pursuant to Section 10644, a copy of the most recent adopted local hazard mitigation plan or multihazard mitigation plan under the federal Disaster Mitigation Act of 2000 (Public Law 106- 390) if the local hazard mitigation plan or multihazard mitigation plan addresses seismic risk.

Section 10633.

The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. The preparation of the plan shall be coordinated with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area, and shall include all of the following:

(a) A description of the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.

(b) A description of the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.

(c) A description of the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use.

(d) A description and quantification of the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, indirect potable reuse, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.

(e) The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision.

(f) A description of actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water used per year.

(g) A plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution systems, to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.

Section 10634.

The plan shall include information, to the extent practicable, relating to the quality of existing sources of water available to the supplier over the same five-year increments as described in subdivision (a) of Section 10631, and the manner in which water quality affects water management strategies and supply reliability.

Article 2.5. Water Service Reliability, Section 10635

Section 10635.

(a) Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the long-term total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and a drought lasting five consecutive water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.

(b) Every urban water supplier shall include, as part of its urban water management plan, a drought risk assessment for its water service to its customers as part of information considered in developing the demand management measures and water supply projects and programs to be included

in the urban water management plan. The urban water supplier may conduct an interim update or updates to this drought risk assessment within the five-year cycle of its urban water management plan update. The drought risk assessment shall include each of the following:

(1) A description of the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a drought period that lasts five consecutive water years, starting from the year following when the assessment is conducted.

(2) A determination of the reliability of each source of supply under a variety of water shortage conditions. This may include a determination that a particular source of water supply is fully reliable under most, if not all, conditions.

(3) A comparison of the total water supply sources available to the water supplier with the total projected water use for the drought period.

(4) Considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions, anticipated regulatory changes, and other locally applicable criteria.

(c) The urban water supplier shall provide that portion of its urban water management plan prepared pursuant to this article to any city or county within which it provides water supplies no later than 60 days after the submission of its urban water management plan.

(d) Nothing in this article is intended to create a right or entitlement to water service or any specific level of water service.

(e) Nothing in this article is intended to change existing law concerning an urban water supplier's obligation to provide water service to its existing customers or to any potential future customers.

Article 3. Adoption and Implementation of Plans, Sections 10640–10645

Section 10640.

(a) Every urban water supplier required to prepare a plan pursuant to this part shall prepare its plan pursuant to Article 2 (commencing with Section 10630). The supplier shall likewise periodically review the plan as required by Section 10621, and any amendments or changes required as a result of that review shall be adopted pursuant to this article.

(b) Every urban water supplier required to prepare a water shortage contingency plan shall prepare a water shortage contingency plan pursuant to Section 10632. The supplier shall likewise periodically review the water shortage contingency plan as required by paragraph (10) of subdivision (a) of

Section 10632 and any amendments or changes required as a result of that review shall be adopted pursuant to this article.

Section 10641.

An urban water supplier required to prepare a plan or a water shortage contingency plan may consult with, and obtain comments from, any public agency or state agency or any person who has special expertise with respect to water demand management methods and techniques.

Section 10642.

Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of both the plan and the water shortage contingency plan. Prior to adopting either, the urban water supplier shall make both the plan and the water shortage contingency plan available for public inspection and shall hold a public hearing or hearings thereon. Prior to any of these hearings, notice of the time and place of the hearing shall be published within the jurisdiction of the publicly owned water supplier pursuant to Section 6066 of the Government Code. The urban water supplier shall provide notice of the time and place of a hearing to any city or county within which the supplier provides water supplies. Notices by a local public agency pursuant to this section shall be provided pursuant to Chapter 17.5 (commencing with Section 7290) of Division 7 of Title 1 of the Government Code. A privately owned water supplier shall provide an equivalent notice within its service area. After the hearing or hearings, the plan or water shortage contingency plan shall be adopted as prepared or as modified after the hearing or hearings.

Section 10643.

An urban water supplier shall implement its plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan.

Section 10644.

(a)

(1) An urban water supplier shall submit to the department, the California State Library, and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption. Copies of amendments or changes to the plans shall be submitted to the department, the California State Library, and any city or county within which the supplier provides water supplies within 30 days after adoption.

(2) The plan, or amendments to the plan, submitted to the department pursuant to paragraph (1) shall be submitted electronically and shall

include any standardized forms, tables, or displays specified by the department.

(b) If an urban water supplier revises its water shortage contingency plan, the supplier shall submit to the department a copy of its water shortage contingency plan prepared pursuant to subdivision (a) of Section 10632 no later than 30 days after adoption, in accordance with protocols for submission and using electronic reporting tools developed by the department.

(c)

(1)

(A) Notwithstanding Section 10231.5 of the Government Code, the department shall prepare and submit to the Legislature, on or before July 1, in the years ending in seven and two, a report summarizing the status of the plans and water shortage contingency plans adopted pursuant to this part. The report prepared by the department shall identify the exemplary elements of the individual plans and water shortage contingency plans. The department shall provide a copy of the report to each urban water supplier that has submitted its plan and water shortage contingency plan to the department. The department shall also prepare reports and provide data for any legislative hearings designed to consider the effectiveness of plans and water shortage contingency plans submitted pursuant to this part.

(B) The department shall prepare and submit to the board, on or before September 30 of each year, a report summarizing the submitted water supply and demand assessment results along with appropriate reported water shortage conditions and the regional and statewide analysis of water supply conditions developed by the department. As part of the report, the department shall provide a summary and, as appropriate, urban water supplier specific information regarding various shortage response actions implemented as a result of annual supplier-specific water supply and demand assessments performed pursuant to Section 10632.1.

(C) The department shall submit the report to the Legislature for the 2015 plans by July 1, 2017, and the report to the Legislature for the 2020 plans and water shortage contingency plans by July 1, 2022.

(2) A report to be submitted pursuant to subparagraph (A) of paragraph (1) shall be submitted in compliance with Section 9795 of the Government Code.

(d) The department shall make available to the public the standard the department will use to identify exemplary water demand management measures.

Section 10645.

(a) Not later than 30 days after filing a copy of its plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.

(b) Not later than 30 days after filing a copy of its water shortage contingency plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.

Chapter 4. Miscellaneous Provisions, Sections 10650–10657

Section 10650.

Any actions or proceedings, other than actions by the board, to attack, review, set aside, void, or annul the acts or decisions of an urban water supplier on the grounds of noncompliance with this part shall be commenced as follows:

(a) An action or proceeding alleging failure to adopt a plan or a water shortage contingency plan shall be commenced within 18 months after that adoption is required by this part.

(b) Any action or proceeding alleging that a plan or water shortage contingency plan, or action taken pursuant to either, does not comply with this part shall be commenced within 90 days after filing of the plan or water shortage contingency plan or an amendment to either pursuant to Section 10644 or the taking of that action.

Section 10651.

In any action or proceeding to attack, review, set aside, void, or annul a plan or a water shortage contingency plan, or an action taken pursuant to either by an urban water supplier on the grounds of noncompliance with this part, the inquiry shall extend only to whether there was a prejudicial abuse of discretion. Abuse of discretion is established if the supplier has not proceeded in a manner required by law or if the action by the water supplier is not supported by substantial evidence.

Section 10652.

The California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) does not apply to the preparation and adoption of plans pursuant to this part or to the implementation of actions taken pursuant to Section 10632. Nothing in this part shall be interpreted as exempting from the California Environmental Quality Act any project that would significantly affect water supplies for fish and wildlife, or any project for implementation of the

plan, other than projects implementing Section 10632, or any project for expanded or additional water supplies.

Section 10653.

The adoption of a plan shall satisfy any requirements of state law, regulation, or order, including those of the board and the Public Utilities Commission, for the preparation of water management plans, water shortage contingency plans, or conservation plans; provided, that if the board or the Public Utilities Commission requires additional information concerning water conservation, drought response measures, or financial conditions to implement its existing authority, nothing in this part shall be deemed to limit the board or the commission in obtaining that information. The requirements of this part shall be satisfied by any urban water demand management plan that complies with analogous federal laws or regulations after the effective date of this part, and which substantially meets the requirements of this part, or by any existing urban water management plan which includes the contents of a plan required under this part.

Section 10654.

An urban water supplier may recover in its rates the costs incurred in preparing its urban water management plan, its drought risk assessment, its water supply and demand assessment, and its water shortage contingency plan and implementing the reasonable water conservation measures included in either of the plans.

Section 10655.

If any provision of this part or the application thereof to any person or circumstances is held invalid, that invalidity shall not affect other provisions or applications of this part which can be given effect without the invalid provision or application thereof, and to this end the provisions of this part are severable.

Section 10656.

An urban water supplier is not eligible for a water grant or loan awarded or administered by the state unless the urban water supplier complies with this part.

Section 10657.

The department may adopt regulations regarding the definitions of water, water use, and reporting periods, and may adopt any other regulations deemed necessary or desirable to implement this part. In developing regulations pursuant to this section, the department shall solicit broad public participation from stakeholders and other interested persons.

Appendix B - Sustainable Water Use and Demand Reduction (SB X7-7)

The following was included in the City of Corona 2015 UWMP as Appendix C. This document presents the Water Code sections associated with the Sustainable Water Use and Demand Reduction (SB X7-7).

California Water Code
Sustainable Water Use and Demand Reduction

California Water Code Division 6, Part 2.55.

Chapter 1. General Declarations and Policy §10608-10608.8
Chapter 2. Definitions §10608.12
Chapter 3. Urban Retail Water Suppliers §10608.16-10608.44
Chapter 4. Agricultural Water Suppliers §10608.48
Chapter 5. Sustainable Water Management §10608.50
Chapter 6 Standardized Data Collection §10608.52
Chapter 7 Funding Provisions §10608.56-10608.60
Chapter 8 Quantifying Agricultural Water Use Efficiency §10608.64

Chapter 1. General Declarations and Policy

SECTION 10608-10608.8

10608. The Legislature finds and declares all of the following:

(a) Water is a public resource that the California Constitution protects against waste and unreasonable use.

(b) Growing population, climate change, and the need to protect and grow California's economy while protecting and restoring our fish and wildlife habitats make it essential that the state manage its water resources as efficiently as possible.

(c) Diverse regional water supply portfolios will increase water supply reliability and reduce dependence on the Delta.

(d) Reduced water use through conservation provides significant energy and environmental benefits, and can help protect water quality, improve streamflows, and reduce greenhouse gas emissions.

(e) The success of state and local water conservation programs to increase efficiency of water use is best determined on the basis of measurable outcomes related to water use or efficiency.

(f) Improvements in technology and management practices offer the potential for increasing water efficiency in California over time, providing an essential water management tool to meet the need for water for urban, agricultural, and environmental uses.

(g) The Governor has called for a 20 percent per capita reduction in urban water use statewide by 2020.

(h) The factors used to formulate water use efficiency targets can vary significantly from location to location based on factors including weather, patterns of urban and suburban development, and past efforts to enhance water use efficiency.

(i) Per capita water use is a valid measure of a water provider's efforts to reduce urban water use within its service area. However, per capita water use is less useful for measuring relative water use efficiency between different water providers. Differences in weather, historical patterns of urban and suburban development, and density of housing in a particular location need to be considered when assessing per capita water use as a measure of efficiency.

10608.4. It is the intent of the Legislature, by the enactment of this part, to do all of the following:

(a) Require all water suppliers to increase the efficiency of use of this essential resource.

(b) Establish a framework to meet the state targets for urban water conservation identified in this part and called for by the Governor.

(c) Measure increased efficiency of urban water use on a per capita basis.

(d) Establish a method or methods for urban retail water suppliers to determine targets for achieving increased water use efficiency by the year 2020, in accordance with the Governor's goal of a 20-percent reduction.

(e) Establish consistent water use efficiency planning and implementation standards for urban water suppliers and agricultural water suppliers.

(f) Promote urban water conservation standards that are consistent with the California Urban Water Conservation Council's adopted best management practices and the requirements for demand management in Section 10631.

(g) Establish standards that recognize and provide credit to water suppliers that made substantial capital investments in urban water conservation since the drought of the early 1990s.

(h) Recognize and account for the investment of urban retail water suppliers in providing recycled water for beneficial uses.

(i) Require implementation of specified efficient water management practices for agricultural water suppliers.

(j) Support the economic productivity of California's agricultural, commercial, and industrial sectors.

(k) Advance regional water resources management.

10608.8. (a) (1) Water use efficiency measures adopted and implemented pursuant to this part or Part 2.8 (commencing with Section 10800) are water conservation measures subject to the protections provided under Section 1011.

(2) Because an urban agency is not required to meet its urban water use target until 2020 pursuant to subdivision (b) of Section 10608.24, an urban retail water supplier's failure to meet those targets shall not establish a violation of law for purposes of any state administrative or judicial proceeding prior to January 1, 2021. Nothing in this paragraph limits the use of data reported to the department or the board in litigation or an administrative proceeding. This paragraph shall become inoperative on January 1, 2021.

(3) To the extent feasible, the department and the board shall provide for the use of water conservation reports required under this part to meet the requirements of Section 1011 for water conservation reporting.

(b) This part does not limit or otherwise affect the application of Chapter 3.5 (commencing with Section 11340), Chapter 4 (commencing with Section 11370), Chapter 4.5 (commencing with Section 11400), and Chapter 5 (commencing with Section 11500) of Part 1 of Division 3 of Title 2 of the Government Code.

(c) This part does not require a reduction in the total water used in the agricultural or urban sectors, because other factors, including, but not limited to, changes in agricultural economics or population growth may have greater effects on water use. This part does not limit the economic productivity of California's agricultural, commercial, or industrial sectors.

(d) The requirements of this part do not apply to an agricultural water supplier that is a party to the Quantification Settlement Agreement, as defined in subdivision (a) of Section 1 of Chapter 617 of the Statutes of 2002, during the period within which the Quantification Settlement Agreement remains in effect. After the expiration of the Quantification Settlement Agreement, to the extent conservation water projects implemented as part of the Quantification Settlement Agreement remain in effect, the conserved water created as part of those projects shall be credited against the obligations of the agricultural water supplier pursuant to this part.

Chapter 2 Definitions

SECTION 10608.12

10608.12. Unless the context otherwise requires, the following definitions govern the construction of this part:

(a) "Agricultural water supplier" means a water supplier, either publicly or privately owned, providing water to 10,000 or more irrigated acres, excluding recycled water. "Agricultural water supplier" includes a supplier or contractor for water, regardless of the basis of right, that distributes or sells water for ultimate resale to customers. "Agricultural water supplier" does not include the department.

(b) "Base daily per capita water use" means any of the following:

(1) The urban retail water supplier's estimate of its average gross water use, reported in gallons per capita per day and calculated over a continuous 10- year period ending no earlier than December 31, 2004, and no later than December 31, 2010.

(2) For an urban retail water supplier that meets at least 10 percent of its 2008 measured retail water demand through recycled water that is delivered within the service area of an urban retail water supplier or its urban wholesale water supplier, the urban retail water supplier may extend the calculation described in paragraph (1) up to an additional five years to a maximum of a continuous 15-year period ending no earlier than December 31, 2004, and no later than December 31, 2010.

(3) For the purposes of Section 10608.22, the urban retail water supplier's estimate of its average gross water use, reported in gallons per capita per day and calculated over a continuous five-year period ending no earlier than December 31, 2007, and no later than December 31, 2010.

(c) "Baseline commercial, industrial, and institutional water use" means an urban retail water supplier's base daily per capita water use for commercial, industrial, and institutional users.

(d) "Commercial water user" means a water user that provides or distributes a product or service.

(e) "Compliance daily per capita water use" means the gross water use during the final year of the reporting period, reported in gallons per capita per day.

(f) "Disadvantaged community" means a community with an annual median household income that is less than 80 percent of the statewide annual median household income.

(g) "Gross water use" means the total volume of water, whether treated or untreated, entering the distribution system of an urban retail water supplier, excluding all of the following:

(1) Recycled water that is delivered within the service area of an urban retail water supplier or its urban wholesale water supplier.

(2) The net volume of water that the urban retail water supplier places into long- term storage.

(3) The volume of water the urban retail water supplier conveys for use by another urban water supplier.

(4) The volume of water delivered for agricultural use, except as otherwise provided in subdivision (f) of Section 10608.24.

(h) "Industrial water user" means a water user that is primarily a manufacturer or processor of materials as defined by the North American Industry Classification System code sectors 31 to 33, inclusive, or an entity that is a water user primarily engaged in research and development.

(i) "Institutional water user" means a water user dedicated to public service. This type of user includes, among other users, higher education institutions, schools, courts, churches, hospitals, government facilities, and nonprofit research institutions.

(j) "Interim urban water use target" means the midpoint between the urban retail water supplier's base daily per capita water use and the urban retail water supplier's urban water use target for 2020.

(k) "Locally cost effective" means that the present value of the local benefits of implementing an agricultural efficiency water management practice is greater than or equal to the present value of the local cost of implementing that measure.

(l) "Process water" means water used for producing a product or product content or water used for research and development, including, but not limited to, continuous manufacturing processes, water used for testing and maintaining equipment used in producing a product or product content, and water used in combined heat and power facilities used in producing a product or product content. Process water does not mean incidental water uses not related to the production of a product or product content, including, but not limited to, water used for restrooms, landscaping, air conditioning, heating, kitchens, and laundry.

(m) "Recycled water" means recycled water, as defined in subdivision (n) of Section 13050, that is used to offset potable demand, including recycled water supplied for direct use and indirect potable reuse, that meets the following requirements, where applicable:

(1) For groundwater recharge, including recharge through spreading basins, water supplies that are all of the following:

(A) Metered.

(B) Developed through planned investment by the urban water supplier or a wastewater treatment agency.

(C) Treated to a minimum tertiary level.

(D) Delivered within the service area of an urban retail water supplier or its urban wholesale water supplier that helps an urban retail water supplier meet its urban water use target.

(2) For reservoir augmentation, water supplies that meet the criteria of paragraph (1) and are conveyed through a distribution system constructed specifically for recycled water.

(j) "Regional water resources management" means sources of supply resulting from watershed-based planning for sustainable local water reliability or any of the following alternative sources of water:

(1) The capture and reuse of stormwater or rainwater.

(2) The use of recycled water.

(3) The desalination of brackish groundwater.

(4) The conjunctive use of surface water and groundwater in a manner that is consistent with the safe yield of the groundwater basin.

(k) "Reporting period" means the years for which an urban retail water supplier reports compliance with the urban water use targets.

(l) "Urban retail water supplier" means a water supplier, either publicly or privately owned, that directly provides potable municipal water to more than 3,000 end users or that supplies more than 3,000 acre-feet of potable water annually at retail for municipal purposes.

(m) "Urban water use target" means the urban retail water supplier's targeted future daily per capita water use.

(n) "Urban wholesale water supplier," means a water supplier, either publicly or privately owned, that provides more than 3,000 acre-feet of water annually at wholesale for potable municipal purposes.

Chapter 3 Urban Retail Water Suppliers

SECTION 10608.16-10608.44

10608.16.(a) The state shall achieve a 20-percent reduction in urban per capita water use in California on or before December 31, 2020.

(b) The state shall make incremental progress towards the state target specified in subdivision (a) by reducing urban per capita water use by at least 10 percent on or before December 31, 2015.

10608.20.(a) (1) Each urban retail water supplier shall develop urban water use targets and an interim urban water use target by July 1, 2011. Urban retail water suppliers may elect to determine and report progress toward achieving these targets on an individual or regional basis, as provided in subdivision (a) of Section 10608.28, and may determine the targets on a fiscal year or calendar year basis.

(2) It is the intent of the Legislature that the urban water use targets described in paragraph (1) cumulatively result in a 20-percent reduction from the baseline daily per capita water use by December 31, 2020.

(b) An urban retail water supplier shall adopt one of the following methods for determining its urban water use target pursuant to subdivision (a):

(1) Eighty percent of the urban retail water supplier's baseline per capita daily water use.

(2) The per capita daily water use that is estimated using the sum of the following performance standards:

(A) For indoor residential water use, 55 gallons per capita daily water use as a provisional standard. Upon completion of the department's 2016 report to the Legislature pursuant to Section 10608.42, this standard may be adjusted by the Legislature by statute.

(B) For landscape irrigated through dedicated or residential meters or connections, water efficiency equivalent to the standards of the Model Water Efficient Landscape Ordinance set forth in Chapter 2.7 (commencing with Section 490) of Division 2 of Title 23 of the California Code of Regulations, as in effect the later of the year of the landscape's installation or 1992. An urban retail water supplier using the approach specified in this subparagraph shall use satellite imagery, site visits, or other best available technology to develop an accurate estimate of landscaped areas.

(C) For commercial, industrial, and institutional uses, a 10-percent reduction in water use from the baseline commercial, industrial, and institutional water use by 2020.

(3) Ninety-five percent of the applicable state hydrologic region target, as set forth in the state's draft 20x2020 Water Conservation Plan (dated April 30, 2009). If the service area of an urban water supplier includes more than one hydrologic region, the supplier shall apportion its service area to each region based on population or area.

(4) A method that shall be identified and developed by the department, through a public process, and reported to the Legislature no later than December 31, 2010. The method developed by the department shall identify per capita targets that cumulatively result in a statewide 20-percent reduction in urban daily per capita water use by December 31,

2020. In developing urban daily per capita water use targets, the department shall do all of the following:

(A) Consider climatic differences within the state.

(B) Consider population density differences within the state.

(C) Provide flexibility to communities and regions in meeting the targets.

(D) Consider different levels of per capita water use according to plant water needs in different regions.

(E) Consider different levels of commercial, industrial, and institutional water use in different regions of the state.

(F) Avoid placing an undue hardship on communities that have implemented conservation measures or taken actions to keep per capita water use low.

(c) If the department adopts a regulation pursuant to paragraph (4) of subdivision (b) that results in a requirement that an urban retail water supplier achieve a reduction in daily per capita water use that is greater than 20 percent by December 31, 2020, an urban retail water supplier that adopted the method described in paragraph (4) of subdivision (b) may limit its urban water use target to a reduction of not more than 20 percent by December 31, 2020, by adopting the method described in paragraph (1) of subdivision (b).

(d) The department shall update the method described in paragraph (4) of subdivision (b) and report to the Legislature by December 31, 2014. An urban retail water supplier that adopted the method described in paragraph (4) of subdivision (b) may adopt a new urban daily per capita water use target pursuant to this updated method.

(e) An urban retail water supplier shall include in its urban water management plan due in 2010 pursuant to Part 2.6 (commencing with Section 10610) the baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.

(f) When calculating per capita values for the purposes of this chapter, an urban retail water supplier shall determine population using federal, state, and local population reports and projections.

(g) An urban retail water supplier may update its 2020 urban water use target in its 2015 urban water management plan required pursuant to Part 2.6 (commencing with Section 10610).

(h) (1) The department, through a public process and in consultation with the California Urban Water Conservation Council, shall develop technical

methodologies and criteria for the consistent implementation of this part, including, but not limited to, both of the following:

(A) Methodologies for calculating base daily per capita water use, baseline commercial, industrial, and institutional water use, compliance daily per capita water use, gross water use, service area population, indoor residential water use, and landscaped area water use.

(B) Criteria for adjustments pursuant to subdivisions (d) and (e) of Section 10608.24.

(2) The department shall post the methodologies and criteria developed pursuant to this subdivision on its Internet Web site, and make written copies available, by October 1, 2010. An urban retail water supplier shall use the methods developed by the department in compliance with this part.

(i) (1) The department shall adopt regulations for implementation of the provisions relating to process water in accordance with subdivision (l) of Section 10608.12, subdivision (e) of Section 10608.24, and subdivision (d) of Section 10608.26.

(2) The initial adoption of a regulation authorized by this subdivision is deemed to address an emergency, for purposes of Sections 11346.1 and 11349.6 of the Government Code, and the department is hereby exempted for that purpose from the requirements of subdivision (b) of Section 11346.1 of the Government Code. After the initial adoption of an emergency regulation pursuant to this subdivision, the department shall not request approval from the Office of Administrative Law to readopt the regulation as an emergency regulation pursuant to Section 11346.1 of the Government Code.

(j) (1) An urban retail water supplier is granted an extension to July 1, 2011, for adoption of an urban water management plan pursuant to Part 2.6 (commencing with Section 10610) due in 2010 to allow the use of technical methodologies developed by the department pursuant to paragraph (4) of subdivision (b) and subdivision (h). An urban retail water supplier that adopts an urban water management plan due in 2010 that does not use the methodologies developed by the department pursuant to subdivision (h) shall amend the plan by July 1, 2011, to comply with this part.

(2) An urban wholesale water supplier whose urban water management plan prepared pursuant to Part 2.6 (commencing with Section 10610) was due and not submitted in 2010 is granted an extension to July 1, 2011, to permit coordination between an urban wholesale water supplier and urban retail water suppliers.

10608.22. Notwithstanding the method adopted by an urban retail water supplier pursuant to Section 10608.20, an urban retail water supplier's per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use as

defined in paragraph(3) of subdivision (b) of Section 10608.12. This section does not apply to an urban retail water supplier with a base daily per capita water use at or below 100 gallons per capita per day.

10608.24.(a) Each urban retail water supplier shall meet its interim urban water use target by December 31, 2015.

(b) Each urban retail water supplier shall meet its urban water use target by December 31, 2020.

(c) An urban retail water supplier's compliance daily per capita water use shall be the measure of progress toward achievement of its urban water use target.

(d) (1) When determining compliance daily per capita water use, an urban retail water supplier may consider the following factors:

(A) Differences in evapotranspiration and rainfall in the baseline period compared to the compliance reporting period.

(B) Substantial changes to commercial or industrial water use resulting from increased business output and economic development that have occurred during the reporting period.

(C) Substantial changes to institutional water use resulting from fire suppression services or other extraordinary events, or from new or expanded operations, that have occurred during the reporting period.

(2) If the urban retail water supplier elects to adjust its estimate of compliance daily per capita water use due to one or more of the factors described in paragraph (1), it shall provide the basis for, and data supporting, the adjustment in the report required by Section 10608.40.

(e) When developing the urban water use target pursuant to Section 10608.20, an urban retail water supplier that has a substantial percentage of industrial water use in its service area may exclude process water from the calculation of gross water use to avoid a disproportionate burden on another customer sector.

(f) (1) An urban retail water supplier that includes agricultural water use in an urban water management plan pursuant to Part 2.6 (commencing with Section 10610) may include the agricultural water use in determining gross water use. An urban retail water supplier that includes agricultural water use in determining gross water use and develops its urban water use target pursuant to paragraph (2) of subdivision (b) of Section 10608.20 shall use a water efficient standard for agricultural irrigation of 100 percent of reference evapotranspiration multiplied by the crop coefficient for irrigated acres.

(2) An urban retail water supplier, that is also an agricultural water supplier, is not subject to the requirements of Chapter 4 (commencing with Section

10608.48), if the agricultural water use is incorporated into its urban water use target pursuant to paragraph (1).

10608.26.(a) In complying with this part, an urban retail water supplier shall conduct at least one public hearing to accomplish all of the following:

(1) Allow community input regarding the urban retail water supplier's implementation plan for complying with this part.

(2) Consider the economic impacts of the urban retail water supplier's implementation plan for complying with this part.

(3) Adopt a method, pursuant to subdivision (b) of Section 10608.20, for determining its urban water use target.

(b) In complying with this part, an urban retail water supplier may meet its urban water use target through efficiency improvements in any combination among its customer sectors. An urban retail water supplier shall avoid placing a disproportionate burden on any customer sector.

(c) For an urban retail water supplier that supplies water to a United States Department of Defense military installation, the urban retail water supplier's implementation plan for complying with this part shall consider the conservation of that military installation under federal Executive Order 13514.

(d) (1) Any ordinance or resolution adopted by an urban retail water supplier after the effective date of this section shall not require existing customers as of the effective date of this section, to undertake changes in product formulation, operations, or equipment that would reduce process water use, but may provide technical assistance and financial incentives to those customers to implement efficiency measures for process water. This section shall not limit an ordinance or resolution adopted pursuant to a declaration of drought emergency by an urban retail water supplier.

(2) This part shall not be construed or enforced so as to interfere with the requirements of Chapter 4 (commencing with Section 113980) to Chapter 13 (commencing with Section 114380), inclusive, of Part 7 of Division 104 of the Health and Safety Code, or any requirement or standard for the protection of public health, public safety, or worker safety established by federal, state, or local government or recommended by recognized standard setting organizations or trade associations.

10608.28.(a) An urban retail water supplier may meet its urban water use target within its retail service area, or through mutual agreement, by any of the following:

(1) Through an urban wholesale water supplier.

(2) Through a regional agency authorized to plan and implement water conservation, including, but not limited to, an agency established under the Bay Area Water Supply and Conservation Agency Act (Division 31

(commencing with Section 81300)).

(3) Through a regional water management group as defined in Section 10537.

(4) By an integrated regional water management funding area.

(5) By hydrologic region.

(6) Through other appropriate geographic scales for which computation methods have been developed by the department.

(b) A regional water management group, with the written consent of its member agencies, may undertake any or all planning, reporting, and implementation functions under this chapter for the member agencies that consent to those activities. Any data or reports shall provide information both for the regional water management group and separately for each consenting urban retail water supplier and urban wholesale water supplier.

10608.32. All costs incurred pursuant to this part by a water utility regulated by the Public Utilities Commission may be recoverable in rates subject to review and approval by the Public Utilities Commission, and may be recorded in a memorandum account and reviewed for reasonableness by the Public Utilities Commission.

10608.36. Urban wholesale water suppliers shall include in the urban water management plans required pursuant to Part 2.6 (commencing with Section 10610) an assessment of their present and proposed future measures, programs, and policies to help achieve the water use reductions required by this part.

10608.40. Urban water retail suppliers shall report to the department on their progress in meeting their urban water use targets as part of their urban water management plans submitted pursuant to Section 10631. The data shall be reported using a standardized form developed pursuant to Section 10608.52.

10608.42.(a) The department shall review the 2015 urban water management plans and report to the Legislature by July 1, 2017, on progress towards achieving a 20-percent reduction in urban water use by December 31, 2020. The report shall include recommendations on changes to water efficiency standards or urban water use targets to achieve the 20-percent reduction and to reflect updated efficiency information and technology changes.

(b) A report to be submitted pursuant to subdivision (a) shall be submitted in compliance with Section 9795 of the Government Code.

10608.43 The department, in conjunction with the California Urban Water Conservation Council, by April 1, 2010, shall convene a representative task force consisting of academic experts, urban retail water suppliers, environmental organizations, commercial water users, industrial water users, and institutional water users to develop alternative best management practices for commercial, industrial, and

institutional users and an assessment of the potential statewide water use efficiency improvement in the commercial, industrial, and institutional sectors that would result from implementation of these best management practices. The taskforce, in conjunction with the department, shall submit a report to the Legislature by April 1, 2012, that shall include a review of multiple sectors within commercial, industrial, and institutional users and that shall recommend water use efficiency standards for commercial, industrial, and institutional users among various sectors of water use. The report shall include, but not be limited to, the following:

(a) Appropriate metrics for evaluating commercial, industrial, and institutional water use.

(b) Evaluation of water demands for manufacturing processes, goods, and cooling.

(c) Evaluation of public infrastructure necessary for delivery of recycled water to the commercial, industrial, and institutional sectors.

(d) Evaluation of institutional and economic barriers to increased recycled water use within the commercial, industrial, and institutional sectors.

(e) Identification of technical feasibility and cost of the best management practices to achieve more efficient water use statewide in the commercial, industrial, and institutional sectors that is consistent with the public interest and reflects past investments in water use efficiency.

10608.44. Each state agency shall reduce water use at facilities it operates to support urban retail water suppliers in meeting the target identified in Section 10608.16.

Chapter 4 Agricultural Water Suppliers

SECTION 10608.48

10608.48.(a) On or before July 31, 2012, an agricultural water supplier shall implement efficient water management practices pursuant to subdivisions (b) and (c).

(b) Agricultural water suppliers shall implement all of the following critical efficient management practices:

(1) Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2).

(2) Adopt a pricing structure for water customers based at least in part on quantity delivered.

(c) Agricultural water suppliers shall implement additional efficient management

practices, including, but not limited to, practices to accomplish all of the following, if the measures are locally cost effective and technically feasible:

(1) Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.

(2) Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.

(3) Facilitate the financing of capital improvements for on-farm irrigation systems.

(4) Implement an incentive pricing structure that promotes one or more of the following goals:

(A) More efficient water use at the farm level.

(B) Conjunctive use of groundwater.

(C) Appropriate increase of groundwater recharge.

(D) Reduction in problem drainage.

(E) Improved management of environmental resources.

(F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.

(5) Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce seepage.

(6) Increase flexibility in water ordering by, and delivery to, water customers within operational limits.

(7) Construct and operate supplier spill and tailwater recovery systems.

(8) Increase planned conjunctive use of surface water and groundwater within the supplier service area.

(9) Automate canal control structures.

(10) Facilitate or promote customer pump testing and evaluation.

(11) Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.

(12) Provide for the availability of water management services to water users.

These services may include, but are not limited to, all of the following:

(A) On-farm irrigation and drainage system evaluations.

(B) Normal year and real-time irrigation scheduling and crop evapotranspiration information.

(C) Surface water, groundwater, and drainage water quantity and quality data.

(D) Agricultural water management educational programs and materials for farmers, staff, and the public.

(13) Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.

(14) Evaluate and improve the efficiencies of the supplier's pumps.

(d) Agricultural water suppliers shall include in the agricultural water management plans required pursuant to Part 2.8 (commencing with Section 10800) a report on which efficient water management practices have been implemented and are planned to be implemented, an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future. If an agricultural water supplier determines that an efficient water management practice is not locally cost effective or technically feasible, the supplier shall submit information documenting that determination.

(e) The data shall be reported using a standardized form developed pursuant to Section 10608.52.

(f) An agricultural water supplier may meet the requirements of subdivisions (d) and (e) by submitting to the department a water conservation plan submitted to the United States Bureau of Reclamation that meets the requirements described in Section 10828.

(g) On or before December 31, 2013, December 31, 2016, and December 31, 2021, the department, in consultation with the board, shall submit to the Legislature a report on the agricultural efficient water management practices that have been implemented and are planned to be implemented and an assessment of the manner in which the implementation of those efficient water management practices has affected and will affect agricultural operations, including estimated water use efficiency improvements, if any.

(h) The department may update the efficient water management practices required pursuant to subdivision (c), in consultation with the Agricultural Water Management Council, the United States Bureau of Reclamation, and the board. All efficient water management practices for agricultural water use pursuant to this chapter shall be adopted or revised by the department only after the

department conducts public hearings to allow participation of the diverse geographical areas and interests of the state.

(i) (1) The department shall adopt regulations that provide for a range of options that agricultural water suppliers may use or implement to comply with the measurement requirement in paragraph (1) of subdivision (b).

(2) The initial adoption of a regulation authorized by this subdivision is deemed to address an emergency, for purposes of Sections 11346.1 and 11349.6 of the Government Code, and the department is hereby exempted for that purpose from the requirements of subdivision (b) of Section 11346.1 of the Government Code. After the initial adoption of an emergency regulation pursuant to this subdivision, the department shall not request approval from the Office of Administrative Law to readopt the regulation as an emergency regulation pursuant to Section 11346.1 of the Government Code.

Chapter 5 Sustainable Water Management

Section 10608.50

10608.50.(a) The department, in consultation with the board, shall promote implementation of regional water resources management practices through increased incentives and removal of barriers consistent with state and federal law. Potential changes may include, but are not limited to, all of the following:

(1) Revisions to the requirements for urban and agricultural water management plans.

(2) Revisions to the requirements for integrated regional water management plans.

(3) Revisions to the eligibility for state water management grants and loans.

(4) Revisions to state or local permitting requirements that increase water supply opportunities, but do not weaken water quality protection under state and federal law.

(5) Increased funding for research, feasibility studies, and project construction.

(6) Expanding technical and educational support for local land use and water management agencies.

(b) No later than January 1, 2011, and updated as part of the California Water Plan, the department, in consultation with the board, and with public input, shall propose new statewide targets, or review and update existing statewide targets, for regional water resources management practices, including, but not limited to, recycled water, brackish groundwater desalination, and infiltration and direct use of urban stormwater runoff.

Chapter 6 Standardized Data Collection

SECTION 10608.52

10608.52.(a) The department, in consultation with the board, the California Bay-Delta Authority or its successor agency, the State Department of Public Health, and the Public Utilities Commission, shall develop a single standardized water use reporting form to meet the water use information needs of each agency, including the needs of urban water suppliers that elect to determine and report progress toward achieving targets on a regional basis as provided in subdivision (a) of Section 10608.28.

(b) At a minimum, the form shall be developed to accommodate information sufficient to assess an urban water supplier's compliance with conservation targets pursuant to Section 10608.24 and an agricultural water supplier's compliance with implementation of efficient water management practices pursuant to subdivision (a) of Section 10608.48. The form shall accommodate reporting by urban water suppliers on an individual or regional basis as provided in subdivision (a) of Section 10608.28.

Chapter 7 Funding Provisions

Section 10608.56-10608.60

10608.56.(a) On and after July 1, 2016, an urban retail water supplier is not eligible for a water grant or loan awarded or administered by the state unless the supplier complies with this part.

(b) On and after July 1, 2013, an agricultural water supplier is not eligible for a water grant or loan awarded or administered by the state unless the supplier complies with this part.

(c) Notwithstanding subdivision (a), the department shall determine that an urban retail water supplier is eligible for a water grant or loan even though the supplier has not met the per capita reductions required pursuant to Section 10608.24, if the urban retail water supplier has submitted to the department for approval a schedule, financing plan, and budget, to be included in the grant or loan agreement, for achieving the per capita reductions. The supplier may request grant or loan funds to achieve the per capita reductions to the extent the request is consistent with the eligibility requirements applicable to the water funds.

(d) Notwithstanding subdivision (b), the department shall determine that an agricultural water supplier is eligible for a water grant or loan even though the supplier is not implementing all of the efficient water management practices described in Section 10608.48, if the agricultural water supplier has submitted to the department for approval a schedule, financing plan, and budget, to be included in the grant or loan agreement, for implementation of the efficient

water management practices. The supplier may request grant or loan funds to implement the efficient water management practices to the extent the request is consistent with the eligibility requirements applicable to the water funds.

(e) Notwithstanding subdivision (a), the department shall determine that an urban retail water supplier is eligible for a water grant or loan even though the supplier has not met the per capita reductions required pursuant to Section 10608.24, if the urban retail water supplier has submitted to the department for approval documentation demonstrating that its entire service area qualifies as a disadvantaged community.

(f) The department shall not deny eligibility to an urban retail water supplier or agricultural water supplier in compliance with the requirements of this part and Part 2.8 (commencing with Section 10800), that is participating in a multiagency water project, or an integrated regional water management plan, developed pursuant to Section 75026 of the Public Resources Code, solely on the basis that one or more of the agencies participating in the project or plan is not implementing all of the requirements of this part or Part 2.8 (commencing with Section 10800).

10608.60.(a) It is the intent of the Legislature that funds made available by Section 75026 of the Public Resources Code should be expended, consistent with Division 43 (commencing with Section 75001) of the Public Resources Code and upon appropriation by the Legislature, for grants to implement this part. In the allocation of funding, it is the intent of the Legislature that the department give consideration to disadvantaged communities to assist in implementing the requirements of this part.

(b) It is the intent of the Legislature that funds made available by Section 75041 of the Public Resources Code, should be expended, consistent with Division 43 (commencing with Section 75001) of the Public Resources Code and upon appropriation by the Legislature, for direct expenditures to implement this part.

Chapter 8 Quantifying Agricultural Water Use Efficiency

SECTION 10608.64

The department, in consultation with the Agricultural Water Management Council, academic experts, and other stakeholders, shall develop a methodology for quantifying the efficiency of agricultural water use. Alternatives to be assessed shall include, but not be limited to, determination of efficiency levels based on crop type or irrigation system distribution uniformity. On or before December 31, 2011, the department shall report to the Legislature on a proposed methodology and a plan for implementation. The plan shall include the estimated implementation costs and the types of data needed to support the methodology. Nothing in this section authorizes the department to implement a methodology established pursuant to this section.

Appendix C – 2025 Checklist Corona

Retail (x = required)	Wholesale (x = required)	Order	2025 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	Relevant Submittal Table	2025 UWMP Location
x	x	1	Chapter 1	10615	A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities.	Introduction and overview	n/a	Executive Summary
x	x	1	Chapter 1	10630.5	Each plan shall include a simple description of the Supplier's plan including water availability, future requirements, a strategy for meeting needs, and other pertinent information. Additionally, a Supplier may also choose to include a simple description at the beginning of each chapter.	Plan preparation	n/a	Executive Summary, CH 1 and Ch 2
x	x	2.1	Section 2.1	10620(b)	Every person that becomes a Supplier shall adopt UWMP within one year after it has become a Supplier.	Plan preparation	n/a	Chapter 2; Section 2.1 Basis for Preparation Plan
x	n/a	2.5	Section 2.5	10644	Supplier shall report the Public Water Systems number, volume of delivered water, and number of connections that are included in this UWMP.	Plan preparation	2-1	Chapter 2; Section 2.1 Basis for Preparation Plan, Section 2.1.1 Public Water Systems
x	x	2.5	Section 2.5	10644	Supplier shall report if this UWMP is an individual UWMP and whether the Supplier belongs to a regional UWMP or regional alliance.	Plan preparation	2-2	Chapter 2; Section 2.2 Individual or Regional Plans.
x	x	2.5	Section 2.5	10644	Supplier shall report whether the data is in fiscal or calendar years and the units of measure used for reporting water volumes.	Plan preparation	2-3	Chapter 2; Section 2.3 Fiscal or Calendar Year and Units of Measure
x	x	2.4	Section 2.4	10642	Provide supporting documentation that the Supplier has encouraged active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan and contingency plan.	Plan preparation	n/a	Chapter 2; Section 2.4 Coordination and outreach
x	x	2.4	Section 2.4.2	10620(d)(3)	Coordinate the preparation of its plan with other appropriate agencies in the area, including other Suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.	Plan preparation	n/a	Chapter 2; Section 2.4 Coordination and outreach
x	n/a	2.4	Section 2.4.1	10631(h)	Retail Suppliers will include documentation that they have provided their Wholesale Supplier(s)—if any—with water use projections from that source.	Plan preparation	2-4 R	Chapter 2; Section 2.4 Coordination and outreach
n/a	x	2.4	Section 2.4.1	10631(h)	Wholesale Suppliers will provide their Suppliers with identification and quantification of the existing and planned sources of water available from the Wholesale Supplier to the Supplier during various water year types.	Plan preparation	2-4 W	N/A
x	x	3	Chapter 3.0	10631(a)	Describe the Supplier service area.	System description	n/a	Chapter 3; Section 3.1 General Description
x	x	3.3	Section 3.3	10631(a)	Describe the climate of the Supplier's service area.	System description	n/a	Chapter 3; Section 3.3 Service Area Climate
x	x	3.4	Section 3.4.1	10631(a)	Provide the current and projected service area populations for 2030, 2035, 2040, 2045 and optionally 2050.	System description	3-1	Chapter 3; Section 3.4 Service Area Population and Demographics, Section 3.4.1 Service Area population
x	x	3.4	Section 3.4.2	10631(a)	Describe other social, economic, and demographic factors affecting the Supplier's water management planning.	System description	n/a	Chapter 3; Section 3.4 Service Area Population and Demographics, Section 3.4.2 Other Social, Economic, and Demographic Factors.
x	x	3.5	Section 3.5	10631(a)	Describe the land uses within the service area… include the current and projected land uses within the existing or anticipated service area affecting the Supplier's water management planning. Describe the land uses within the service area.	System description and baselines	n/a	Chapter 3; Section 3.6 Land Uses within the Service
x	Optional	4.2	Sections 4.2.3 and 4.2.4	10631(d)(1)	Quantify past, current, and projected water use, identifying the uses among water use sectors.	System water use	4-1 and 4-2	Chapter 4; Section 4.2.3 Past Water Use & Section 4.2.5 Projected Water Use
x	Optional	4.3	Section 4.3.1	10631(d)(3)(A)	Report the distribution system water loss for each of the five years preceding the plan update.	System water use	4-5	Chapter 4; Section 4.3 Distribution System Water Loss, Section 4.3.1 Previous Five Years Distribution System Losses
x	n/a	4.3	Section 4.3.2	10631(d)(3)(C)	Retail Suppliers shall provide data to show the distribution loss standards were met.	System water use	4-6	Chapter 4; Section 4.3 Distribution System Water Loss, Section 4.3.2 Progress Towards Meeting the Water Loss Performance Standard
x	n/a	4.2	Section 4.2.5.4	10631.1(a)	Include projected water use needed for lower income housing projected in the service area of the Supplier.	System water use	4-3	Chapter 4; Section 4.2.5 Projected Water Use, Section Lower Income Households
x	n/a	4.2	Section 4.2.5.3	10631(d)(4)(A)	In projected water use, include estimates of water savings from adopted codes, plans, and other policies or laws.	System water use	4-3	N/A
x	n/a	4.2	Section 4.2.5.3	10631(d)(4)(B)	Provide citations of codes, standards, ordinances, or plans used to make water use projections.	System water use	4-3	Chapter 4; Section 4.2.5 Projected Water Use
x	n/a	4.2	Section 4.2.5.3	10631(d)(4)(B)(ii)	To the extent that a Supplier reports the information described in subparagraph (A), an urban water Supplier shall… Indicate the extent that the water use projections consider savings from codes, standards, ordinances, or transportation and land use plans. Water use projections that do not account for these water savings shall be noted of that fact.	System water use	4-3	Chapter 4; Section 4.2.5 Projected Water Use
x	x	4.2	Section 4.2.5.6	10635(b)	Demands under climate change considerations must be included as part of the drought risk assessment.	System water use	n/a	Chapter 4; Section 4.2.5 Projected Water Use, Section Climate Change and Local Considerations
n/a	x	5.1	Section 5.1	10608.36	Wholesale Suppliers shall include an assessment of present and proposed future measures, programs, and policies to help their Retail Suppliers achieve targeted water use reductions.	Baselines and targets	n/a	N/A
x	n/a	5.2	Section 5.2	10608.4	Retail Suppliers shall report on their compliance in meeting their water use targets. Reporting requirements will vary depending on whether the Supplier: - Was considered an urban retail water supplier in 2020, - Met its 2020 target in 2020, or - Was part of a merger or consolidation since 2020. Chapter 5 Subsections 5.2.1, 5.2.2, and 5.2.3 address each of these situations.	Baselines and targets	5-1	Chapter 5; SB X7-7 Baselines, Targets, and 2025 Reporting.
x	x	6.1	Section 6.1	10631(b)(2)	When multiple sources of water supply are identified, describe the management of each supply in relationship to other identified supplies.	System supplies	n/a	Chapter 6, Section 6.2 Water Supply Analysis Overview, Section 6.3 Purchased or Imported Water and Section 6.4 Grounwater
x	x	6.1	Sections 6.1 and 6.2	10631(b)(1)	Provide a discussion of anticipated supply availability under a normal, single dry year, and a drought lasting five years, as well as more frequent and severe periods of drought, including changes in supply due to climate change.	System supplies	n/a	Chapter 6, Section 6.2 Water Supply Analysis Overview, Section 6.3 Purchased or Imported Water and Section 6.4 Grounwater
x	x	6.2	Section 6.2.2	10631(b)(4)(C)	Indicate whether groundwater is an existing or planned source of water available to the Supplier. If groundwater is identified as an existing or planned source of water… (include) a detailed description and analysis of the location, amount and sufficiency of groundwater pumped by the Supplier for the past five years.	Water supplies and recycled water	6-1	Chapter 6; Section 6.4 Groundwater
x	x	6.2	Section 6.2.2	10631(b)(4)(A)	Indicate whether a groundwater sustainability plan or groundwater management plan has been adopted by the Supplier or if there is any other specific authorization for groundwater management. Include a copy of the plan or authorization.	System supplies	n/a	Chapter 6; Section 6.4 Groundwater
x	x	6.2	Section 6.2.2	10631(b)(4)(B)	Describe the groundwater basin.	System supplies	n/a	Chapter 6; Section 6.4 Groundwater
x	x	6.2	Section 6.2.2	10631(b)(4)(B)	Indicate if the basin has been adjudicated and include a copy of the court order or decree and a description of the amount of water the Supplier has the legal right to pump.	System supplies	n/a	Chapter 6; Section 6.4 Groundwater
x	x	6.2	Section 6.2.2	10631(b)(4)(B)	For unadjudicated basins… (include) information as to whether DWR has identified the basin as a high- or medium-priority basin in the most current official departmental bulletin…	Water supplies and recycled water	n/a	Chapter 6; Section 6.4 Groundwater
x	x	6.2	Section 6.2.2	10631(b)(4)(B)	For unadjudicated basins… describe efforts by the Supplier to coordinate with sustainability or groundwater agencies to achieve sustainable groundwater conditions.	Water supplies and recycled water	n/a	Chapter 6; Section 6.4 Groundwater

Retail (x = required)	Wholesale (x = required)	Order	2025 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	Relevant Submittal Table	2025 UWMP Location
x	x	6.2	Section 6.2.2.	10631(b)(4)(C)	If groundwater is identified as an existing or planned source of water… (include) a detailed description and analysis of the location, amount and sufficiency of groundwater pumped by the Supplier for the past five years.	System supplies	n/a	Chapter 6; Section 6.4 Groundwater
x	x	6.2	Section 6.2.2	10631(b)(4)(D)	Provide a detailed description and analysis of the amount and location of groundwater that is projected to be pumped.	System supplies	6-9	Chapter 6; Section 6.4 Groundwater
x	x	6.1	Section 6.1	10631(b)	Identify and quantify the existing and planned sources of water available for 2025, 2030, 2035, 2040, 2045 and optionally 2050.	System supplies	6-8 and 6-9	Chapter 6; Section 6.10 Summary of Existing and Planned Sources of Water
x	x	6.2	Section 6.2.7	10631(c)	Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.	System supplies	n/a	Chapter 6; Section 6.9 Water Exchanges and Water Transfers
x	n/a	6.2	Section 6.2.5	10633(a)	Describe the wastewater collection and treatment systems in the Supplier's service area with quantified amount of collection and treatment and the disposal methods.	System supplies (recycled water)	6-2	Chapter 6; Section 6.7 Wastewater and Recycled Water
x	x	6.2	Section 6.2.5	10633(b)	Describe the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.	System supplies (recycled water)	6-3	Chapter 6; Section 6.7 Wastewater and Recycled Water
x	x	6.2	Section 6.2.5	10633(c)	Describe the recycled water currently being used in the Supplier's service area.	System supplies (recycled water)	6-4	Chapter 6; Section 6.7 Wastewater and Recycled Water
x	x	6.2	Section 6.2.5	10633(d)	Describe and quantify the potential uses of recycled water and provide a determination of the technical and economic feasibility of those uses.	System supplies (recycled water)	6-4	Chapter 6; Section 6.7 Wastewater and Recycled Water
x	x	6.2	Section 6.2.5	10633(e)	Describe the projected use of recycled water within the Supplier's service area at the end of 5, 10, 15, and 20 years, and describe the actual use of recycled water in comparison to uses previously projected.	System supplies (recycled water)	6-4 and 6-5	Chapter 6; Section 6.7 Wastewater and Recycled Water
x	x	6.2	Section 6.2.5	10633(f)	Describe the actions that may be taken to encourage the use of recycled water and the projected results of these actions in terms of acre-feet of recycled water used per year.	System supplies (recycled water)	6-6	Chapter 6; Section 6.7 Wastewater and Recycled Water
x	x	6.2	Section 6.2.5	10633(g)	Provide a plan for optimizing the use of recycled water in the Supplier's service area.	System supplies (recycled water)	n/a	Chapter 6; Section 6.7 Wastewater and Recycled Water
x	x	6.2	Section 6.2.6	10631(g)	Describe desalinated water project opportunities for long-term supply.	System supplies	6-7	Chapter 6; Section 6.8 Dsesalinated Water Opportunities
x	x	6.2	Section 6.2.10	10631(f)	Describe the expected future water supply projects and programs that may be undertaken by the water Supplier to address water supply reliability in average, single-dry, and for a period of drought lasting five consecutive water years.	System supplies	6-7	Chapter 6; Section 6.10 Future Water Projects
x	x	6.3	Section 6.3 and Appendix O	10631.2(a)	The UWMP must include energy information, as stated in the code, that a Supplier can readily obtain.	System suppliers, energy intensity	O-1A, O-1B, O-1C, and O-2	Chapter 6; Section 6.12 Energy Intensity
x		7.1	Section 7.1	10634	Provide information on the quality of existing sources of water available to the Supplier and the manner in which water quality affects water management strategies and supply reliability.	Water supply reliability assessment	n/a	Chapter 7; Section 7.2 Water Service Reliability Assessment
x	x	7.2	Section 7.2	10635(a)	Service Reliability Assessment: Assess the water supply reliability during normal, dry, and a drought lasting five consecutive water years by comparing the total water supply sources available to the Supplier with the total projected water use over the next 20 years.	Water supply reliability assessment	7-2, 7-3, and 7-4	Chapter 7; Section 7.2.2 7.2.2WSRA Description of Management Tools and Options
x	x	7.2	Section 7.2.3	10620(f)	Describe water management tools and options to maximize resources and minimize the need to import water from other regions.	Water supply reliability assessment	n/a	Chapter 7; Section 7.2.3 WRSA Description of Management Tools and Options
x	x	7.3	Section 7.3	10635(b)	Provide a drought risk assessment as part of information considered in developing the demand management measures and water supply projects.	Water supply reliability assessment	n/a	Chapter 7; Section 7.2 Drought Risk Assessment
x	x	7.3	Section 7.3	10635(b)(1)	Include a description of the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a drought period that lasts five consecutive years.	Water supply reliability assessment	n/a	Chapter 7; Section 7.3.1 7.3.1 Data, Methods, and Basis for Water Shortage Condition
x	x	7.3	Section 7.3	10635(b)(2)	Include a determination of the reliability of each source of supply under a variety of water shortage conditions.	Water supply reliability assessment	n/a	Chapter 7, Section 7.3.2 7.3.2 DRA Water Source Reliability
x	x	7.3	Section 7.3	10635(b)(3)	Include a comparison of the total water supply sources available to the Supplier with the total projected water use for the drought period.	Water supply reliability assessment	7-5	Chapter 7; Section 7.3.3 DRA Water Supply and Use Comparison
x	x	7.3	Section 7.3	10635(b)(4)	Include considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions, anticipated regulatory changes, and other locally applicable criteria.	Water supply reliability assessment	n/a	Chapter 7; Section 7.3.3 DRA Water Supply and Use Comparison
x	x	8	Chapter 8	10632(a)	Provide a water shortage contingency plan (WSCP) with specified elements below.	Water shortage contingency planning	n/a	Chapter 8; WSCP
x	x	8	Chapter 8	10632(a)(1)	Provide an analysis of water supply reliability (from Guidebook Chapter 7) in the WSCP.	Water shortage contingency planning	n/a	Chapter 8; Section 8.5 Shortage Response Actions
x	x	8.2	Section 8.2	10632(a)(2)(A)	Provide the written decision-making process and other methods that the Supplier will use each year to determine its water reliability.	Water shortage contingency planning	n/a	Chapter 8; WSCP, Section 8.2 Annual Water Supply and Demand Assessment Procedures, Section 8.2.1 Decision-Making Process
x	x	8.2	Section 8.2	10632(a)(2)(B)	Provide data and methodology to evaluate the Supplier's water reliability for the current year and one dry year pursuant to factors in the code.	Water shortage contingency planning	n/a	Chapter 8; WSCP, Section 8.2 Annual Water Supply and Demand Assessment Procedures, 8.2.2 Data and Methodologies
x	x	8.3	Section 8.3	10632(a)(3)(A)	Define six standard water shortage levels of 10%, 20%, 30%, 40%, 50% shortage, and greater than 50% shortage. These levels shall be based on supply conditions, including percent reductions in supply, changes in groundwater levels, changes in surface elevation, or other conditions. The shortage levels shall also apply to a catastrophic interruption of supply.	Water shortage contingency planning	n/a	Chapter 8; WSCP, Section 8.3 Six Standard Water Shortages Stages
x	x	8.3	Section 8.3	10632(a)(3)(B)	Suppliers with an existing WSCP that uses different water shortage levels must cross reference their categories with the six standard categories.	Water shortage contingency planning	8-1	Chapter 8; WSCP, Section 8.3 Six Standard Water Shortages Stages
x	x	8.4	Section 8.4	10632(a)(4)(A)	Suppliers with WSCPs that align with the defined shortage levels must specify locally appropriate supply augmentation actions.	Water shortage contingency planning	8-2	Chapter 8: WSCP, Section 8.4 Shortage Response Actions, 8.4.1 Supply Augmentation
x	x	8.4	Section 8.4	10632(a)(4)(B)	Specify locally appropriate demand reduction actions to adequately respond to shortages.	Water shortage contingency planning	8-3	Chapter 8: WSCP, Section 8.4 Shortage Response Actions, 8.4.2 Demand Reductions
x	x	8.4	Section 8.4	10632(a)(4)(C)	Specify locally appropriate operational changes.	Water shortage contingency planning	8-2	Chapter 8: WSCP, Section 8.4 Shortage Response Actions, 8.4.3 Operational Changes
x	x	8.4	Section 8.4	10632(a)(4)(D)	Specify additional mandatory prohibitions against specific water use practices that are in addition to State-mandated prohibitions are appropriate to local conditions.	Water shortage contingency planning	Table 8-3	Chapter 8: WSCP, Section 8.4 Shortage Response Actions, 8.4.4 Additional Mandatory Restrictions
x	x	8.4	Section 8.4	10632(a)(4)(E)	Estimate the extent to which the gap between supplies and demand will be reduced by implementation of the action.	Water shortage contingency planning	8-2 and 8-3	Chapter 8: WSCP, Section 8.4 Shortage Response Actions, 8.4.2 Demand Reduction & 8.4.3 Operational Changes
x	x	8.4	Section 8.4.6	10632.5	The UWMP shall include a seismic risk assessment and mitigation plan.	Water shortage contingency plan	n/a	Chapter 8: WSCP, Section 8.4 Shortage Response Actions, 8.4.6 Seismic Risk Assessment and Mitigation Plan
x	x	8.5	Section 8.5	10632(a)(5)(A)	Suppliers must describe that they will inform customers, the public and others regarding any current or predicted water shortages.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.5 Communication Protocols
x	x	8.5	Section 8.5	10632(a)(5)(B), 10632(a)(5)(C)	Suppliers must describe that they will inform customers, the public and others regarding any shortage response actions triggered or anticipated to be triggered and other relevant communications.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.5 Communication Protocols
x	n/a	8.6	Section 8.6	10632(a)(6)	Retail Supplier must describe how it will ensure compliance with and enforce provisions of the WSCP.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.6 Compliance and Enforcement
x	x	8.7	Section 8.7	10632(a)(7)(A)	Describe the legal authority that empowers the Supplier to enforce shortage response actions.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.6 Compliance and Enforcement
x	x	8.7	Section 8.7	10632(a)(7)(B)	Provide a statement that the Supplier will declare a water shortage emergency per Water Code Chapter 3. *Water Shortage Emergencies* .	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.7 Legal Authorities

Retail (x = required)	Wholesale (x = required)	Order	2025 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	Relevant Submittal Table	2025 UWMP Location
x	x	8.7	Section 8.7	10632(a)(7)(C)	Provide a statement that the Supplier will coordinate with any city or county within which it provides water for the possible proclamation of a local emergency.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.7 Legal Authorities
x	x	8.8	Section 8.8	10632(a)(8)(A)	Describe the potential revenue reductions and expense increases associated with activated shortage response actions.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.8 Financial Consequences of WSCP
x	x	8.8	Section 8.8	10632(a)(8)(B)	Provide a description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage response actions.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.8 Financial Consequences of WSCP
x	n/a	8.8	Section 8.8	10632(a)(8)(C)	Retail Suppliers must describe the cost of compliance with Water Code Chapter 3.3, *Excessive Residential Water Use During Drought* .	Water shortage contingency planning	n/a	N/A
x	n/a	8.9	Section 8.9	10632(a)(9)	Retail Suppliers must describe the monitoring and reporting requirements and procedures that ensure appropriate data are collected, tracked, and analyzed for purposes of monitoring customer compliance.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.9 Monitoring and Reporting
x	x	8.10	Section 8.10	10632(a)(10)	Describe reevaluation and improvement procedures for monitoring and evaluation the WSCP to ensure risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.10 WSCP Refinement Procedures
x	n/a	8.11	Section 8.11	10632(b)	Analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.10 WSCP Refinement Procedures
x	x	8.12	Section 8.12	10632(c)	Make available the WSCP to customers and any city or county where it provides water within 30 days after adoption of the plan.	Water shortage contingency planning	n/a	Chapter 8: WSCP, Section 8.11 Special Water Feature Distinction
x	n/a	9.1	Sections 9.1	10631(e)(1)	Retail Suppliers shall provide a description of the nature and extent of each demand management measure implemented over the past five years. The description will address specific measures listed in code.	Demand management measures	n/a	Chapter 9: Demand Management Measures, Section 9.1 DMM for Retail Suppliers
n/a	x	9.2	Sections 9.2	10631(e)(2)	Wholesale Suppliers shall describe specific demand management measures listed in code, their distribution system asset management program, and Supplier assistance program.	Demand management measures	n/a	N/A
x	n/a	10	Chapter 10	10608.26(a)	Retail Suppliers shall conduct a public hearing to discuss adoption, implementation, and economic impact of water use targets (recommended to discuss compliance).	Plan adoption, submittal, and implementation	n/a	Chapter 10: P,A,S, and I
x	x	10.2	Section 10.2.1	10621(b)	Notify, at least 60 days prior to the public hearing, any city or county within which the Supplier provides water that the Supplier will be reviewing the UWMP and considering amendments or changes to the plan.	Plan adoption, submittal, and implementation	10-1	Chapter 10: P, A, S, and I, 10.3 Notice of Public Hearing, 10.3.2 60 Day Notification
x	x	10.4	Section 10.4	10621(f)	Each urban water Supplier shall update and submit its 2025 plan to DWR by July 1, 202 6.	Plan adoption, submittal, and implementation	n/a	Chapter 10: P, A, S, and I, 10.5 Plan Submittal
x	x	10.2	Sections 10.2.2, 10.3, and 10.5	10642	Provide supporting documentation that the Supplier made the UWMP and WSCP available for public inspection, published notice of the public hearing, and held a public hearing about the UWMP and WSCP.	Plan adoption, submittal, and implementation	n/a	Chapter 10: P, A, S, and I, 10.4 Public Hearing and Adoption
x	x	10.2	Section 10.2.2	10642	The Supplier is to provide the time and place of the hearing to any city or county within which the Supplier provides water.	Plan adoption, submittal, and implementation	10-1	Chapter 10: Section 10.3 Notice of Public Hearing, Section 10.3.3 Notice of Public Hearing
x	x	10.3	Section 10.3.2	10642	Provide supporting documentation that the UWMP and WSCP has been adopted as prepared or modified.	Plan adoption, submittal, and implementation	n/a	Chapter 10: P, A, S, and I, 10.4 Public Hearing and Adoption
x	x	10.4	Section 10.4	10644(a)	Provide supporting documentation that the Supplier has submitted their UWMP to the California State Library.	Plan adoption, submittal, and implementation	n/a	Chapter 10: P, A, S, and I, 10.5 Plan Submittal, Section 10.5.3 Submitting a UWMP, Including WSCP, to the California State Library
x	x	10.4	Section 10.4	10644(a)(1)	Provide supporting documentation that the Supplier has submitted their UWMP to any city or county within which the Supplier provides water no later than 30 days after adoption.	Plan adoption, submittal, and implementation	n/a	Chapter 10: P, A, S, and I, 10.5 Plan Submittal, Section 10.5.4 Submittal to Cities and Counties
x	x	10.4	Sections 10.4.1 and 10.4.2	10644(a)(2)	The UWMP, or amendments to the UWMP, submitted to DWR shall be submitted electronically.	Plan adoption, submittal, and implementation	n/a	Chapter 10: P, A, S, and I, 10.5 Plan Submittal, Section 10.5.2 Electronic Submittal to California DWR
x	x	10.7	Section 10.7.2	10644(b)	If revised, submit a copy of the WSCP to DWR within 30 days of adoption.	Plan adoption, submittal, and implementation	n/a	Chapter 10: P, A, S, and I, 10.9 Amending an Adopted Urban Water Management Plan or Water Shortage Contingency Plan, Section 10.9.2 Submitting Revised Water Shortage Contingency Plan
x	x	10.5	Section 10.5	10645(a)	Provide supporting documentation that, not later than 30 days after filing a copy of its UWMP with DWR, the Supplier has or will make the plan available for public review during normal business hours.	Plan adoption, submittal, and implementation	n/a	Chapter 10: P, A, S, and I, 10.6 Public Availability
x	x	10.5	Section 10.5	10645(b)	Provide supporting documentation that, not later than 30 days after filing a copy of its WSCP with DWR, the Supplier has or will make the plan available for public review during normal business hours.	Plan adoption, submittal, and implementation	n/a	Chapter 10: P, A, S, and I, 10.6 Public Availability
x	x	10.6	Section 10.6	10621(c)	If Supplier is regulated by the Public Utilities Commission, include its plan and contingency plan as part of its general rate case filings.	Plan adoption, submittal, and implementation	n/a	Chapter 10: P, A, S, and I, 10.7 Notification to Public Utilities Commision

Appendix D – Corona 2025 Submittal Tables

Submittal Table 2-1 Retail: Public Water Systems			
Public Water System Number	Public Water System Name	Number of Municipal Connections 2025	Volume of Water Supplied 2025 (AF)
Add additional rows as needed			
CA3310037	Corona, City of	46,569	30,379
	Total	46,569	30,379

DWR NOTES:
Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3. This table identifies the unit of measure selected in Submittal Table 2-3.

NOTES:

Submittal Table 2-2: Plan Identification		
Select One	**Type of Plan**	**Name of Regional Alliance or RUWMP** (Drop Down List)
☑	**Individual UWMP**	
	If Water Supplier is also a member of a SB X7-7 Regional Alliance, select name from the drop-down.	
☐	**Regional Urban Water Management Plan (RUWMP)**	
	If Supplier selected RUWMP, select name from the drop-down.	
NOTES:		

Submittal Table 2-3: Supplier Identification	
Type of Supplier (select one or both)	
☐	Supplier is a wholesale supplier
☑	Supplier is a retail supplier
Fiscal or Calendar Year (select one)	
☑	UWMP Tables are in calendar years
☐	UWMP Tables are in fiscal years
If using fiscal years provide month and date that the fiscal year begins (mm/dd)	
Units of measure used in UWMP (Select from the drop down list).	
Unit	AF
DWR NOTES: **Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Submittal Table 2-3.	
NOTES:	

Submittal Table 2-4 Retail: Water Supplier Information Exchange **Water Code Section 10631(h)**
The retail Supplier has informed the following wholesale supplier(s) of projected water use.
Wholesale Water Supplier Name
Add additional rows as needed
Western Municipal Water District Of Riverside
NOTES:

10631(h) An urban water supplier that relies upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available.

Submittal Table 3-1 Retail: Population - Current and Projected Water Code Section 10631(a)						
Population Served	2025	2030	2035	2040	2045	2050(opt)
	169,380	168,892	168,404	167,916	167,428	166,940
NOTES:						

CWC 10631(a) describe the current and projected population of the service area including current and projected population…

Submittal Table 4-1 Retail: Total Uses for Potable and Non-Potable Water — Actual Water Code Section 10631(d)(1)			
Use Type	Additional Description (as needed)	2025 Actual Water Use	
Drop down list May select each use multiple times These are the only use types that will be recognized by the WUEdata online submittal tool		**Potable or Non-Potable** (OPTIONAL) Drop down list	Volume (AF)
Add additional rows as needed			
Single Family		Potable	17,934
Multi-Family		Potable	2,666
Other (optional)	Commercial/Institutional	Potable	3,006
Industrial		Potable	902
Landscape		Potable	2,934
Landscape	Reclaimed Water Use	Non-Potable	3,854
Other (optional)	Temp Construction/Hydrants	Potable	76
Other (optional)	Temp Construction/Hydrants	Non-Potable	74
Other (optional)	Brine Discharge	Non-Potable	626
Distribution System Water Loss	Real and Apparent Losses	Potable	2,521
Sales/Transfers/Exchanges to Other Suppliers	Norco and Home Gardens	Potable	355
		Subtotal Potable	30,394
		Subtotal Non-Potable	4,555
		Total	34,949
DWR NOTES: Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3. This table identifies the unit of measure selected in Submittal Table 2-3.			
NOTES:			

Submittal Table 4-2 Retail: Total Uses for Potable, and Non-Potable Water — Projected
Water Code Section 10631(d)(1)

Use Type	Additional Description (as needed)	Projected Water Use (Report To the Extent that Records are Available)					
Drop down list May select each use multiple times These are the only Use Types that will be recognized by the WUEdata online submittal tool		**Potable or Non-Potable** (OPTIONAL) Drop down list	**2030 (AF)**	**2035 (AF)**	**2040 (AF)**	**2045 (AF)**	**2050 opt (AF)**
Add additional rows as needed.							
Single Family		Potable	21,743	21,745	21,815	21,750	21,753
Multi-Family		Potable	3,237	3,238	3,248	3,238	3,239
Other (optional)	Commercial/Institutional	Potable	3,593	3,593	3,605	3,594	3,594
Industrial		Potable	1,094	1,095	1,098	1,095	1,095
Landscape		Potable	2,834	2,734	2,634	2,534	2,434
Landscape	Reclaimed Water Use	Non-Potable	3,830	3,930	4,030	4,130	4,230
Other (optional)	Temp Construction/Hydrants	Potable	366	366	366	366	366
Other (optional)	Temp Construction/Hydrants	Non-Potable	95	95	95	95	95
Other (optional)	Brine Discharge	Potable	618	618	618	618	618
Distribution System Water Loss	Real and Apparent Losses	Potable	2,612	2,604	2,604	2,589	2,582
Sales/Transfers/Exchanges to other Suppliers	Norco and Home Gardens	Potable	370	370	370	370	370
		Subtotal Potable	36,467	36,364	36,358	36,154	36,051
		Subtotal Non-Potable	3,925	4,025	4,125	4,225	4,325
		Total	40,392	40,389	40,483	40,379	40,376

DWR NOTES: Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3. This table identifies the unit of measure selected in Submittal Table 2-3.

NOTES:

CWC 10631(d)(1) For an urban retail water supplier, quantify, to the extent records are available... projected water use...identifying the uses among water use sectors...

Submittal Table 4-3 Retail: Inclusion in Water Use Projections Water Code Section 10631 (a), 10631 (d)(4)(A), and 10631 (d)(4)(B)	
Are Future Water Savings Included in Projections? **Drop down list (y/n)**	No
If "Yes" to above, **state the section or page number**, in the cell to the right, where citations of the codes, ordinances, or otherwise are utilized in demand projections are found. ***Optional*** Suppliers may complete Optional Submittal Table 4-4 R to quantify the expected savings.	
Are Lower Income Residential Demands Included In Projections? **Drop down list (y/n)**	Yes
Optional If the method for accounting Lower Income Residential Demands has been included, provide page number where this accounting can be found.	
DWR NOTES: Additional guidance is provided in Appendix K.	
NOTES:	

Submittal Table 4-5 Retail: Water Loss Audit Reporting Water Code Section 10631(d)(3)(A)		
Public Water System ID # Reported in Table 2-1 R	Reporting Period	Submitted to DWR Water Loss Audit Program (yes/no)
Report submittal status for all five years for each Public Water System as available. Add rows as needed		
CA3310037	**2020**	Yes
	2021	Yes
	2022	Yes
	2023	Yes
	2024	Yes
DWR NOTES: Suppliers will provide a link to the WUEdata submittals of their Water Loss Audit Reports.		
NOTES:		

CWC 10631(d)(3) (A) The distribution system water loss shall be quantified for each of the five years preceding the plan update, in accordance with rules adopted pursuant to Section 10608.34.

Submittal Table 4-6 Retail: Progress Towards 2028 Water Loss Standard
Water Code Section 10631(d)(3)(C)

Public Water System ID # Reported in Submittal Table 2-1 R	Did the Water Board Calculate a Water Loss Standard for this Public Water System? (y/n) If no, Supplier will not complete this row.	Real Water Loss					Apparent Water Loss				
		State Water Board Standard		Most Recent AWWA Water Loss Audit			State Water Board Standard		Most Recent AWWA Water Loss Audit		
		2028 Real Water Loss Standard per Unit per day	Units for Real Water Loss Drop down list	Number of Units (Connections or Miles corresponding with units selected)	Volume of Total Real Loss (from AWWA Water Loss Audit) (AF)	Real Water Loss Per Unit per Day	2028 Apparent Water Loss Standard per Unit per Day	Units for Apparent Water Loss	Number of Connections	Volume of Total Apparent Loss (from AWWA Water Loss Audit) (AF)	Apparent Water Loss Per Unit per Day
Add additional rows as needed.											
CA3310037	Yes	13.9	Gallons per Service Connection per Day (GPSCD)	46569	895	17.1	14.5	Gallons per Service Connection per Day (GPSCD)	46569	728	14.0

Water Board's Calculated Water Loss Standards

DWR NOTES: Units of measure (AF, CCF, MG) for Water Loss **MUST** remain consistent with units reported in Submittal Table 2-3. The units reported in Submittal Table 2-3 are used in this table's calculations.

NOTES:

CWC 10631(d)(3)(C) In the plan due July 1, 2021, and in each update thereafter, data shall be included to show whether the urban retail water supplier met the distribution loss standards enacted by the board pursuant to Section 10608.34.

Submittal Table 5-1 Retail: SB X7-7 2020 Target Progress Water Code Section 10608.40						
☐	**Check the box if the Supplier was not an Urban Water Supplier during or before the 2020 UWMP reporting cycle. Proceed to the next table.**					
Was Supplier part of a merger or consolidation since 2020?	Regional Alliance Target or Individual Target? Drop down list	2020 Target	Actual 2020 GPCD	Did Supplier Achieve Targeted Reduction for 2020?	**Only for suppliers that did not meet the Target in 2020** **See DWR NOTES below.**	
					Actual 2025 GPCD (From SB X7-7 Compliance Form)	Did Supplier meet the 2020 Target in 2025?
No	Individual Target	213	177	Yes		NA

DWR NOTES:
Suppliers calculating a 2025 GPCD will need to complete and submit SB X 7-7 Compliance Tables to verify the use of SB X7-7 Methodologies.
Suppliers that were part of a merger or consolidation since 2020 see Chapter 5 and Appendix P for guidance.
NA=Not Applicable

NOTES:

10608.40 Urban water retail suppliers shall report to the department on their progress in meeting their urban water use targets as part of their urban water management plans submitted pursuant to Section 10631.

Submittal Table 6-1 Retail: Groundwater Volume Pumped
Water Code Section 10631(4) and 10631(4)(c)

☐	Check the box if the Supplier does not pump groundwater. Proceed to the next table.
☐	Check the box if all or part of the groundwater described below is desalinated. (OPTIONAL)

Groundwater Type **Drop Down List** May use each category multiple times	Potable or Non-Potable (OPTIONAL) **Drop down list**	Location or Basin Name	2021 (AF)	2022 (AF)	2023 (AF)	2024 (AF)	2025 (AF)
Add additional rows as needed							
Alluvial Basin		Temescal Basin	16465	14482	14472	14227	15569
Alluvial Basin		Bedford-Coldwater Basin	0	0	0	0	0
		Total	16,465	14,482	14,472	14,227	15,569

DWR NOTES:
Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3. This table identifies the unit of measure selected in Submittal Table 2-3.

NOTES

10631(4) If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information:

(C) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

Submittal Table 6-2 Retail: Wastewater Collected Within Service Area Water Code Section 10633(a)				
☐	Check the box if there is no wastewater collection system. Proceed to the next table.			
	Percentage of 2025 service area served by wastewater collection system (OPTIONAL)			
	Percentage of 2025 service area population served by wastewater collection system (OPTIONAL)			
Wastewater Collection			**Recipient of Collected Wastewater**	
Name of Wastewater Collection Agency	Wastewater Volume Metered or Estimated? OPTIONAL **Drop Down List**	Volume of Wastewater Collected from UWMP Service Area 2025 (AF)	Name of Wastewater Treatment Plant (WWTP) and Place ID Number **Drop down list**	Is WWTP Located Within UWMP Area? **Drop Down List**
Add additional rows as needed				
City of Corona	Metered	9,157	Corona WWRF #1, Place ID 259171	No
City of Corona	Metered	2,251	Corona WWRF #2, Place ID 259173	No
City of Corona	Metered	763	Corona WWRF #3, Place ID 259174	No
Total Wastewater Received from UWMP Service Area in 2025:		12,171		
DWR NOTES: Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3. This table identifies the unit of measure selected in Submittal Table 2-3. **Additional Guidance**: See Appendix M, Section M.21 for detailed guidance on this table.				
NOTES:				

Submittal Table 6-3 Retail: Wastewater Treatment and Outcomes Within UWMP Service Area
Water Code Section 10633(b)

☐ **Check the box if no wastewater is treated or disposed of within the UWMP service area.**
Proceed to the next table.

Wastewater Treatment Plant Name and Place ID Number **Drop down list**	Does This Plant Treat Wastewater Generated Outside the UWMP Service Area? (OPTIONAL) **Drop down list**	2025 Volume of Wastewater Received from UWMP Service Area (As Reported in Submittal Table 6-2 R) (AF)	Total 2025 Volume of Water Treated (AF)	2025 Outcomes of Treated Wastewater										
				Water Recycled Within UWMP Service Area (enter data as applicable)		**Water Recycled Outside of UWMP Service Area** (enter data as applicable)		**Effluent Discharge that is not a Permitted Recycled Water Use** (enter data as applicable)		**Required Discharge for Instream Flow** (enter data as applicable)		**Delivered to Another Entity for Additional Treatment** (enter data as applicable)		
				Treatment Level **Drop down list**	Volume (AF)	Treatment Level **Drop down list**	Volume (AF)	Treatment Level **Drop down list**	Volume (AF)	Treatment Level **Drop down list**	Volume (AF)	Treatment Level **Drop down list**	Volume (AF)	Name of other entity
Add additional rows as needed														
Corona WWRF #1, Place ID 259171	No	9,157	8,379	Tertiary	2,480		-	Tertiary	5,899		0		0	
Corona WWRF #2, Place ID 259173	No	2,251	2,063		598		-		1,465		0		0	
Corona WWRF #3, Place ID 259174	No	763	831		831		-		-		0		0	
Total		12,171	11,273		3,909		0		7,364		0		0	

DWR NOTES:
Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3. This table identifies the unit of measure selected in Submittal Table 2-3.
IPR: Indirect Potable Reuse would have the treatment level of its end use requirement in the Level of Treatment drop-down.
Additional Guidance: See Appendix M, Section M.21 for detailed guidance on this table.

NOTES:

Submittal Table 6-4 Retail: Recycled Water Direct Beneficial Uses Within Service Area
Water Code Section 10633 (c),(d),(e)

☐	Check box if recycled water is not used and is not planned for use within the service area of the supplier. The supplier will only complete the column on "Potential Recycled Water Use" and submit an accompanying narrative on the feasibility of that potential recycled water use.

Name(s) of Facility/ies Producing (Treating) the Recycled Water (OPTIONAL) :	City of Corona
Name of Supplier Operating the Recycled Water Distribution System (OPTIONAL) :	City of Corona
Volume of Supplemental Water Added in 2025 (OPTIONAL) :	
Source of 2025 Supplemental Water (OPTIONAL) :	

Use Type **Drop down list**	**Potable or Non-Potable** (after treatment if treated) (OPTIONAL) Drop down list	Additional Information (as needed)	2025 (AF)	2030 (AF)	2035 (AF)	2040 (AF)	2045 (AF)	2050 (AF)	**Potential Recycled Water Use**	
									Volume	Narrative page number (OPTIONAL)
Add additional rows as needed										
Other (Description Required)			4554	4443	4543	4643	4743	4843		
		Subtotal Potable	0	0	0	0	0	0	0	
		Subtotal Non-Potable	0	0	0	0	0	0	0	
		Total	4554	4443	4543	4643	4743	4843	0	0

DWR NOTES: Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3. This table identifies the unit of measure selected in Submittal Table 2-3.
Additional Guidance: See Appendix M, Section M.21 for detailed guidance on this table.
Potential recycled water use: a description of the feasibility of these uses must be included in the narrative.
Multiple Producers: If you have multiple recycled water producers, submit a separate table for each.

NOTES: The City is anticipated 100 AFY every 5 years

Submittal Table 6-5 Retail: 2020 UWMP Recycled Water Use Projection Compared to 2025 Actual
Water Code Section 10633(e)

☐ Check the box if recycled water was not used in 2025 nor previously projected for use in 2020.
Proceed to the next table.

Use Type Drop Down list	2020 Projection for 2025 (AF)	2025 Actual Use (AF)
Add additional rows as needed		
Other (Description Required)	4,795	4,554
Total	4,795	4,554

DWR NOTES:
Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3. This table identifies the unit of measure reported in Submittal Table 2-3
Additional Guidance: See Appendix M, Section M.21 for detailed guidance on this table.

NOTES:

Submittal Table 6-6 Retail: Methods to Encourage Future Recycled Water Use
Water Code Section 10633(f)

☐	Check the box if the Supplier does not plan to expand recycled water use in the future. Supplier will not complete the table below but will provide narrative explanation.
	Provide page location of narrative in the UWMP

Name of Action	Description	Planned Implementation Year	Expected Increase in Recycled Water Use (AF)
Add additional rows as needed			
Large Distribution Pipeline Projects	Buena Vista Tenth Pipeline, Ontario Slipline, Sampson Pipeline, River Pipeline		842
Medium Distribution Pipeline Projects	Old Temescal Pipeline, Lincoln Foothill Pipeline, Avenida Del Vista Pipeline, Border Pipeline, Promenade Pipeline, Research Pipeline, Smith Pipeline, Via Pacifica Pipeline, Tehachapi Pipeline		259
Small Distribution Pipeline Projects	Jenks Pipeline, Airport Circle Pipeline, Helicopter Pipeline, Glider Pipeline, Citation Pipeline, Klug Pipeline, Monica Pipeline, Chase Hudson Pipeline, Cessna Pipeline,Main Citrus Pipeline		85
Conversion of Adjacent Demands	Commercial, Industrial, Institutional, Multi-Family Residential, Single Family Residential		225
		Total (AF)	1,411
		Unit Conversion to AF	1,411

DWR NOTES:
Units of measure (AF, CCF, MG) MUST remain consistent with units reported in Submittal Table 2-3. This table identifies the unit of measure selected in Submittal Table 2-3.
The unit conversion to Acre Feet addresses the Water Code's requirement that this value be provided in acre-feet.

NOTES:

Submittal Table 6-7 Retail: Expected Future Water Supply Projects or Programs
Water Code Section 10631(f)

☐	Check the box if there are no expected future water supply projects or programs that provide a quantifiable increase to the agency's water supply. Proceed to the next table.
☐	Check the box if some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in a narrative format.
	Provide page location of narrative in the UWMP

Name of Future Projects or Programs	Joint Project with other suppliers?		Additional Description (as needed)	**Potable or Non-Potable** (after treatment if treated) (OPTIONAL) Drop Down list	Planned Implementation Year	Planned for Use in Year Type **Drop Down List**	Expected Increase in Water Supply to Supplier (This may be a range) (AF)
	Drop Down List (yes/no)	If Yes, Supplier Name					
Add additional rows as needed							
WRCRWA Treatment	Yes	WRCRWA	2.62 MGD (2,937 AFY) of treated reclaimed water delivered from WRCRWA Wastewater Treatment Plant				2,937
Bedford-Coldwater Recharge Basin	Yes		Coldwater Pit to be converted to a recharge basin, enhancing groundwater storage capacity in the basin				0
Well 7A/8A Treatment	No		City intends to do GAC Treatment				TBD
Glen Ivy Disinfection	No		Water Disinfection System at Glen Ivy Site				TBD

DWR NOTES:
Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3. This table identifies the unit of measure reported in Submittal Table 2-3.

NOTES: Coldwater Recharge basin is intended to enhance groundwater storage capacity and will not increase normal supply; however, under single dry year and multiple dry year conditions, stored groundwater may be used to offset a drop in imported water supply availability. GAC Treatment at Well 7A/8A is intended, with no current planned date.

Submittal Table 6-8 Retail: Water Supplies — Actual
Water Code Section 10631(b)

Water Supply		2025		
Drop down list May use each category multiple times. These are the only water supply categories that will be recognized by the WUEdata online submittal tool	Additional Description (as needed)	**Potable or Non-Potable** (after treatment if treated) (OPTIONAL) Drop Down list	Actual Volume (AF)	Total Entitlement (OPTIONAL) See 'DWR Notes' below (AF)
Add additional rows as needed				
Purchased or Imported Water	WMWD - Mills WTP	Potable	1,483	
Purchased or Imported Water	WMWD - Raw Water	Non-Potable	14,899	
Purchased or Imported Water	WMWD Arlington Desalter	Non-Potable	0	
Groundwater (not desalinated)	Temescal Basin	Potable	15,569	
Groundwater (not desalinated)	Bedford-Coldwater Basin		0	
Recycled Water	Reclaimed	Non-Potable	11,273	
		Subtotal Potable	17,052	0
		Subtotal Non-Potable	26,172	0
		Total	43,224	0

DWR NOTES:

Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3. This table identifies the unit of measure selected in Submittal Table 2-3.

Total Entitlement: e.g. Water Right, Groundwater Allocation, Contracted Amount.

NOTES:

Optional **Table 6-8DS: Source Water Desalination by Urban Water Supplier**

☐ Check the box if the Supplier does not reduce salinity in either groundwater or surface water prior to distribution.

Desalination Facility **Drop Down list**	Plant Capacity	Intake Type **Drop down list**	Source Water Type **Drop down list**	Influent TDS	Brine Discharge **Drop down list**	Volume of Water Desalinated					Name(s) of Agencies that Receive this Water
						2021 (AF)	**2022 (AF)**	**2023 (AF)**	**2024 (AF)**	**2025 (AF)**	
Add additional rows as needed											
Temescal Basin Desalter	10 MGD		Groundwater		Brine Line	11,380	11,383	11,055	10,157	10,779	City of Corona
					Total	11380	11383	11055	10157	10779	

DWR NOTES:

Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submital Table 2-3. This table identifies the units of measure reported in Submittal Table 2-3.

NOTES:

Submittal Table 6-9 Retail: Water Supplies — Projected
Water Code Section 10631 (b)

Water Supply			Projected Water Supply (Report to the Extent Practicable)									
			2030		2035		2040		2045		2050 (opt)	
Drop down list May use each category multiple times. These are the only water supply categories that will be recognized by the WUEdata online submittal tool	Additional Detail on Water Supply	**Potable or Non-Potable** (after treatment if treated) (OPTIONAL) Drop Down list	Reasonably Available Volume (AF)	Total Entitlement (OPTIONAL) See 'DWR Notes' below (AF)	Reasonably Available Volume (AF)	Total Entitlement (OPTIONAL) See 'DWR Notes' below (AF)	Reasonably Available Volume (AF)	Total Entitlement (OPTIONAL) See 'DWR Notes' below (AF)	Reasonably Available Volume (AF)	Total Entitlement (OPTIONAL) See 'DWR Notes' below (AF)	Reasonably Available Volume (AF)	Total Entitlement (OPTIONAL) See 'DWR Notes' below (AF)
Add additional rows as needed												
Purchased or Imported Water	WMWD (all sources)		21,110		21,110		21,110		21,110		21,110	
Desalinated Water - Groundwater	Temescal Basin		14,482		14,482		14,482		14,482		14,482	
Groundwater (not	Bedford-		2,112		2,112		2,112		2,112		2,112	
Recycled Water	Reclaimed		10,000		19,000		19,000		19,000		19,000	
		Subtotal Potable	0	0	0	0	0	0	0	0	0	0
		Subtotal Non-Potable	0	0	0	0	0	0	0	0	0	0
		Total	47,704	0	56,704	0	56,704	0	56,704	0	56,704	0

DWR NOTES:
Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3.
Total Entitlement: e.g. Water Right, Groundwater Allocation, Contracted Amount.
NOTES:

10631. A plan shall be adopted in accordance with this chapter that shall do all of the following... (b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year

Optional Submittal Table O-1A: Recommended Energy Reporting - SINGLE DELIVERY PRODUCT - WATER SUPPLY PROCESS APPROACH

Water Delivery Product drop down list (If delivering more than one type of product recommend using Table O-1C)	Retail Potable Deliveries	Only for Water Delivery Products Under the Urban Water Supplier's Operational Control							
Start Date of Reporting Period	1/1/2025	Water Management Process						Non-Consequential Hydropower (if applicable)	
End Date of Reporting Period	12/31/2025								
Is upstream embedded energy included in the values reported?	No								
	Units for Water Volume	Extract and Divert	Place into Storage	Conveyance	Treatment	Distribution	**Total Utility** See DWR NOTES	Hydropower	Net Utility
Volume of Water Entering Process	AF	5,475			16,254	29,589	29,589		29,589
Energy Consumed (kWh)	N/A	6,735,400			12,427,020	23,185,661	42,348,081		42,348,081
Energy Intensity (kWh/vol. converted to MG)	N/A	3,775	-	-	2,346	2,405	4,392	-	4,392

DWR NOTES: Total Utility: The volume of water entered in the "Total Utility" column should equal the volume of water entering the distribution system (excluding recycled water); in most cases, this is the total volume calculated in UWMP Table 4-1: 2025 Actual Total Uses for Potable and Non-Potable Water. Note if recycled water is included in your Submittal Table 4-1, you must exclude it from your volume in this table.

Quantity of Self-Generated Renewable Energy

0 kWh

Data Quality (Estimate, Metered Data, Combination of Estimates and Metered Data)

Metered Data

Data Quality Narrative:

All energy and water volume data are metered. Often, a single energy meter records all energy consumption at a site or facility, making it impossible to distinguish the energy consumed by individual processes when multiple processes are present at one site.

Narrative:

The following sources of potable supply have similar operational control: imported untreated surface water, imported treated surface water, groundwater, and groundwater with high TDS.
Delivery of imported untreated surface water from WMWD undergoes conveyance (source water pumped from wholesaler's transmission pipeline to the City's surface water treatment facilities), treatment (conventional surface water treatment, as well as energy consumed at the facilities for security, lighting, SCADA, and domestic uses at onsite buildings), and distribution (gravity flow to storage facilities where it is pumped as necessary to the various distribution system pressure zones).
Delivery of imported treated surface water from WMWD undergoes conveyance (pressure reduction) and distribution (pumped as necessary to various distribution system pressure zones).
Delivery of low TDS groundwater from the Temescal Basin undergoes extraction (pumped to nearby storage facilities or diverted to blending facilities) and distribution (pumped as necessary to various distribution system pressure zones).
Delivery of groundwater with high TDS from the Temescal Basin undergoes extraction (pumped to Temescal Desalter), treatment (reverse osmosis and blending), and distribution (pumped as necessary to various distribution system pressure zones).

NOTES:

Optional Submittal Table O-2: Recommended Energy Reporting - WASTEWATER AND RECYCLED WATER					
Start Date of Reporting Period	1/1/2025	Only for Water Delivery Products Under the Urban Water Supplier's Operational Control			
End Date of Reporting Period	12/31/2025				
Is upstream embedded energy in the values reported?		Water Management Process			
Units of Measure for Water	AF	Collection / Conveyance	Treatment	Discharge / Distribution	Total
Volume of Wastewater Entering Process (volume units selected above)		7,621	1,198	7,367	16186
Wastewater Energy Consumed (kWh)		628,743	13,804,533	0	14433276
Wastewater Energy Intensity (kWh/volume converted to MG)		253.2	35362.9	0.0	2736.6
Volume of Recycled Water Entering Process (volume units selected above)		4,554	0	3,910	8464
Recycled Water Energy Consumed (kWh)		3,512,937	0	0	3512937
Recycled Water Energy Intensity (kWh/volume converted to MG)		2367.3	0.0	0.0	1273.7

Quantity of Self-Generated Renewable Energy related to recycled water and wastewater operations

kWh

Data Quality (drop down)

Data Quality Narrative:

All energy and water volume data are metered. Natural gas is used at several facilities.

Narrative:

Energy use for reclaimed water consists of conveyance and distribution. For purposes of this table, these processes have been aggregated. Energy use for wastewater consists of collection, primary/secondary/tertiary treatment, dewatering/drying of biomass, and diversion/disposal of effluent. For purposes of this table, these processes have also been aggregated.

NOTES:

Submittal Table 7-2 Retail: Normal Year Supply and Use Comparison Water Code Section 10635 (a)					
	2030 (AF)	**2035 (AF)**	**2040 (AF)**	**2045 (AF)**	**2050 (AF)**
Supply totals (autofill from Submittal Table 6-9 R)	47,704	56,704	56,704	56,704	56,704
Use totals (autofill from Submittal Table 4-2 R)	40,392	40,389	40,483	40,379	40,376
Surplus/(shortfall)	7,312	16,315	16,221	16,325	16,328
OPTIONAL Planned WSCP Actions					
WSCP - supply augmentation benefit					
WSCP - use reduction savings benefit					
Revised Surplus/(shortfall)					
DWR NOTES : Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3.					
NOTES:					

Submittal Table 7-3 Retail: Single Dry Year Supply and Use Comparison Water Code Section 10635(a)					
	2030 (AF)	**2035 (AF)**	**2040 (AF)**	**2045 (AF)**	**2050 (AF)**
Supply totals	47,704	56,704	56,704	56,704	56,704
Use totals	46,788	46,783	46,892	46,773	46,768
Surplus/(shortfall)	916	9,921	9,812	9,931	9,936
OPTIONAL Planned WSCP Actions					
WSCP - supply augmentation benefit					
WSCP - use reduction savings benefit					
Revised Surplus/(shortfall)					
DWR NOTES : Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3.					
NOTES					

Submittal Table 7-4 Retail: Multiple Dry Years Supply and Use Comparison
Water Code Section 10635(a)

		2030 (AF)	2035 (AF)	2040 (AF)	2045 (AF)	2050 (AF)
First year	Supply totals	47,704	56,704	56,704	56,704	56,704
	Use totals	42,771	42,766	42,866	42,757	42,753
	Surplus/(shortfall)	4,933	13,938	13,838	13,947	13,951
	OPTIONAL Planned WSCP Actions					
	WSCP - supply augmentation benefit					
	WSCP - use reduction savings benefit					
	Revised Surplus/(shortfall)					
Second year	Supply totals	47,704	56,704	56,704	56,704	56,704
	Use totals	44,834	44,829	44,934	44,820	44,815
	Surplus/(shortfall)	2,870	11,875	11,770	11,884	11,889
	OPTIONAL WSCP Actions					
	WSCP - supply augmentation benefit					
	WSCP - use reduction savings benefit					
	Revised Surplus/(shortfall)					
Third year	Supply totals	47,704	56,704	56,704	56,704	56,704
	Use totals	46,788	46,783	46,892	46,773	46,768
	Surplus/(shortfall)	916	9,921	9,812	9,931	9,936
	OPTIONAL Planned WSCP Actions					
	WSCP - supply augmentation benefit					
	WSCP - use reduction savings benefit					
	Revised Surplus/(shortfall)					
Fourth year	Supply totals	47,704	56,704	56,704	56,704	56,704
	Use totals	45,265	45,260	45,366	45,251	45,246
	Surplus/(shortfall)	2,439	11,444	11,338	11,453	11,458
	OPTIONAL Planned WSCP Actions					
	WSCP - supply augmentation benefit					
	WSCP - use reduction savings benefit					
	Revised Surplus/(shortfall)					
Fifth year	Supply totals	47,704	56,704	56,704	56,704	56,704
	Use totals	43,351	43,346	43,447	43,337	43,333
	Surplus/(shortfall)	4,353	13,358	13,257	13,367	13,371
	OPTIONAL Planned WSCP Actions					
	WSCP - supply augmentation benefit					
	WSCP - use reduction savings benefit					
	Revised Surplus/(shortfall)					

DWR NOTES: Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3.

NOTES:

Submittal Table 7-5 Retail: Five-Year Drought Risk Assessment Water Code Section 10635(b)(3)	
2026	**Total**
Total Water Use (AF)	36,017
Total Supplies (AF)	39,417
Surplus/Shortfall w/o WSCP Action	3,400
OPTIONAL Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit (AF)	
WSCP - use reduction savings benefit (AF)	
Revised Surplus/(shortfall)	
2027	**Total**
Total Water Use (AF)	37,086
Total Supplies (AF)	39,417
Surplus/Shortfall w/o WSCP Action	2,331
OPTIONAL Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit (AF)	
WSCP - use reduction savings benefit (AF)	
Revised Surplus/(shortfall)	
2028	**Total**
Total Water Use (AF)	38,155
Total Supplies (AF)	39,417
Surplus/Shortfall w/o WSCP Action	1,262
OPTIONAL Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit (AF)	
WSCP - use reduction savings benefit (AF)	
Revised Surplus/(shortfall)	
2029	**Total**
Total Water Use (AF)	39,224
Total Supplies (AF)	39,417
Surplus/Shortfall w/o WSCP Action	193
OPTIONAL Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit (AF)	
WSCP - use reduction savings benefit (AF)	
Revised Surplus/(shortfall)	
2030	**Total**
Total Water Use (AF)	40,293
Total Supplies (AF)	47,704
Surplus/Shortfall w/o WSCP Action	7,411

Submittal Table 7-5 Retail: Five-Year Drought Risk Assessment Water Code Section 10635(b)(3)	
OPTIONAL Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit (AF)	
WSCP - use reduction savings benefit (AF)	
Revised Surplus/(shortfall)	
DWR NOTES: Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3.	
NOTES: City is assuming projected supply for the next 5-years based on projections from its recent GSP and no constraints on its purchased water.	

Submittal Table 8-1: Cross-reference for Standard vs Supplier Shortage Levels
Water Code Section 10632(a)(3)(B)

☐	Check the box if the Supplier uses the Standard six levels of water shortage. Proceed to the next table.

Standard Shortage Levels	Percent Shortage Range	Suppliers Shortage Levels	Percent Shortage Range
1	Up to 10%	1	0 to 9%
2	Up to 20%	2	10 to 15%
3	Up to 30%	3	16 to 20%
4	Up to 40%	4	21 to 40%
5	Up to 50%	5	>40%
6	>50%	5	>40%

NOTES: City of Corona has 5 levels as shown in table above. City is always on Stage 1 which is considered normal water supply.

Submittal Table 8-2 Retail: Supply Augmentation and Other Actions Water Code Section 10632(a)(4)(A),(C) and (E)				
No	Is the Supplier completing this table using the standard six levels? (yes/no)			
Shortage Level	Supply Augmentation Methods and Other Actions by Water Supplier **Drop down list** These are the only categories that will be accepted by the WUEdata online submittal tool	How much is this going to reduce the shortage gap?		Additional Explanation or Reference (OPTIONAL)
		Volume or Percentage Drop down	Shortage Gap Reduction Value (May be a range) (AF)	
Add additional rows as needed				
DWR NOTES: Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3.				
NOTES: The City does not use supply augmentation to meet its water shortage needs.				

10632(a)(4) Shortage response actions that align with the defined shortage levels and include, at a minimum, all of the following:

(A) Locally appropriate supply augmentation actions.

(C) Locally appropriate operational changes.

(E) For each action, an estimate of the extent to which the gap between supplies and demand will be reduced by implementation of the action.

Submittal Table 8-3 Retail: Demand Reduction Actions
Water Code Section 10632(a)(4)(B),(D), and (E)

No	Is the Supplier completing this table using the standard six levels? (yes/no)				
Shortage Level	Demand Reduction Actions **Drop down list** These are the only categories that will be accepted by the WUEdata online submittal tool. Select those that apply.	How much is this going to reduce the shortage gap?		Additional Explanation or Reference (OPTIONAL)	Penalty, Charge, or Other Enforcement? **For Retail Suppliers Only** Drop Down List
		Volume or Percentage Drop down	Shortage Gap Reduction Value (May be a range) (AF)		
Add additional rows as needed					
1	Other	Volume	0-9%	Normal water conservation program implemented	No
2	Landscape - Restrict or prohibit runoff from landscape irrigation	Volume	10-15%		No
2	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner	Volume	10-15%		No
2	Other - Prohibit use of potable water for washing hard surfaces	Volume	10-15%		No
2	Landscape - Other landscape restriction or prohibition	Volume	10-15%	Prohibit the application of potable water to outdoor landscapes during and within 48 hours after rainfall measuring one-half (1/2) inch or more.	No
2	Landscape - Limit landscape irrigation to specific times	Volume	10-15%	Lawns and/or ground cover may be watered and landscaping may be irrigated for private properties, parks, and the public right-of-ways, only between the hours of 8:00 p.m. and 10:00 a.m., if the watering and irrigation is performed with potable water. This restriction shall not apply to watering and irrigation performed with reclaimed water	No
3	Other	Volume	16-20%	Use of water from fire hydrants shall be limited to fire fighting, related activities, or other activities necessary to maintain the health, safety, and welfare of the public.	Yes
3	Other water feature or swimming pool restriction	Volume	16-20%	All swimming pools, spas, ponds, and fountains shall be equipped with re-circulating pumps	Yes
3	Other - Require automatic shut of hoses	Volume	16-20%		Yes
3	Landscape - Other landscape restriction or prohibition	Volume	16-20%	The use of reclaimed water to water / irrigate is permitted on any day and at any time	No
3	Landscape - Limit landscape irrigation to specific days	Volume	16-20%	A govermnent agency may water / irrigate with potable water on three days per week of the agency's choosing	Yes
3	Landscape - Limit landscape irrigation to specific days	Volume	16-20%	Watering / irrigating is prohibited on Fridays and on any day of the week outside of the designated watering windows	Yes
3	Landscape - Limit landscape irrigation to specific days	Volume	16-20%	Even number street addresses, parks and the public right-of-ways, allowed to water / irrigate with potable water only on Sundays, Tuesdays and Thursdays	Yes
3	Other	Volume	16-20%	Except as otherwise provided, all water conservation and drought response measures of Water Conservation Stage 1 shall be in full force and effect during Water Conservation Stage 2.	Yes
3	Landscape - Other landscape restriction or prohibition	Volume	16-20%	Watering / irrigating, including construction meter irrigation, allowed for a maximum of 20 minutes per day	Yes
3	Landscape - Limit landscape irrigation to specific days	Volume	16-20%	Odd number street addresses, parks and the public right-of-ways, allowed to water / irrigate with potable water only on Saturdays, Mondays and Wednesdays	Yes
3	CII - Restaurants may only serve water upon request	Volume	16-20%		Yes

4	Other	Volume	21-40%	Except as otherwise provided, all water conservation and drought response measures of Water Conservation Stages 1 and 2 shall be in full force and effect during Water Conservation Stage 3.	Yes
4	Landscape - Limit landscape irrigation to specific times	Volume	21-40%	Lawns and/or ground covers may be watered and landscaping may be irrigated, including construction meter irrigation, for a maximum number of minutes per day.	Yes
4	Landscape - Limit landscape irrigation to specific days	Volume	21-40%	Lawns and/or ground cover may be watered and landscaping may be irrigated for properties with odd number street addresses, up to three days per week and only on Saturdays, Mondays and Wednesdays.	Yes
4	Landscape - Limit landscape irrigation to specific days	Volume	21-40%	Lawns and/or ground cover may be watered and landscaping may be irrigated for properties with even number street addresses, up to three days per week and only on Sundays, Tuesdays and Thursdays.	Yes
4	Landscape - Limit landscape irrigation to specific days	Volume	21-40%	Watering lawns and/or ground cover and irrigating landscaping is prohibited on Fridays and on any day of the week outside of the designated water windows.	Yes
4	Landscape - Limit landscape irrigation to specific days	Volume	21-40%	A govenunent agency may water lawns and/or ground cover and irrigate landscaping on day(s) of the agency's choosing, up to three days per week.	Yes
4	Other water feature or swimming pool restriction	Volume	21-40%	The overfilling of swimming pools and spas is prohibited.	Yes
4	Water Features - Restrict water use for decorative water features, such as fountains	Volume	21-40%	The filling or refilling of ornamental ponds, streams, and artificial lakes is prohibited.	Yes
4	Water Features - Restrict water use for decorative water features, such as fountains	Volume	21-40%	The operation of any ornamental fountain or similar structure is prohibited except for short periods of time to prevent damage, unless the fountain recirculates water.	Yes
4	Landscape - Prohibit certain types of landscape irrigation	Volume	21-40%	Construction projects shall only use reclaimed water except as approved by the General Manager and shall not use water unnecessarily for any purposes other than those required by regulatory agencies. Construction projects requiring water for new landscapes shall adhere to the designated days and watering windows. Further, construction projects necessary to maintain the health, safety, and welfare of the public, as determined by the city, are exempt from these regulations.	Yes
5	Other	Volume	>40%	Except as otherwise provided, all water conservation and drought response measures of Water Conservation Stages 1, 2 and 3 shall be in full force and effect during Water Conservation Stage 4.	Yes
5	Landscape - Prohibit certain types of landscape irrigation	Volume	>40%	Irrigation of landscaping shall be limited to supporting minimal survival of trees and shrubs.	Yes
5	Landscape - Prohibit certain types of landscape irrigation	Volume	>40%	All outdoor watering and irrigation of lawns and ground covers is prohibited with the exception of plant materials classified and determined by the City Manager to be rare, exceptionally valuable, or essential to the well- being of the public at large or rare animals, and for which relief has been otherwise granted.	Yes

5	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water	Volume	>40%	The washing of automobiles, trucks, trailers, boats, airplanes and other types of mobile equipment is prohibited. Washing is permitted at any time on the immediate premises of a commercial car wash. Commercial car washes shall only use partially reclaimed or recycled water.	Yes
5	Other water feature or swimming pool restriction	Volume	>40%	The filling, refilling, or adding of water to swimming pools and spas or ornamental ponds, streams, and artificial lakes is prohibited.	Yes
5	Water Features - Restrict water use for decorative water features, such as fountains	Volume	>40%	The operation of any ornamental fountain, pond, or similar structure is prohibited except for short periods of time to prevent damage.	Yes
5	Other	Volume	>40%	The use of water for cooling mists is prohibited.	Yes
5	CII - Other CII restriction or prohibition	Volume	>40%	The use of water for commercial, manufacturing, or processing purposes shall be reduced in volume by an amount determined by the General Manager.	Yes
5	Other	Volume	>40%	No new construction meters will be issued.	Yes
5	Other	Volume	>40%	Construction water shall not be used for earth work, road construction purposes, dust control, compaction, or trenching jetting.	Yes
5	Other	Volume	>40%	No new building permit(s) shall be provided, except in the following circumstances: (a) For projects necessary to protect the public's health, safety, and welfare (b) When using reclaimed water (c) When the recipient of the building permit can demonstrate that no net increase in water use will occur (d) Where the recipient of the building permit provides a conservation offset.	Yes
6	Other	Volume	>40%	Except as otherwise provided, all water conservation and drought response measures of Water Conservation Stages 1, 2, 3 and 4 shall be in full force and effect during Water Conservation Stage 5.	Yes
6	Landscape - Other landscape restriction or prohibition	Volume	>40%	All outdoor watering and irrigation of lawns and ground cover, and landscaping is prohibited, with the exception of the use of recycled water to irrigate fruit trees, lawns and ground covers, and ornamental trees and shrubs, which is permitted on any day and at any time.	Yes
6	CII - Other CII restriction or prohibition	Volume	>40%	The city shall not allow any new connections to the water system.	Yes

DWR NOTES: Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Submittal Table 2-3.

NOTES: Restrictions and prohibitions for each stage are additive to the stage before. Irrigation restrictions become progressively more strict with each stage. Shortage gap reduction shown is the total estimated reduction for all actions under the Shortage Level.

Submittal Table 10-1 Retail: Notification to Cities and Counties Water Code Section 10621(b) and 10642		
City Name	60 Day Notice **Drop Down (yes/no)**	Notice of Public Hearing **Drop Down (yes/no)**
Add additional rows as needed		
Home Gardens County Water District	Yes	Yes
Western Municipal Water District	Yes	Yes
City of Norco	Yes	Yes
Orange County Sanitation District	Yes	Yes
City of Riverside	Yes	Yes
Temescal Valley Water District	Yes	Yes
Yorba Linda Water District	Yes	Yes
City of Eastvale	Yes	Yes
City of Jurupa Valley	Yes	Yes
Jurupa Community Services District	Yes	Yes
City of Lake Elsinore	Yes	Yes
Elsinore Valley Municipal Water District	Yes	Yes
Home Gardens Sanitary District	Yes	Yes
Metropolitan Water District	Yes	Yes
Rancho California Water District	Yes	Yes
Riverside Public Utilities	Yes	Yes
County Name **Drop Down List**	60 Day Notice **Drop Down (yes/no)**	Notice of Public Hearing **Drop Down (yes/no)**
Add additional rows as needed		
Riverside County	Yes	Yes
NOTES:		

Appendix E – 2021 through 2025 Corona Consumer Confidence Reports

City of Corona, Utilities Department

2021 Water Quality Report

PRIMARY STANDARDS - Mandatory Health-Related Standards

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	Water Source		Major Sources in Drinking Water
CLARITY								
Combined Filter Effluent Turbidity	%	95[a]			% < 0.3	100%	Metropolitan Water District	Soil runoff
	NTU	TT 0.3	NA	--	Highest	0.06	Henry J. Mills Water Treatment Plant	
Combined Filter Effluent Turbidity	%	95[a]			% < 0.3	100%	City of Corona, Lester & Sierra Del Oro	Soil runoff
	NTU	TT 0.3	NA	--	Highest	0.08	Water Treatment Facilities	

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	Regulated in Distribution System	Major Sources in Drinking Water
MICROBIOLOGICAL CONTAMINANTS							
Total Coliform Bacteria (State Total Coliform Rule)	%	5.0 [b]	(0)	--	--	Highest % of positive samples collected in any one month = 0%	Naturally present in the environment
Fecal Coliform and E. Coli (State Total Coliform Rule)	[c]	[c]	(0)	--	--	Total number of positive samples collected in 2021 = 0	Human and animal fecal waste
Total Coliform Bacteria (Federal Total Coliform Rule)	%	TT [d]	--	--	--	Highest % of positive samples collected in any one month = 0%	Naturally present in the environment
Fecal Coliform and E. Coli (Federal Total Coliform Rule)	[e]	[e]	(0)	--	--	Total number of positive samples collected in 2021 = 0	Human and animal fecal waste
Heterotrophic Plate Count (HPC)	CFU/mL	TT	NA	NA	Range	Distribution System Wide: ND-140	Naturally present in the environment
					Average	Distribution System Wide: 1	

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	State Project Water	Colorado River Water	Arlington Water [z]	Ground Water	Treated Average System Water	Major Sources in Drinking Water
RADIOACTIVE CONTAMINANTS (f)											
Gross Alpha Particle Activity [k]	pCi/L	15	(0)	3	Range	ND - 4	ND - 3.6	ND - 4	ND - **18**	-	Erosion of natural deposits
					Average	ND	ND	ND	5.5		
Uranium	pCi/L	20	0.43	1	Range	ND - 2	2.8 - 3.4	ND - 8.3	ND - 20	-	Erosion of natural deposits
					Average	ND	3	1	6		
INORGANIC CONTAMINANTS											
Arsenic	µg/L	10	0.004	2	Range	ND	2.1	ND - 3.7	ND - 3.4	ND - 2.2	Erosion of natural deposits; runoff from orchards; glass and electronics production wastes
					Average			ND	ND	ND	
Barium	mg/L	1	2	0.1	Range	ND	0.14	-	ND - 0.14	ND - 0.12	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits
					Average			-	ND	ND	
Fluoride [e, h]	mg/L	2.0	1	0.1	Range	0.5 - 0.9	0.3	ND - 0.9	0.23 - 2.3	ND - 0.79	Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories
					Average	0.8		0.74	0.40	0.23	
Nitrate (as Nitrogen) [k, t]	mg/L	10 (as N)	10 (as N)	0.4	Range	ND	ND	ND - 6.5	ND - **22**	ND - 6.9	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits
					Average			1	10	2.0	
Perchlorate [k, s, t]	µg/L	6	1	2	Range	ND	ND	ND - 2.4	ND - **9.8**	ND - 3.0	Perchlorate is an inorganic chemical used in solid rocket propellant, fireworks, explosives, flares, matches, and a variety of industries. It usually gets into drinking water as a result of environmental contamination from historic aerospace or other industrial operations that used or use, store, or dispose of perchlorate and its salts.
					Average			ND	3.4	ND	
Selenium	µg/L	50	30	5	Range	ND	ND	ND - 5.1	ND - 5.3	ND	Discharge from petroleum, glass, and metal refineries; erosion of natural deposits; discharge from mines and chemical manufacturers; runoff from livestock lots (feed additive).
					Average			ND	ND		
SYNTHETIC ORGANIC CONTAMINANTS including Pesticides/PCBs											
Dibromochloro-propane (DBCP)	ng/L	200	3	10	Range	ND	ND	ND - 12	ND - 23	ND	Banned nematocide that may still be present in soils due to runoff/leaching from former use on soybeans, cotton, vineyards, tomatoes, and tree fruit
					Average			ND	ND		
1,2,3-Trichloropropane (1,2,3-TCP) [k, t, u]	µg/L	0.005	0.0007	0.005	Range	ND	ND	-	ND - **0.021**	ND	Discharge from industrial and agricultural chemical factories; leaching from hazardous waste sites; used as cleaning and maintenance solvent, paint and varnish remover, and cleaning and degreasing agent; byproduct during the production of other compounds and pesticides.
					Average				ND		
VOLATILE ORGANIC CONTAMINANTS											
Tetrachloroethylene (PCE)	µg/L	5	0.06	0.5	Range	ND	ND	-	ND - 0.8	ND	Discharge from factories, dry cleaners, and auto shops (metal degreaser)
					Average				ND		
Trichloroethylene (TCE)	µg/L	5	1.7	0.5	Range	ND	ND	-	ND - 1.3	ND	Discharge from metal degreasing sites and other factories
					Average				ND		

SECONDARY STANDARDS - Aesthetic Standards

Aluminum [j]	µg/L	200	600	50	Range	ND - 85	ND	ND - 85	ND	ND - **380**	Erosion of natural deposits; residual from some surface water treatment processes
					Max RAA	ND		ND		130	
Chloride	mg/L	500	NA	NA	Range	75 -93	90 - 92	12 - 93	86 - 240	13 - 120	Runoff/leaching from natural deposits; seawater influence
					Average	84	91	75	170	61	
Corrosivity (as Aggressiveness Index)	AI	NA	NA	NA	Range	12.0 - 12.2	-	12.0 - 12.2	12.5 - 13.3	11 - 13	Elemental balance in water; affected by temperature, other factors
					Average	12.1		9.92	12.8	12	
Iron	µg/L	300	NA	100	Range	ND	ND	-	ND - 110	ND	Leaching from natural deposits; industrial wastes
					Average				ND		
Manganese [f, k]	µg/L	50	NL=500	20	Range	ND	ND	-	ND - **140**	ND	Leaching from natural deposits
					Average				ND		
Odor Threshold	Units	3	NA	1	Range	2	**8**	2	ND - 3.4	ND - 2	Naturally-occurring organic materials
					Average				0.39	1	
Specific Conductance [k]	µS/cm	1600	NA	NA	Range	536 - 612	924 - 948	370 - 612	1,100 - **2,000**	81 - 1,207	Substances that form ions when in water; seawater influence
					Average	574	936	571	1,424	592	
Sulfate	mg/L	500	NA	0.5	Range	52 - 67	205 - 210	8.0 - 74	150 - 400	3.5 - 220	Runoff/leaching from natural deposits; industrial wastes
					Average	60	208	61	217	108	
Total Dissolved Solids [j, k, t]	mg/L	1000	NA	NA	Range	284 - 331	586 - 598	220-400	710 - **1,300**	35 - 730	Runoff/leaching from natural deposits
					Average	298	592	320	902	338	
Turbidity	NTU	5	NA	0.1	Range	ND	0.6 - 3.0	ND - 0.62	ND - 0.99	0.14 - 0.3	Soil runoff
					Average		1.8	ND	0.26	0.2	

UNREGULATED CONTAMINANTS WITH NO MCLs (g)											Health Effects
Boron [p]	mg/L	NL=1	NA	0.1	Range	0.19	0.13	0.156	0.32 - 4.3	0.14 - 0.41	The babies of some pregnant women who drink water containing boron in excess of the notification level may have an increased risk of developmental effects, based on studies in laboratory animals.
					Average				1.7	0.26	
Hexavalent Chromium	µg/L	NA	0.02	1	Range	ND	ND	ND - 3.9	ND - 3.2	ND	Discharge from electroplating factories, leather tanneries, wood preservation, chemical synthesis, refractory production, and textile manufacturing facilities; erosion of natural deposits.
					Average			ND	ND		
Perfluorobutane Sulfonic (PFBS)	ng/L	NL=500	NA	NA	Range	ND	ND	ND - 2.9	ND - 42	ND - 4.5	Perfluorobutane sulfonic acid exposures resulted in decreased thyroid hormone in pregnant female mice.
					Average			0.37	17	ND	
Perfluorooctanoic Acid (PFOA)	ng/L	NL=5.1	NA	NA	Range	ND	ND	ND - 4.7	ND - 230	ND - 7.5	Perfluorooctanoic acid exposures resulted in increased liver weight in laboratory animals.
					Average			0.63	66	2.2	
Perfluorooctanesulfonate acid (PFOS)	ng/L	NL=6.5	NA	NA	Range	ND	ND	ND - 5.9	ND - 300	ND - 5.9	Perfluorooctanesulfonic acid exposures resulted in immune suppression, specifically, a decrease in antibody response to an exogenous antigen challenge.
					Average			0.72	74	ND	
Vanadium	µg/L	NL=50	NA	3	Range	3	ND	ND - 5.7	ND - 17	ND - 3.4	The babies of some pregnant women who drink water containing vanadium in excess of the notification level may have an increased risk of developmental effects, based on studies in laboratory animals.
					Average			ND	5	ND	

OTHER PARAMETERS										
Chemical	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	State Project Water	Colorado River Water	Arlington Water	Ground Water	Treated Average System Water
Alkalinity	mg/L	NA	NA	NA	Range	79 - 91	129 - 132	79 - 160	170 - 390	17 - 150
					Average	85	130	98	256	72
Bicarbonate	mg/L	NA	NA	NA	Range	-	-	-	210 - 470	ND - 190
					Average				311	86
Calcium	mg/L	NA	NA	NA	Range	24 - 26	68	24 - 70	72 - 180	2.4 - 110
					Average	25		32	127	41
Hardness [q]	mg/L	NA	NA	NA	Range	111 - 119	270 - 282	110 - 210	260 - 740	8.4 - 430
					Average	115	276	130	462	169
Magnesium	mg/L	NA	NA	NA	Range	12	25 - 26	5.6 - 14	20 - 77	0.59 - 38
					Average		26	11	35	15
pH	pH Units	NA	NA	NA	Range	8.2 - 8.5	8.3	7.0 - 10	6.1 - 7.8	7.2 - 8.9
					Average	8.4		8.4	7.1	8.0
Potassium	mg/L	NA	NA	NA	Range	3.0 - 3.4	4.3 - 4.5	1.0 - 3.5	1.5 - 14	ND - 4.5
					Average	3.2	4.4	3.2	4.9	2.6
Sodium [r]	mg/L	NA	NA	NA	Range	60 - 76	91 - 92	23 - 76	50 - 170	19 - 92
					Average	68	92	64	116	56

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average/LRAA/RAA	Distribution System Wide	Major Sources in Drinking Water	Health Effects Language
DISINFECTION BYPRODUCTS, DISINFECTANT RESIDUALS, AND DISINFECTION BYPRODUCT PRECURSORS FEDERAL RULE (m)								
Total Trihalomethanes (TTHMs) (n)	µg/L	80	NA	1	Range LRAA	ND-37 29.5	Byproduct of drinking water disinfection	Some people who drink water containing trihalomethanes in excess of the MCL over many years may experience liver, kidney, or central nervous system problems, and may have an increased risk of getting cancer.
Haloacetic Acids (HAA5) (o)	µg/L	60	NA	1	Range LRAA	ND-12 11.4	Byproduct of drinking water disinfection	Some people who drink water containing haloacetic acids in excess of the MCL over many years may have an increased risk of getting cancer.
Bromate (Mills - WR-24 Conn.) (l)	µg/L	10	0.1	1	Range Max RAA	ND - 8.6 4.1	Byproduct of drinking water disinfection	Some people who drink water containing bromate in excess of the MCL over many years may have an increased risk of getting cancer.
Chloramines	mg/L	[4 as Cl2]	[4 as Cl2]	NA	Range Max RAA	0.92-2.68 1.94	Drinking water disinfectant added for treatment	Some people who use water containing chloramines well in excess of the MRDL could experience irritating effects to their eyes and nose. Some people who drink water containing chloramines well in excess of the MRDL could experience stomach discomfort or anemia.
Control of DBP precursors (TOC)	mg/L	TT	NA	0.3	Range Average	2.3-3.1 2.7	Various natural and manmade sources	Total organic carbon (TOC) has no health effects. However, total organic carbon provides a medium for the formation of disinfection byproducts. These byproducts include trihalomethanes (THMs) and haloacetic acids (HAAs). Drinking water containing these byproducts in excess of the MCL may lead to adverse health effects, liver or kidney problems, or nervous system effects, and may lead to an increased risk of cancer.

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	Distribution System
FEDERAL UNREGULATED CONTAMINANTS MONITORING RULE (UCMR 3) (v)						
List 1 - Assessment Monitoring						
1,4-Dioxane	µg/L	NA	NA	0.07	Range	ND-0.14
					Average	ND
Chlorate	µg/L	NA	NA	20	Range	75-360
					Average	155
Chromium	µg/L	NA	NA	0.2	Range	ND-0.52
					Average	ND
Hexavalent Chromium (Dissolved)	µg/L	NA	NA	0.03	Range	ND-0.43
					Average	0.134
Molybdenum	µg/L	NA	NA	1	Range	ND-17
					Average	3.6
Strontium	µg/L	NA	NA	0.3	Range	25-1,100
					Average	591
Vanadium	µg/L	NA	NA	0.2	Range	ND-6.4
					Average	2.4
Perfluorooctanesulfonic acid - PFOS	µg/L	NA	NA	0.04	Range	ND-0.046
					Average	ND
Perfluorooctanoic acid - PFOA	µg/L	NA	NA	0.02	Range	ND-0.042
					Average	ND
Perfluoroheptanoic acid - PFHpA	µg/L	NA	NA	0.01	Range	ND-0.013
					Average	ND

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	Distribution System
FEDERAL UNREGULATED CONTAMINANTS MONITORING RULE (UCMR 4) (w)						
Haloactic Acid (HAA) Group						
HAA5 [(o)]	µg/L	NA	NA	NA	Range	ND-15.8
					Average	5.9
HAA6Br [(x)]	µg/L	NA	NA	NA	Range	ND-17.3
					Average	6.1
HAA9 [(y)]	µg/L	NA	NA	NA	Range	ND-28
					Average	10.2
Total Organic Carbon	µg/L	NA	NA	NA	Range	ND-2600
					Average	1925
Bromide	µg/L	NA	NA	NA	Range	ND-32
					Average	15.3
Metals and Metalloids Group						
Manganese	µg/L	NA	NA	NA	Range	ND-62
					Average	2

Footnotes

(a) The turbidity level of the filtered water shall be less than or equal to 0.3 NTU in 95% of the measurements taken each month and shall not exceed 1 NTU at any time. Turbidity, a measure of the cloudiness of the water, is an indicator of treatment performance. The averages and ranges of turbidity shown in the Secondary Standards were based on the treatment plant effluent.

(b) Total coliform MCLs: No more than 5.0% of the monthly samples may be total coliform-positive. Compliance is based on the combined distribution system sampling from all the treatment plants. In 2021, 1560 samples were analyzed and there were no positive detections for total coliform. The MCL was not violated.

(c) *E. coli* MCL: The occurrence of two consecutive total coliform-positive samples, one of which contains E. coli, constitutes an acute MCL violation. The MCL was not violated.

(d) Total coliform TT trigger, Level 1 assessments, and total coliform TT violations: More than 5.0% total coliform-positive samples in a month trigger Level 1 assessments. Failure to conduct assessments and correct findings within 30 days is a total coliform violation. No triggers, Level 1 assessments, or violations occurred.

(e) *E. coli* MCL and Level 2 TT triggers for assessments: Routine and repeat samples are total coliform-positive and either sample is E. coli-positive or system fails to collect all repeat samples following an E. coli-positive sample, or fails to test for E. coli when the repeat sample is total coliform-positive. No samples were E. coli-positive. No MCLs violations or no assessments occurred.

(f) Results included in this section range from 2013-2021.

(g) Unregulated contaminant monitoring helps the USEPA and the State Board determine where certain contaminants occur and whether the contaminants need to be regulated.

(h) City of Corona was in compliance with all provisions of the State's Fluoridation System Requirements. This is part of the City of Corona's blending plan to reduce the levels of fluoride being delivered to the consumer's tap. Refer to the "Treated Average System Water" column for a more accurate representation of system water quality.

(i) Aluminum has a secondary standard limit. In 2021, the secondary standard limit was exceeded but the maximum running annual average (Max RAA) was in compliance. Our current Max RAA for 2022 is 180 ug/L.

(j) Total Dissolved Solids (TDS) is a measure of the total amount of all the materials that are dissolved in water. These minerals, both natural and anthropogenic (made by humans), are mainly inorganic solids, with a minor amount of organic material.

(k) This constituent was detected at levels exceeding the MCL, results shown in bold. Please note that this water is blended with water from other sources to provide customers with the highest quality drinking water.

(l) Reported from Mills Filtration Plant Metropolitan Water District (MWD). Mills MWD water is blended with other Corona water sources. Please note that this water is blended with water from other sources to provide customers with the highest quality drinking water.

(m) The City of Corona was in compliance with all provisions of the Stage 2 Disinfectants and Disinfection Byproducts Rules (D/DBP). Compliance was based on the locational running annual average (LRAA). The average reported reflects the highest TTHM and HAA5 LRAAs for the year.

(n) Total Trihalomethanes is the sum of bromodichloromethane, bromoform, chloroform, and dibromochloromethane.

(o) HAA5 is the sum of dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, dibromoacetic acid, and monochloroacetic acid.

(p) The sources that were detected for Boron are all directed to the Temescal Desalter for reverse osmosis treatment. The treated water is monitored at the effluent of the facility which is represented in the "Treated Average System Water" column.

(q) Hardness is the sum of polyvalent cations present in the water, generally magnesium and calcium. The cations are usually naturally occurring.

(r) Sodium refers to the salt present in the water and is generally naturally occurring.

(s) On June 17, 2021, the Office of Administrative Law approved the perchlorate detection limit for purposes of reporting (DLR) regulations adopted by the State Water Resources Control Board on October 6, 2020. The regulations took effect on July 1, 2021. The DLR changed from 4 parts per billion to 2 ppb.

(t) Fluoride, nitrate, perchlorate, TDS, and 1,2,3-TCP are a part of Corona's blending remediation plan to reduce the levels being delivered to the consumer's tap. Refer to the "Treated Average System Water" column for a more accurate representation of system water quality.

(u) 1,2,3-Trichloropropane (1,2,3-TCP) had a notification level (NL) of 0.005 ug/L until December 14, 2017, when the MCL of 0.005 ug/L became effective. 1,2,3-TCP was monitored quarterly in Corona's source and treated waters for the State's initial monitoring requirement and continues to be monitored per our Blending Plan requirements.

(v) Data was collected in 2014 and reported per UCMR 3 guidance. Minimum reporting levels are as stipulated in the Federal UCMR 3. List 1 - Assessment Monitoring consists of 21 chemical contaminants for which standard analytical methods were available. All analyses conducted by contract laboratories. Values listed in state DLR column are federal minimum reporting levels.

(w) UCMR 4 sampling took place from 2018-2019. Minimum reporting levels are as stipulated in the Federal UCMR 4. Detected parameter results are included in the CCR.

(x) HAA6Br: Bromochloroacetic acid, bromodichloroacetic acid, dibromoacetic acid, dibromochloroacetic acid, monobromoacetic acid, and tribromoacetic acid.

(y) HAA9: Bromochloroacetic acid, bromodichloroacetic acid, chlorodibromoacetic acid, dibromoacetic acid, dichloroacetic acid, monobromoacetic acid, monochloroacetic acid, tribromoacetic acid, and trichloroacetic acid.

(z) Water quality data reported for Arlington Water reflects water quality for all sources of Western Municipal Water District's Riverside System distributed during the reporting year. The sources of water within the Riverside System include treated groundwater from Western Municipal Water District's Arlington Desalter, Chino Desalter Authority's Chino Desalter II, and Riverside Public Utilities, along with surface water from Metropolitan Water District's Mills Water Treatment Plant.

PRIMARY STANDARDS - Mandatory Health-Related Standards

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range / Average	Water Source		Major Sources in Drinking Water
CLARITY								
Combined Filter	%	95[a]			% < 0.3	100%	Metropolitan Water District	Soil runoff
Effluent Turbidity	NTU	TT 0.3	NA	--	Highest	0.06	Henry J. Mills Water Treatment Plant	
Combined Filter	%	95[a]			% < 0.3	100%	City of Corona, Lester & Sierra Del Oro	Soil runoff
Effluent Turbidity	NTU	TT 0.3	NA	--	Highest	0.09	Water Treatment Facilities	

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range / Average	Regulated in Distribution System	Major Sources in Drinking Water
MICROBIOLOGICAL CONTAMINANTS							
Total Coliform Bacteria (State Total Coliform Rule)	%	5.0 [b]	(0)	--	--	Highest % of positive samples collected in any one month = 1%	Naturally present in the environment
Fecal Coliform and E. Coli (State Total Coliform Rule)	[c]	[c]	(0)	--	--	Total number of positive samples collected in 2022 = 0	Human and animal fecal waste
Total Coliform Bacteria (Federal Total Coliform Rule)	%	TT [d]	--	--	--	Highest % of positive samples collected in any one month = 1%	Naturally present in the environment
Fecal Coliform and E. Coli (Federal Total Coliform Rule)	[e]	[e]	(0)	--	--	Total number of positive samples collected in 2022 = 0	Human and animal fecal waste
Heterotrophic Plate Count (HPC)	CFU/mL	TT	NA	NA	Range	Distribution System Wide: ND-276	Naturally present in the environment
					Average	Distribution System Wide: 1	

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range / Average	State Project Water	Colorado River Water	Ground Water	Treated Average System Water	Major Sources in Drinking Water
RADIOACTIVE CONTAMINANTS (f)										
Gross Alpha Particle Activity [k]	pCi/L	15	(0)	3	Range	ND - 4	ND - 3.6	ND - 15	-	Erosion of natural deposits
					Average	ND	ND	4.5		
Uranium	pCi/L	20	0.43	1	Range	ND - 2	2.8 - 3.4	ND - **25**	-	Erosion of natural deposits
					Average	ND	3	5.87		
INORGANIC CONTAMINANTS										
Arsenic	µg/L	10	0.004	2	Range	ND	2	ND - 4.5	ND - 2.7	Erosion of natural deposits; runoff from orchards; glass and electronics production wastes
					Average			ND	ND	
Barium	mg/L	1	2	0.1	Range	ND	0.1	ND - 0.16	ND - 0.12	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits
					Average			ND	ND	
Fluoride [e, h]	mg/L	2.0	1	0.1	Range	0.6 - 0.8	0.3	0.27 - 2.3	ND - 0.79	Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories
					Average	0.7		0.40	0.21	
Nitrate (as Nitrogen) [k, t]	mg/L	10 (as N)	10 (as N)	0.4	Range	ND	ND	ND - **22**	ND - 6.5	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits
					Average			9.5	1.7	
Perchlorate [k, s, t]	µg/L	6	1	2	Range	ND	ND	ND - **10**	ND - 3.3	Perchlorate is an inorganic chemical used in solid rocket propellant, fireworks, explosives, flares, matches, and a variety of industries. It usually gets into drinking water as a result of environmental contamination from historic aerospace or other industrial operations that used or use, store, or dispose of perchlorate and its salts.
					Average			3	ND	
SYNTHETIC ORGANIC CONTAMINANTS including Pesticides/PCBs										
1,2,3-Trichloropropane (1,2,3-TCP)[k, t, u]	µg/L	0.005	0.0007	0.005	Range	ND	ND	ND - **0.022**	ND	Discharge from industrial and agricultural chemical factories; leaching from hazardous waste sites; used as cleaning and maintenance solvent, paint and varnish remover, and cleaning and degreasing agent; byproduct during the production of other compounds and pesticides.
					Average			ND		
VOLATILE ORGANIC CONTAMINANTS										
Tetrachloroethylene (PCE)	µg/L	5	0.06	0.5	Range	ND	ND	ND - 0.99	ND	Discharge from factories, dry cleaners, and auto shops (metal degreaser)
					Average			ND		
Trichloroethylene (TCE)	µg/L	5	1.7	0.5	Range	ND	ND	ND - 1.1	ND	Discharge from metal degreasing sites and other factories
					Average			ND		
SECONDARY STANDARDS - Aesthetic Standards										
Aluminum [i]	µg/L	200	600	50	Range	ND - 150	ND	ND	ND - **360**	Erosion of natural deposits; residual from some surface water treatment processes
					Max RAA	60			180	
Chloride	mg/L	500	NA	NA	Range	76 - 73	95 - 101	110 - 230	14 - 200	Runoff/leaching from natural deposits; seawater influence
					Average	76	98	176	70	
Corrosivity (as Aggressiveness Index)	AI	NA	NA	NA	Range	12.0 - 12.1	-	12.2 - 13.2	10.9 - 13	Elemental balance in water; affected by temperature, other factors
					Average	12.0		12.8	11.6	
Foaming Agents - Methylene Blue Active Substances	µg/L	500	NA	(50)	Range	ND	ND	ND - 120	ND	Municipal and industrial waste discharges
					Average			13		
Iron	µg/L	300	NA	100	Range	ND	ND	ND - 47	ND	Leaching from natural deposits; industrial wastes
					Average			ND		
Manganese [f, k]	µg/L	50	NL=500	20	Range	ND	ND	ND - **500**	ND	Leaching from natural deposits
					Average			40		
Odor Threshold	Units	3	NA	1	Range	2	**8**	ND - **4**	ND	Naturally-occurring organic materials
					Average			ND		
Specific Conductance [k]	µS/cm	1,600	NA	NA	Range	552 - 546	939 - 981	1,100 - **1,800**	89 - 1,177	Substances that form ions when in water; seawater influence
					Average	534	960	1,393	606	
Sulfate	mg/L	500	NA	0.5	Range	56 - 57	209 - 218	140 - 240	3.1 - 430	Runoff/leaching from natural deposits; industrial wastes
					Average	56	214	200	125	
Total Dissolved Solids [j, k, t]	mg/L	1,000	NA	NA	Range	289 - 304	598 - 629	660 - **1,200**	56 - 660	Runoff/leaching from natural deposits
					Average	296	614	870	368	
Turbidity	NTU	5	NA	0.1	Range	ND	1.3 - 2.3	ND - 0.31	ND	Soil runoff
					Average		1.8	ND		

UNREGULATED CONTAMINANTS WITH NO MCLs (g)	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range / Average					Health Effects
Boron [p]	mg/L	NL=1	NA	0.1	Range	0.16	0.13	0.34 - 4.0	0.14 - 0.38	The babies of some pregnant women who drink water containing boron in excess of the notification level may have an increased risk of developmental effects, based on studies in laboratory animals.
					Average			1.6	0.25	
Hexavalent Chromium	µg/L	NA	0.02	1	Range	ND	ND	ND - 3.2	ND	Discharge from electroplating factories, leather tanneries, wood preservation, chemical synthesis, refractory production, and textile manufacturing facilities; erosion of natural deposits.
					Average			ND		
Vanadium	µg/L	NL=50	NA	3	Range	ND	ND	ND - 18	ND - 2.6	The babies of some pregnant women who drink water containing vanadium in excess of the notification level may have an increased risk of developmental effects, based on studies in laboratory animals.
					Average			5.9	ND	

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) with Notification Levels										
Perfluorobutane Sulfonic (PFBS)	ng/L	NL=500	NA	NA	Range	ND	ND	ND - 47	ND - 5.6	Perfluorobutane sulfonic acid exposures resulted in decreased thyroid hormone in pregnant female mice.
					Average			18	ND	
Perfluorohexane Sulfonic Acid (PFHxS)	ng/L	NL=3	NA	NA	Range	ND	ND	ND - 52	ND - 6.6	Perfluorohexane sulfonic acid exposures resulted in decreased total thyroid hormone in male rats.
					Average			20	ND	
Perfluorooctanoic Acid (PFOA)	ng/L	NL=5.1	NA	NA	Range	ND	ND	ND - 250	ND - 8.5	Perfluorooctanoic acid exposures resulted in increased liver weight in laboratory animals.
					Average			71	ND	
Perfluorooctanesulfonate acid (PFOS)	ng/L	NL=6.5	NA	NA	Range	ND	ND	ND - 270	ND - 11	Perfluorooctanesulfonic acid exposures resulted in immune suppression, specifically, a decrease in antibody response to an exogenous antigen challenge.
					Average			77	ND	

OTHER PARAMETERS

Chemical	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	State Project Water	Colorado River Water	Ground Water	Treated Average System Water
Alkalinity	mg/L	NA	NA	NA	Range	83 - 89	128 - 134	130 - 380	16 - 140
					Average	86	131	237	73
Bicarbonate	mg/L	NA	NA	NA	Range	-	-	150 - 380	25 - 170
					Average			275	77
Carbonate	mg/L	NA	NA	NA	Range	-	-	ND - 2	ND
					Average			0.13	
Calcium	mg/L	NA	NA	NA	Range	25 -28	69 - 70	62 - 160	2.2 - 82
					Average	26	70	124	40
Hardness [q]	mg/L	NA	NA	NA	Range	115 - 120	276 - 281	220 - 570	7.9 - 310
					Average	118	278	439	162
Magnesium	mg/L	NA	NA	NA	Range	12 - 13	25 - 26	17 - 46	0.54 - 27
					Average	12	26	32	14
pH	pH Units	NA	NA	NA	Range	8.2 - 8.4	8.2 - 8.3	6.4 - 8.1	7.3 - 9.1
					Average	8.3	8.2	7.2	8.2
Potassium	mg/L	NA	NA	NA	Range	3.6 - 3.8	4.5 - 4.8	1.8 - 14	ND - 5
					Average	3.7	4.6	5.4	2.6
Sodium [r]	mg/L	NA	NA	NA	Range	60 - 61	90 - 96	55 - 170	19 - 98
					Average	60	93	122	59

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average/LRAA/RAA	Distribution System Wide	Major Sources in Drinking Water	Health Effects Language
DISINFECTION BYPRODUCTS, DISINFECTANT RESIDUALS, AND DISINFECTION BYPRODUCT PRECURSORS FEDERAL RULE (m)								
Total Trihalomethanes (TTHMs) (n)	µg/L	80	NA	1	Range LRAA	ND - 39 31.3	Byproduct of drinking water disinfection	Some people who drink water containing trihalomethanes in excess of the MCL over many years may experience liver, kidney, or central nervous system problems, and may have an increased risk of getting cancer.
Haloacetic Acids (HAA5) (o)	µg/L	60	NA	1	Range LRAA	ND - 12 10.1	Byproduct of drinking water disinfection	Some people who drink water containing haloacetic acids in excess of the MCL over many years may have an increased risk of getting cancer.
Bromate (Mills - WR-24 Conn.) (l)	µg/L	10	0.1	1	Range Max RAA	ND - 14 5.5	Byproduct of drinking water disinfection	Some people who drink water containing bromate in excess of the MCL over many years may have an increased risk of getting cancer.
Chloramines	mg/L	[4 as Cl2]	[4 as Cl2]	NA	Range Max RAA	0.2 - 3.04 1.94	Drinking water disinfectant added for treatment	Some people who use water containing chloramines well in excess of the MRDL could experience irritating effects to their eyes and nose. Some people who drink water containing chloramines well in excess of the MRDL could experience stomach discomfort or anemia.
Control of DBP precursors (TOC)	mg/L	TT	NA	0.3	Range Average	1.7 - 3.2 2.3	Various natural and manmade sources	Total organic carbon (TOC) has no health effects. However, total organic carbon provides a medium for the formation of disinfection byproducts. These byproducts include trihalomethanes (THMs) and haloacetic acids (HAAs). Drinking water containing these byproducts in excess of the MCL may lead to adverse health effects, liver or kidney problems, or nervous system effects, and may lead to an increased risk of cancer.

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	Distribution System
FEDERAL UNREGULATED CONTAMINANTS MONITORING RULE (UCMR 3) (v)						
List 1 - Assessment Monitoring						
1,4-Dioxane	µg/L	NA	NA	0.07	Range	ND-0.14
					Average	ND
Chlorate	µg/L	NA	NA	20	Range	75-360
					Average	155
Chromium	µg/L	NA	NA	0.2	Range	ND-0.52
					Average	ND
Hexavalent Chromium (Dissolved)	µg/L	NA	NA	0.03	Range	ND-0.43
					Average	0.134
Molybdenum	µg/L	NA	NA	1	Range	ND-17
					Average	3.6
Strontium	µg/L	NA	NA	0.3	Range	25-1,100
					Average	591
Vanadium	µg/L	NA	NA	0.2	Range	ND-6.4
					Average	2.4
Perfluorooctanesulfonic acid - PFOS	µg/L	NA	NA	0.04	Range	ND-0.046
					Average	ND
Perfluorooctanoic acid - PFOA	µg/L	NA	NA	0.02	Range	ND-0.042
					Average	ND
Perfluoroheptanoic acid - PFHpA	µg/L	NA	NA	0.01	Range	ND-0.013
					Average	ND

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	Distribution System
FEDERAL UNREGULATED CONTAMINANTS MONITORING RULE (UCMR 4) (w)						
Haloactic Acid (HAA) Group						
HAA5 [(o)]	µg/L	NA	NA	NA	Range	ND-15.8
					Average	5.9
HAA6Br [(x)]	µg/L	NA	NA	NA	Range	ND-17.3
					Average	6.1
HAA9 [(y)]	µg/L	NA	NA	NA	Range	ND-28
					Average	10.2
Total Organic Carbon	µg/L	NA	NA	NA	Range	ND-2600
					Average	1925
Bromide	µg/L	NA	NA	NA	Range	ND-32
					Average	15.3
Metals and Metalloids Group						
Manganese	µg/L	NA	NA	NA	Range	ND-62
					Average	2

Footnotes

(a) The turbidity level of the filtered water shall be less than or equal to 0.3 NTU in 95% of the measurements taken each month and shall not exceed 1 NTU at any time. Turbidity, a measure of the cloudiness of the water, is an indicator of treatment performance. The averages and ranges of turbidity shown in the Secondary Standards were based on the treatment plant effluent.

(b) Total coliform MCLs: No more than 5.0% of the monthly samples may be total coliform-positive. Compliance is based on the combined distribution system sampling from all the treatment plants. In 2022, 1563 samples were analyzed and there were no positive detections for total coliform. The MCL was not violated.

(c) *E. coli* MCL: The occurrence of two consecutive total coliform-positive samples, one of which contains E. coli, constitutes an acute MCL violation. The MCL was not violated.

(d) Total coliform TT trigger, Level 1 assessments, and total coliform TT violations: More than 5.0% total coliform-positive samples in a month trigger Level 1 assessments. Failure to conduct assessments and correct findings within 30 days is a total coliform violation. No triggers, Level 1 assessments, or violations occurred.

(e) *E. coli* MCL and Level 2 TT triggers for assessments: Routine and repeat samples are total coliform-positive and either sample is E. coli-positive or system fails to collect all repeat samples following an E. coli-positive sample, or fails to test for E. coli when the repeat sample is total coliform-positive. No samples were E. coli-positive. No MCLs violations or no assessments occurred.

(f) Results included in this section range from 2014-2022.

(g) Unregulated contaminant monitoring helps the USEPA and the State Board determine where certain contaminants occur and whether the contaminants need to be regulated.

(h) City of Corona was in compliance with all provisions of the State's Fluoridation System Requirements. This is part of the City of Corona's blending plan to reduce the levels of fluoride being delivered to the consumer's tap. Refer to the "Treated Average System Water" column for a more accurate representation of system water quality.

(i) Aluminum has a secondary standard limit. In 2022 the secondary standard limit was exceeded at our Treatment Facility effluent with a Maximum Running Annual Average (Max RAA) of 212 ug/L. No consumer action is necessary since secondary standards for aluminum are established only for aesthetic effects (water color). We are continually calibrating our aluminum base coagulant to achieve the non-mandatory secondary standard limit of 200 ug/L. We expect to achieve this limit by the end of 2023. Our current Max RAA for 2023 is 115 ug/L.

(j) Total Dissolved Solids (TDS) is a measure of the total amount of all the materials that are dissolved in water. These minerals, both natural and anthropogenic (made by humans), are mainly inorganic solids, with a minor amount of organic material.

(k) This constituent was detected at levels exceeding the MCL, results shown in bold. Please note that this water is blended with water from other sources to provide customers with the highest quality drinking water.

(l) Reported from Mills Filtration Plant Metropolitan Water District (MWD). Mills MWD water is blended with other Corona water sources. Please note that this water is blended with water from other sources to provide customers with the highest quality drinking water.

(m) The City of Corona was in compliance with all provisions of the Stage 2 Disinfectants and Disinfection Byproducts Rules (D/DBP). Compliance was based on the locational running annual average (LRAA). The average reported reflects the highest TTHM and HAA5 LRAAs for the year.

(n) Total Trihalomethanes is the sum of bromodichloromethane, bromoform, chloroform, and dibromochloromethane.

(o) HAA5 is the sum of dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, dibromoacetic acid, and monochloroacetic acid.

(p) The sources that were detected for Boron are all directed to the Temescal Desalter for reverse osmosis treatment. The treated water is monitored at the effluent of the facility which is represented in the "Treated Average System Water" column.

(q) Hardness is the sum of polyvalent cations present in the water, generally magnesium and calcium. The cations are usually naturally occurring.

(r) Sodium refers to the salt present in the water and is generally naturally occurring.

(s) On June 17, 2021, the Office of Administrative Law approved the perchlorate detection limit for purposes of reporting (DLR) regulations adopted by the State Water Resources Control Board on October 6, 2020. The regulations took effect on July 1, 2021. The DLR changed from 4 parts per billion to 2 ppb.

(t) Fluoride, nitrate, perchlorate, TDS, and 1,2,3-TCP are a part of Corona's blending remediation plan to reduce the levels being delivered to the consumer's tap. Refer to the "Treated Average System Water" column for a more accurate representation of system water quality.

(u) 1,2,3-Trichloropropane (1,2,3-TCP) had a notification level (NL) of 0.005 ug/L until December 14, 2017, when the MCL of 0.005 ug/L became effective. 1,2,3-TCP was monitored quarterly in Corona's source and treated waters for the State's initial monitoring requirement and continues to be monitored per our Blending Plan requirements.

(v) Data was collected in 2014 and reported per UCMR 3 guidance. Minimum reporting levels are as stipulated in the Federal UCMR 3. List 1 - Assessment Monitoring consists of 21 chemical contaminants for which standard analytical methods were available. All analyses conducted by contract laboratories. Values listed in state DLR column are federal minimum reporting levels.

(w) UCMR 4 sampling took place from 2018-2019. Minimum reporting levels are as stipulated in the Federal UCMR 4. Detected parameter results are included in the CCR.

(x) HAA6Br: Bromochloroacetic acid, bromodichloroacetic acid, dibromoacetic acid, dibromochloroacetic acid, monobromoacetic acid, and tribromoacetic acid.

(y) HAA9: Bromochloroacetic acid, bromodichloroacetic acid, chlorodibromoacetic acid, dibromoacetic acid, dichloroacetic acid, monobromoacetic acid, monochloroacetic acid, tribromoacetic acid, and trichloroacetic acid.

PRIMARY STANDARDS - Mandatory Health-Related Standards

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	Water Source			Major Sources in Drinking Water
CLARITY									
Combined Filter	%	95[a]			% < 0.3	100%	Metropolitan Water District		Soil runoff
Effluent Turbidity	NTU	TT 0.3	NA	--	Highest	0.05	Henry J. Mills Water Treatment Plant		
Combined Filter	%	95[a]			% < 0.3	100%	City of Corona, Lester & Sierra Del Oro		Soil runoff
Effluent Turbidity	NTU	TT 0.3	NA	--	Highest	0.07	Water Treatment Facilities		

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	Regulated in Distribution System	Major Sources in Drinking Water
MICROBIOLOGICAL CONTAMINANTS							
Total Coliform Bacteria (State Total Coliform Rule)	%	5.0 [b]	(0)	--	--	Highest % of positive samples collected in any one month = 1%	Naturally present in the environment
Fecal Coliform and E. Coli (State Total Coliform Rule)	[c]	[c]	(0)	--	--	Total number of positive samples collected in 2023 = 0	Human and animal fecal waste
Total Coliform Bacteria (Federal Total Coliform Rule)	%	TT [d]	--	--	--	Highest % of positive samples collected in any one month = 1%	Naturally present in the environment
Fecal Coliform and E. Coli (Federal Total Coliform Rule)	[e]	[e]	(0)	--	--	Total number of positive samples collected in 2023 = 0	Human and animal fecal waste
Heterotrophic Plate Count (HPC)	CFU/mL	TT	NA	NA	Range	Distribution System Wide: ND-884	Naturally present in the environment
					Average	Distribution System Wide: 5	

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	State Project Water	Colorado River Water	Ground Water	Treated Average System Water	Major Sources in Drinking Water
RADIOACTIVE CONTAMINANTS (f)										
Gross Alpha Particle Activity [k]	pCi/L	15	(0)	3	Range	ND	ND - 3.2	ND - 15	-	Erosion of natural deposits
					Average		ND	4.7		
Uranium	pCi/L	20	0.43	1	Range	ND	2.8 - 3.1	ND - **23**	-	Erosion of natural deposits
					Average		2.9	6.53		
INORGANIC CONTAMINANTS										
Arsenic	µg/L	10	0.004	2	Range	ND	ND	ND - 5.4	ND	Erosion of natural deposits; runoff from orchards; glass and electronics production wastes
					Average			ND	ND	
Barium	mg/L	1	2	0.1	Range	ND	0.12	ND - 0.12	ND - 0.13	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits
					Average			ND	ND	
Fluoride [e, h]	mg/L	2.0	1	0.1	Range	0.6 - 0.8	0.3 - 0.4	0.1 - 1.7	ND - 0.72	Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories
					Average	0.7	0.4	0.4	0.2	
Nitrate (as Nitrogen) [k, t]	mg/L	10 (as N)	10 (as N)	0.4	Range	0.8	ND	ND - **20**	ND - 6.2	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits
					Average			8.9	2.1	
Perchlorate [k, s, t]	µg/L	6	1	2	Range	ND	ND	ND - **9.4**	ND - 3.3	Perchlorate is an inorganic chemical used in solid rocket propellant, fireworks, explosives, flares, matches, and a variety of industries. It usually gets into drinking water as a result of environmental contamination from historic aerospace or other industrial operations that used or use, store, or dispose of perchlorate and its salts.
					Average			2.8	ND	
SYNTHETIC ORGANIC CONTAMINANTS including Pesticides/PCBs										
1,2,3-Trichloropropane (1,2,3-TCP) [k, t, u]	µg/L	0.005	0.0007	0.005	Range	ND	ND	ND - **0.019**	ND	Discharge from industrial and agricultural chemical factories; leaching from hazardous waste sites; used as cleaning and maintenance solvent, paint and varnish remover, and cleaning and degreasing agent; byproduct during the production of other compounds and pesticides.
					Average			ND		
VOLATILE ORGANIC CONTAMINANTS										
Dichloromethane (methylene chloride)	µg/L	5	4	0.5	Range	ND	ND	ND - 1.1	ND	Discharge from factories, dry cleaners, and auto shops (metal degreaser)
					Average			ND		
Tetrachloroethylene (PCE)	µg/L	5	0.06	0.5	Range	ND	ND	ND - 0.63	ND	Discharge from factories, dry cleaners, and auto shops (metal degreaser)
					Average			ND		
Trichloroethylene (TCE)	µg/L	5	1.7	0.5	Range	ND	ND	ND - 1.4	ND	Discharge from metal degreasing sites and other factories
					Average			0.53		
SECONDARY STANDARDS - Aesthetic Standards										
Aluminum [i]	µg/L	200	600	50	Range	ND - 68	ND	ND	ND - **280**	Erosion of natural deposits; residual from some surface water treatment processes
					Max RAA	60			115	
Chloride	mg/L	500	NA	NA	Range	38 - 44	102 - 116	110 - 210	16 - 120	Runoff/leaching from natural deposits; seawater influence
					Average	41	109	166	64	
Corrosivity (as Aggressiveness Index)	AI	NA	NA	NA	Range	11.9 - 12.1	-	12 - 13	9.6-13	Elemental balance in water; affected by temperature, other factors
					Average	12.0		13	11	
Foaming Agents - Methylene Blue Active Substances (MBAS)	µg/L	500	NA	(50)	Range	ND	ND	ND - 120	ND	Municipal and industrial waste discharges
					Average			15		
Manganese [f, k]	µg/L	50	NL=500	20	Range	ND	ND	ND - **500**	ND	Leaching from natural deposits
					Average			38		
Odor Threshold	Units	3	NA	1	Range	2	**8**	ND - 2	ND - 1	Naturally-occurring organic materials
					Average			ND	ND	
Specific Conductance [k]	µS/cm	1,600	NA	NA	Range	357 - 359	995 - 1,030	980 - **1,800**	85 - 1,177	Substances that form ions when in water; seawater influence
					Average	358	1,010	1,339	573	
Sulfate	mg/L	500	NA	0.5	Range	32 - 50	219 - 253	120 - 240	3.6 - 240	Runoff/leaching from natural deposits; industrial wastes
					Average	41	236	189	109	
Total Dissolved Solids [j, k, t]	mg/L	1,000	NA	NA	Range	200 - 207	623 - 671	490 - **1,100**	68 - 680	Runoff/leaching from natural deposits
					Average	204	647	832	351	
Turbidity	NTU	5	NA	0.1	Range	ND	0.4 - 0.5	ND - 0.4	ND	Soil runoff
					Average		0.4	0.13		

UNREGULATED CONTAMINANTS WITH NO MCLs (g)										Health Effects
Boron [p]	mg/L	NL=1	NA	0.1	Range	0.13	0.14	0.33 - 3.4	0.13 - 0.37	Boron exposures resulted in decreased fetal weight (developmental effects) in newborn rats.
					Average			1.4	0.24	
Hexavalent Chromium	µg/L	NA	0.02	1	Range	ND	ND	ND - 3.1	ND	Discharge from electroplating factories, leather tanneries, wood preservation, chemical synthesis, refractory production, and textile manufacturing facilities; erosion of natural deposits.
					Average			ND		
Vanadium	µg/L	NL=50	NA	3	Range	3.3	ND	ND - 19	ND - 3.4	Vanadium exposures resulted in developmental and reproductive effects in rats.
					Average			6.2	ND	

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) with Notification Levels, Analyzed by EPA Methods 533 and 537.1 (s, t)										
Perfluorobutane Sulfonic (PFBS)	ng/L	NL=500	NA	NA	Range	ND	ND	2.7-5.1	ND - 2.2	Perfluorobutane sulfonic acid exposures resulted in decreased thyroid hormone in pregnant female mice.
					Average			19	ND	
Perfluorohexane Sulfonic Acid (PFHxS)	ng/L	NL=3	NA	NA	Range	ND	ND	ND - 58	ND	Perfluorohexane sulfonic acid exposures resulted in decreased total thyroid hormone in male rats.
					Average			20		
Perfluorooctanoic Acid (PFOA)	ng/L	NL=5.1	NA	NA	Range	ND	ND	ND - 240	ND - 3.3	Perfluorooctanoic acid exposures resulted in increased liver weight in laboratory animals.
					Average			71	ND	
Perfluorooctanesulfonate acid (PFOS)	ng/L	NL=6.5	NA	NA	Range	ND	ND	ND - 240	ND - 3.5	Perfluorooctanesulfonic acid exposures resulted in immune suppression, specifically, a decrease in antibody response to an exogenous antigen challenge.
					Average			89	ND	

OTHER PARAMETERS									
Chemical	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	State Project Water	Colorado River Water	Ground Water	Treated Average System Water
Alkalinity	mg/L	NA	NA	NA	Range	57 - 64	122 - 131	110 - 380	17 - 140
					Average	60	126	227	70
Bicarbonate	mg/L	NA	NA	NA	Range	-	-	110 - 380	17 - 140
					Average			227	70
Calcium	mg/L	NA	NA	NA	Range	17 - 20	70 - 71	48 - 150	2.3 - 84
					Average	18	70	115	38
Hardness [q]	mg/L	NA	NA	NA	Range	79 - 80	290	180 - 530	7.9 - 310
					Average	80		409	157
Magnesium	mg/L	NA	NA	NA	Range	7.8 - 8.9	27	14 - 44	0.52 - 30
					Average	8.4		30	14
pH	pH Units	NA	NA	NA	Range	8.5 - 8.7	8.1 - 8.2	7.6 - 8.0	7.3 - 9.5
					Average	8.6	8.2	7.8	7.5
Potassium	mg/L	NA	NA	NA	Range	2.5	4.7 - 5.1	2.3 - 12	ND - 6
					Average		4.9	5.2	3.7
Sodium [r]	mg/L	NA	NA	NA	Range	39 - 40	95 - 108	56 - 160	18 - 100
					Average	40	102	122	58

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average/LRAA/RAA	Distribution System Wide	Major Sources in Drinking Water	Health Effects Language
DISINFECTION BYPRODUCTS, DISINFECTANT RESIDUALS, AND DISINFECTION BYPRODUCT PRECURSORS FEDERAL RULE (m)								
Total Trihalomethanes (TTHMs) (n)	µg/L	80	NA	1	Range LRAA	ND - 57 48.5	Byproduct of drinking water disinfection	Some people who drink water containing trihalomethanes in excess of the MCL over many years may experience liver, kidney, or central nervous system problems, and may have an increased risk of getting cancer.
Haloacetic Acids (HAA5) (o)	µg/L	60	NA	1	Range LRAA	ND - 11 10.3	Byproduct of drinking water disinfection	Some people who drink water containing haloacetic acids in excess of the MCL over many years may have an increased risk of getting cancer.
Bromate (Mills - WR-24 Conn.) (l)	µg/L	10	0.1	1	Range Max RAA	ND - 20 6.7	Byproduct of drinking water disinfection	Some people who drink water containing bromate in excess of the MCL over many years may have an increased risk of getting cancer.
Chloramines	mg/L	[4 as Cl2]	[4 as Cl2]	NA	Range Max RAA	1.25 - 2.92 2.00	Drinking water disinfectant added for treatment	Some people who use water containing chloramines well in excess of the MRDL could experience irritating effects to their eyes and nose. Some people who drink water containing chloramines well in excess of the MRDL could experience stomach discomfort or anemia.
Control of DBP precursors (TOC)	mg/L	TT	NA	0.3	Range Average	ND - 2.7 2.2	Various natural and manmade sources	Total organic carbon (TOC) has no health effects. However, total organic carbon provides a medium for the formation of disinfection byproducts. These byproducts include trihalomethanes (THMs) and haloacetic acids (HAAs). Drinking water containing these byproducts in excess of the MCL may lead to adverse health effects, liver or kidney problems, or nervous system effects, and may lead to an increased risk of cancer.

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	Distribution System
FEDERAL UNREGULATED CONTAMINANTS MONITORING RULE (UCMR 4) (v)						
Haloactic Acid (HAA) Group						
HAA5 [o]	µg/L	NA	NA	NA	Range	ND-15.8
					Average	5.9
HAA6Br [x]	µg/L	NA	NA	NA	Range	ND-17.3
					Average	6.1
HAA9 [y]	µg/L	NA	NA	NA	Range	ND-28
					Average	10.2
Total Organic Carbon	µg/L	NA	NA	NA	Range	ND-2600
					Average	1925
Bromide	µg/L	NA	NA	NA	Range	ND-32
					Average	15.3
Metals and Metalloids Group						
Manganese	µg/L	NA	NA	NA	Range	ND-62
					Average	2

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average	Distribution System
FEDERAL UNREGULATED CONTAMINANTS MONITORING RULE (UCMR 5) (w)						
Lithium by ICP						
Lithium	µg/L	NA	NA	9	Range	ND-55.1
					Average	20
EPA 533						
PFBA	µg/L	NA	NA	0.005	Range	ND-0.0076
					Average	ND
PFHxA	µg/L	NA	NA	0.003	Range	ND-0.0038
					Average	ND
PFHxS	µg/L	NA	NA	0.003	Range	ND-0.0033
					Average	ND
PFPeA	µg/L	NA	NA	0.003	Range	ND-0.0061
					Average	ND

Footnotes

(a) The turbidity level of the filtered water shall be less than or equal to 0.3 NTU in 95% of the measurements taken each month and shall not exceed 1 NTU at any time. Turbidity, a measure of the cloudiness of the water, is an indicator of treatment performance. The averages and ranges of turbidity shown in the Secondary Standards were based on the treatment plant effluent.

(b) Total coliform MCLs: No more than 5.0% of the monthly samples may be total coliform-positive. Compliance is based on the combined distribution system sampling from all the treatment plants. In 2023, 1540 samples were analyzed and there were three positive detections for total coliform. The MCL was not violated.

(c) *E. coli* MCL: The occurrence of two consecutive total coliform-positive samples, one of which contains E. coli, constitutes an acute MCL violation. The MCL was not violated.

(d) Total coliform TT trigger, Level 1 assessments, and total coliform TT violations: More than 5.0% total coliform-positive samples in a month trigger Level 1 assessments. Failure to conduct assessments and correct findings within 30 days is a total coliform violation. No triggers, Level 1 assessments, or violations occurred.

(e) *E. coli* MCL and Level 2 TT triggers for assessments: Routine and repeat samples are total coliform-positive and either sample is E. coli-positive or system fails to collect all repeat samples following an E. coli-positive sample, or fails to test for E. coli when the repeat sample is total coliform-positive. No samples were E. coli-positive. No MCLs violations or no assessments occurred.

(f) Results included in this section range from 2015-2023.

(g) Unregulated contaminant monitoring helps the USEPA and the State Board determine where certain contaminants occur and whether the contaminants need to be regulated.

(h) City of Corona was in compliance with all provisions of the State's Fluoridation System Requirements. This is part of the City of Corona's blending plan to reduce the levels of fluoride being delivered to the consumer's tap. Refer to the "Treated Average System Water" column for a more accurate representation of system water quality.

(i) Aluminum has a secondary standard limit. In 2023 the secondary standard limit was exceeded at our Treatment Facility effluent with a Maximum Running Annual Average (Max RAA) of 115 ug/L. No consumer action is necessary since secondary standards for aluminum are established only for aesthetic effects (water color). We are continually calibrating our aluminum base coagulant to achieve the non-mandatory secondary standard limit of 200 ug/L.

(j) Total Dissolved Solids (TDS) is a measure of the total amount of all the materials that are dissolved in water. These minerals, both natural and anthropogenic (made by humans), are mainly inorganic solids, with a minor amount of organic material.

(k) This constituent was detected at levels exceeding the MCL, results shown in bold. Please note that this water is blended with water from other sources to provide customers with the highest quality drinking water.

(l) Reported from Mills Filtration Plant Metropolitan Water District (MWD). Mills MWD water is blended with other Corona water sources. Please note that this water is blended with water from other sources to provide customers with the highest quality drinking water.

(m) The City of Corona was in compliance with all provisions of the Stage 2 Disinfectants and Disinfection Byproducts Rules (D/DBP). Compliance was based on the locational running annual average (LRAA). The average reported reflects the highest TTHM and HAA5 LRAAs for the year.

(n) Total Trihalomethanes is the sum of bromodichloromethane, bromoform, chloroform, and dibromochloromethane.

(o) HAA5 is the sum of dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, dibromoacetic acid, and monochloroacetic acid.

(p) The sources that were detected for Boron are all directed to the Temescal Desalter for reverse osmosis treatment. The treated water is monitored at the effluent of the facility which is represented in the "Treated Average System Water" column.

(q) Hardness is the sum of polyvalent cations present in the water, generally magnesium and calcium. The cations are usually naturally occurring.

(r) Sodium refers to the salt present in the water and is generally naturally occurring.

(s) Data are the average of the results from two analytical methods.

(t) Fluoride, nitrate, perchlorate, TDS, 1,2,3-TCP, PFOA, PFOS, PFBS and PFHxS are a part of Corona's blending remediation plan to reduce the levels being delivered to the consumer's tap. Refer to the "Treated Average System Water" column for a more accurate representation of system water quality.

(u) 1,2,3-Trichloropropane (1,2,3-TCP) had a notification level (NL) of 0.005 ug/L until December 14, 2017, when the MCL of 0.005 ug/L became effective. 1,2,3-TCP was monitored quarterly in Corona's source and treated waters for the State's initial monitoring requirement and continues to be monitored per our Blending Plan requirements.

(v) UCMR 4 sampling took place from 2018-2019. Minimum reporting levels are as stipulated in the Federal UCMR 4. Detected parameter results are included in the CCR.

(w) UCMR 5 sampling began in September 2023 and is scheduled to be completed by September 2024. Minimum reporting levels are as stipulated in the Federal UCMR 5. Detected parameter results are included in the CCR.

(x) HAA6Br: Bromochloroacetic acid, bromodichloroacetic acid, dibromoacetic acid, dibromochloroacetic acid, monobromoacetic acid, and tribromoacetic acid.

(y) HAA9: Bromochloroacetic acid, bromodichloroacetic acid, chlorodibromoacetic acid, dibromoacetic acid, dichloroacetic acid, monobromoacetic acid, monochloroacetic acid, tribromoacetic acid, and trichloroacetic acid.

PRIMARY STANDARDS - Mandatory Health-Related Standards

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR/ CCRDL(RL)	Range Average	Water Source		Major Sources in Drinking Water
CLARITY								
Combined Filter	%	95[a]			% < 0.3	100%	Metropolitan Water District	Soil runoff
Effluent Turbidity	NTU	TT 0.3	NA	--	Highest	0.08	Henry J. Mills Water Treatment Plant	
Combined Filter	%	95[a]			% < 0.3	100%	City of Corona, Lester & Sierra Del Oro	Soil runoff
Effluent Turbidity	NTU	TT 0.3	NA	--	Highest	0.05	Water Treatment Facilities	

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR/ CCRDL(RL)	Range Average	Regulated in Distribution System	Major Sources in Drinking Water
MICROBIOLOGICAL CONTAMINANTS							
Total Coliform Bacteria (State Total Coliform Rule)	%	5.0 [b]	(0)	--	--	Highest % of positive samples collected in any one month = 0%	Naturally present in the environment
Fecal Coliform and E. Coli (State Total Coliform Rule)	[c]	[c]	(0)	--	--	Total number of positive samples collected in 2024 = 0	Human and animal fecal waste
Total Coliform Bacteria (Federal Total Coliform Rule)	%	TT [d]	--	--	--	Highest % of positive samples collected in any one month = 0%	Naturally present in the environment
Fecal Coliform and E. Coli (Federal Total Coliform Rule)	[e]	[e]	(0)	--	--	Total number of positive samples collected in 2024 = 0	Human and animal fecal waste
Heterotrophic Plate Count (HPC)	CFU/mL	TT	NA	NA	Range	Distribution System Wide: ND-969	Naturally present in the environment
					Average	Distribution System Wide:25	

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR/ CCRDL(RL)	Range Average	State Project Water	Colorado River Water	Ground Water	Treated Average System Water	Major Sources in Drinking Water
RADIOACTIVE CONTAMINANTS (f)										
Gross Alpha Particle Activity [k]	pCi/L	15	(0)	3	Range	ND	ND - 3.2	ND - 7.5	-	Erosion of natural deposits
					Average		ND	3.84		
Uranium	pCi/L	20	0.43	1	Range	ND	2.8 - 3.1	ND - 16.8	-	Erosion of natural deposits
					Average		2.9	4.71		
INORGANIC CONTAMINANTS										
Arsenic	µg/L	10	0.004	2	Range	ND	2	ND - 6.5	ND - 2	Erosion of natural deposits; runoff from orchards; glass and electronics production wastes
					Average			ND	ND	
Barium	mg/L	1	2	0.1	Range	ND	0.13	ND - 0.13	ND - 0.13	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits
					Average			ND	ND	
Chromium (hexavalent)	µg/L	10	0.02	0.1	Range	ND	ND	ND - 8.2	ND	Erosion of natural deposits; transformation of naturally occurring trivalent chromium to hexavalent chromium by natural processes and human activities such as discharges from electroplating factories, leather tanneries, wood preservation, chemical synthesis, refractory production, and textile manufacturing facilities.
					Average			ND		
Fluoride [e, h]	mg/L	2.0	1	0.1	Range	0.6 - 0.9	0.3 - 0.4	0.26 - 2.0	ND - 0.78	Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories
					Average	0.7	0.3	0.4	0.22	
Nitrate (as Nitrogen) [k, t]	mg/L	10 (as N)	10 (as N)	0.4	Range	0.6	ND	ND - **20**	ND - 5.9	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits
					Average			9.5	2.3	
Perchlorate [k, s]	µg/L	6	1	1	Range	ND	ND	ND - **9.4**	ND - 2.9	Perchlorate is an inorganic chemical used in solid rocket propellant, fireworks, explosives, flares, matches, and a variety of industries. It usually gets into drinking water as a result of environmental contamination from historic aerospace or other industrial operations that used or use, store, or dispose of perchlorate and its salts.
					Average			3.3	ND	
SYNTHETIC ORGANIC CONTAMINANTS including Pesticides/PCBs										
1,2,3-Trichloropropane (1,2,3-TCP) [k, s, t]	µg/L	0.005	0.0007	0.005	Range	ND	ND	ND - **0.02**	ND	Discharge from industrial and agricultural chemical factories; leaching from hazardous waste sites; used as cleaning and maintenance solvent, paint and varnish remover, and cleaning and degreasing agent; byproduct during the production of other compounds and pesticides.
					Average			ND		
VOLATILE ORGANIC CONTAMINANTS										
Tetrachloroethylene (PCE)	µg/L	5	0.06	0.5	Range	ND	ND	ND - 1	ND	Discharge from factories, dry cleaners, and auto shops (metal degreaser)
					Average			ND		
Trichloroethylene (TCE)	µg/L	5	1.7	0.5	Range	ND	ND	ND - 1.1	ND	Discharge from metal degreasing sites and other factories
					Average			ND		

SECONDARY STANDARDS - Aesthetic Standards

Aluminum [i]	µg/L	200	600	50	Range	ND - 110	ND	ND	ND - **230**	Erosion of natural deposits; residual from some surface water treatment processes
					Max RAA	ND			120	
Chloride	mg/L	500	NA	(2)	Range	41 - 67	108	110 - 210	16 - 120	Runoff/leaching from natural deposits; seawater influence
					Average	54		162	71	
Color	units	15	NA	(1)	Range	1 - 2	3	ND - 3	-	Naturally-occurring organic materials
					Average	2		ND		
Corrosivity (as Aggressiveness Index)	AI	NA	NA	NA	Range	12.2 - 12.3	-	12 - 13	10 - 12	Elemental balance in water; affected by temperature, other factors
					Average	12.2		13	12	
Foaming Agents - Methylene Blue Active Substances (MBAS)	µg/L	500	NA	(50)	Range	ND	ND	ND - 120	ND	Municipal and industrial waste discharges
					Average			36		
Manganese [f, k]	µg/L	50	NL=500	(5)	Range	ND	ND	ND - **580**	ND	Leaching from natural deposits
					Average			49		
Odor Threshold	Units	3	NA	1	Range	1	**5**	ND - 2	ND - 1	Naturally-occurring organic materials
					Average			ND	ND	
Specific Conductance [k]	µS/cm	1,600	NA	NA	Range	317 - 466	1,040 - 1,050	1,011 - **1,800**	115 - **3,037**	Substances that form ions when in water; seawater influence
					Average	392	1,040	1,374	655	
Sulfate	mg/L	500	NA	0.5	Range	21 47	231 - 240	140-260	3.0 - 240	Runoff/leaching from natural deposits; industrial wastes
					Average	34	236	197	127	
Total Dissolved Solids [j, k, s]	mg/L	1,000	NA	(2)	Range	178 - 263	663 - 696	610 - **1,200**	64 - 700	Runoff/leaching from natural deposits
					Average	220	680	872	408	
Turbidity	NTU	5	NA	0.1	Range	ND	0.6 - 1.3	0.1 - 0.55	0.15 - 0.2	Soil runoff
					Average		0.9	0.18	0.17	

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) with Notification Levels, Analyzed by EPA Methods 533 (s)										
Perfluorobutane Sulfonic (PFBS)	ng/L	NL=500	NA	3	Range	ND	ND	ND - 52	ND - 2.2	Industrial chemical factory discharges; runoff/leaching from landfills; used in fire-retarding foams and various industrial processes
					Average			20	ND	
Perfluorohexane Sulfonic Acid (PFHxS)	ng/L	NL=3	NA	3	Range	ND	ND	ND - 68	ND	
					Average			22		
Perfluorooctanoic Acid (PFOA)	ng/L	NL=5.1	0.007	4	Range	ND	ND	ND - 300	ND - 4.3	
					Average			80	ND	
Perfluorooctanesulfonate acid (PFOS)	ng/L	NL=6.5	1	4	Range	ND	ND	ND - 330	ND - 4.2	
					Average			93	ND	

UNREGULATED CONTAMINANTS WITH NO MCLs (g)										Health Effects
Boron [p]	mg/L	NL=1	NA	0.1	Range	0.13	0.15	0.29 - 3.4	0.11 - 0.41	Boron exposures resulted in decreased fetal weight (developmental effects) in newborn rats.
					Average			1.33	0.24	
Vanadium	µg/L	NL=50	NA	3	Range	ND	ND	ND - 19	ND - 3.9	Vanadium exposures resulted in developmental and reproductive effects in rats.
					Average			6.39	ND	

OTHER PARAMETERS

Chemical	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR/ CCRDL(RL)	Range Average	State Project Water	Colorado River Water	Ground Water	Treated Average System Water
Alkalinity	mg/L	NA	NA	(1)	Range	68 - 71	123 - 128	120 - 390	16 - 130
					Average	70	126	230	79
Bicarbonate	mg/L	NA	NA	NA	Range	-	-	120 - 390	14 - 130
					Average			230	78
Calcium	mg/L	NA	NA	(0.1)	Range	15 - 22	72 - 75	55 - 170	1.6 - 83
					Average	18	74	118	43
Hardness [q]	mg/L	NA	NA	(1)	Range	68 - 99	291 - 296	200 - 590	5.5 - 320
					Average	84	294	419	171
Magnesium	mg/L	NA	NA	(0.01)	Range	8.4 -11	28 - 29	15 - 45	0.37 - 30
					Average	9.7	28	30	15
pH	pH Units	NA	NA	NA	Range	8.7 - 8.8	8.1 - 8.2	7.7 - 8.0	7.4 - 10.2
					Average	8.7	8.1	7.9	7.5
Potassium	mg/L	NA	NA	(0.2)	Range	1.9 - 3.1	5.4	1.9 - 14	ND - 6
					Average	2.5		5.4	3.3
Sodium [r]	mg/L	NA	NA	(1)	Range	35 - 54	104 - 108	54 - 180	21 - 110
					Average	44	106	118	67

Key to Abbreviations

AI	Aggressiveness Index
CCDLP	Consumer Confidence Report Detection Level
CFU/mL	Colony-Forming Units per Milliliter
DBP	Disinfection Byproducts
DLR	Detection Limits for Purposes of Reporting
LRAA	Locational Running Annual Average
MBAS	Methylene Blue Active Substances
mg/L	Milligrams per liter or parts per million (ppm)
N	Nitrogen
NA	Not Applicable
ND	Not Detected
ng/L	Nanograms per liter or parts per trillion (ppt)
NL	Notification Level
NTU	Nephelometric Turbidity Units
pCi/L	PicoCuries per liter
RAA	Running Annual Average
TOC	Total Organic Carbon
µg/L	Micrograms per liter or parts per billion (ppb)
µS/cm	microSiemen per centimeter; or micromho per centimeter (µmho/cm)

Extended Abbreviations

Maximum Contaminant Level (MCL): The highest level of a contaminant that is allowed in drinking water. Primary MCLs are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. Secondary MCLs are set to protect the odor, taste and appearance of drinking water.

Maximum Contaminant Level Goal (MCLG): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the U.S. Environmental Protection Agency.

Public Health Goal (PHG): The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the California Environmental Protection Agency.

Primary Drinking Water Standard (PDWS): MCLs and MRDLs for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.

Maximum Residual Disinfectant Level (MRDL): The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

Maximum Residual Disinfectant Level Goal (MRDLG): The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

Regulatory Action Level (AL): The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

Treatment Technique (TT): A required process intended to reduce the level of a contaminant in drinking water.

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR	Range Average/LRAA/RAA	Distribution System Wide	Major Sources in Drinking Water	Health Effects Language
DISINFECTION BYPRODUCTS, DISINFECTANT RESIDUALS, AND DISINFECTION BYPRODUCT PRECURSORS FEDERAL RULE (m)								
Total Trihalomethanes (TTHMs) (n)	µg/L	80	NA	1	Range LRAA	ND - 34 29.3	Byproduct of drinking water disinfection	Some people who drink water containing trihalomethanes in excess of the MCL over many years may experience liver, kidney, or central nervous system problems, and may have an increased risk of getting cancer.
Haloacetic Acids (HAA5) (o)	µg/L	60	NA	1	Range LRAA	ND - 11 9.7	Byproduct of drinking water disinfection	Some people who drink water containing haloacetic acids in excess of the MCL over many years may have an increased risk of getting cancer.
Bromate (Mills - WR-24 Conn.) (l)	µg/L	10	0.1	1	Range Max RAA	ND - 19 7.9	Byproduct of drinking water disinfection	Some people who drink water containing bromate in excess of the MCL over many years may have an increased risk of getting cancer.
Chloramines	mg/L	[4 as Cl2]	[4 as Cl2]	NA	Range Max RAA	1.21 - 2.8 2.0	Drinking water disinfectant added for treatment	Some people who use water containing chloramines well in excess of the MRDL could experience irritating effects to their eyes and nose. Some people who drink water containing chloramines well in excess of the MRDL could experience stomach discomfort or anemia.
Control of DBP precursors (TOC)	mg/L	TT	NA	0.3	Range Average	2.2 - 2.7 2.4	Various natural and manmade sources	Total organic carbon (TOC) has no health effects. However, total organic carbon provides a medium for the formation of disinfection byproducts. These byproducts include trihalomethanes (THMs) and haloacetic acids (HAAs). Drinking water containing these byproducts in excess of the MCL may lead to adverse health effects, liver or kidney problems, or nervous system effects, and may lead to an increased risk of cancer.

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR/ CCRDL(RL)	Range Average	Distribution System
FEDERAL UNREGULATED CONTAMINANTS MONITORING RULE (UCMR 4) (u)						
Haloactic Acid (HAA) Group						
HAA5 [(o)]	µg/L	NA	NA	NA	Range	ND-15.8
					Average	5.9
HAA6Br [(w)]	µg/L	NA	NA	NA	Range	ND-17.3
					Average	6.1
HAA9 [(x)]	µg/L	NA	NA	NA	Range	ND-28
					Average	10.2
Total Organic Carbon	µg/L	NA	NA	NA	Range	ND-2600
					Average	1925
Bromide	µg/L	NA	NA	NA	Range	ND-32
					Average	15.3
Metals and Metalloids Group						
Manganese	µg/L	NA	NA	NA	Range	ND-62
					Average	2

Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	State DLR/ CCRDL(RL)	Range Average	Distribution System
FEDERAL UNREGULATED CONTAMINANTS MONITORING RULE (UCMR 5) (v)						
Lithium by ICP						
Lithium	µg/L	NA	NA	9	Range	ND-55.1
					Average	16
EPA 533						
PFBA	µg/L	NA	NA	0.005	Range	ND-0.0076
					Average	ND
PFHxA	µg/L	NA	NA	0.003	Range	ND-0.0038
					Average	ND
PFHxS	µg/L	NA	NA	0.003	Range	ND-0.0033
					Average	ND
PFPeA	µg/L	NA	NA	0.003	Range	ND-0.0061
					Average	ND

Footnotes

(a) The turbidity level of the filtered water shall be less than or equal to 0.3 NTU in 95% of the measurements taken each month and shall not exceed 1 NTU at any time. Turbidity, a measure of the cloudiness of the water, is an indicator of treatment performance. The averages and ranges of turbidity shown in the Secondary Standards were based on the treatment plant effluent.

(b) Total coliform MCLs: No more than 5.0% of the monthly samples may be total coliform-positive. Compliance is based on the combined distribution system sampling from all the treatment plants. In 2024, 1591 samples were analyzed and there were no positive detections for total coliform. The MCL was not violated.

(c) *E. coli* MCL: The occurrence of two consecutive total coliform-positive samples, one of which contains E. coli, constitutes an acute MCL violation. The MCL was not violated.

(d) Total coliform TT trigger, Level 1 assessments, and total coliform TT violations: More than 5.0% total coliform-positive samples in a month trigger Level 1 assessments. Failure to conduct assessments and correct findings within 30 days is a total coliform violation. No triggers, Level 1 assessments, or violations occurred.

(e) *E. coli* MCL and Level 2 TT triggers for assessments: Routine and repeat samples are total coliform-positive and either sample is E. coli-positive or system fails to collect all repeat samples following an E. coli-positive sample, or fails to test for E. coli when the repeat sample is total coliform-positive. No samples were E. coli-positive. No MCLs violations or no assessments occurred.

(f) Results included in this section range from 2016-2024.

(g) Unregulated contaminant monitoring helps the USEPA and the State Board determine where certain contaminants occur and whether the contaminants need to be regulated.

(h) City of Corona was in compliance with all provisions of the State's Fluoridation System Requirements. This is part of the City of Corona's blending plan to reduce the levels of fluoride being delivered to the consumer's tap. Refer to the "Treated Average System Water" column for a more accurate representation of system water quality.

(i) Aluminum has a secondary standard limit. In 2024 the secondary standard limit was exceeded at our Treatment Facility effluent. The Maximum Running Annual Average (Max RAA) was 158 ug/L, no consumer action is necessary since secondary standards for aluminum are established only for aesthetic effects (water color). We are continually calibrating our aluminum base coagulant to achieve the non-mandatory secondary standard limit of 200 ug/L.

(j) Total Dissolved Solids (TDS) is a measure of the total amount of all the materials that are dissolved in water. These minerals, both natural and anthropogenic (made by humans), are mainly inorganic solids, with a minor amount of organic material.

(k) This constituent was detected at levels exceeding the MCL, results shown in bold. Please note that this water is blended with water from other sources to provide customers with the highest quality drinking water.

(l) Reported from Mills Filtration Plant Metropolitan Water District (MWD). Mills MWD water is blended with other Corona water sources. Please note that this water is blended with water from other sources to provide customers with the highest quality drinking water.

(m) The City of Corona was in compliance with all provisions of the Stage 2 Disinfectants and Disinfection Byproducts Rules (D/DBP). Compliance was based on the locational running annual average (LRAA). The average reported reflects the highest TTHM and HAA5 LRAAs for the year.

(n) Total Trihalomethanes is the sum of bromodichloromethane, bromoform, chloroform, and dibromochloromethane.

(o) HAA5 is the sum of dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, dibromoacetic acid, and monochloroacetic acid.

(p) The sources that were detected for Boron are all directed to the Temescal Desalter for reverse osmosis treatment. The treated water is monitored at the effluent of the facility which is represented in the "Treated Average System Water" column.

(q) Hardness is the sum of polyvalent cations present in the water, generally magnesium and calcium. The cations are usually naturally occurring.

(r) Sodium refers to the salt present in the water and is generally naturally occurring.

(s) Fluoride, nitrate, perchlorate, TDS, 1,2,3-TCP, PFOA, PFOS, PFBS and PFHxS are a part of Corona's blending remediation plan to reduce the levels being delivered to the consumer's tap. Refer to the "Treated Average System Water" column for a more accurate representation of system water quality.

(t) 1,2,3-TCP was monitored quarterly in Corona's source and treated waters for the State's initial monitoring requirement and continues to be monitored per our Blending Plan requirements.

(u) UCMR 4 sampling took place from 2018-2019. Minimum reporting levels are as stipulated in the Federal UCMR 4. Detected parameter results are included in the CCR.

(v) UCMR 5 sampling took place 2023-2024. Minimum reporting levels are as stipulated in the Federal UCMR 5. Detected parameter results are included in the CCR.

(w) HAA6Br: Bromochloroacetic acid, bromodichloroacetic acid, dibromoacetic acid, dibromochloroacetic acid, monobromoacetic acid, and tribromoacetic acid.

(x) HAA9: Bromochloroacetic acid, bromodichloroacetic acid, chlorodibromoacetic acid, dibromoacetic acid, dichloroacetic acid, monobromoacetic acid, monochloroacetic acid, tribromoacetic acid, and trichloroacetic acid.

Appendix F – AWWA Water Audit Reports past 5 years

AWWA Free Water Audit Software v5.0

American Water Works Association Copyright © 2014, All Rights Reserved.

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person:	Stacy Joyce	
Email Address:	Stacy.Joyce@CoronaCA.gov	
Telephone | Ext.:	951 736-2265	
Name of City / Utility:	City of Corona	
City/Town/Municipality:	Corona	
State / Province:	California (CA)	
Country:	US	
Year:	20/21	Financial Year
Start Date:	07/2020	Enter MM/YYYY numeric format
End Date:	06/2021	Enter MM/YYYY numeric format
Audit Preparation Date:	9/14/2021	
Volume Reporting Units:	Acre-feet	
PWSID / Other ID:	CA3310037	

The following guidance will help you complete the Audit

All audit data are entered on the ***Reporting Worksheet***

- Value can be entered by user
- Value calculated based on input data
- These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions
The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet
Enter the required data on this worksheet to calculate the water balance and data grading

Comments
Enter comments to explain how values were calculated or to document data sources

Performance Indicators
Review the performance indicators to evaluate the results of the audit

Water Balance
The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard
A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix
Presents the possible grading options for each input component of the audit

Service Connection Diagram
Diagrams depicting possible customer service connection line configurations

Definitions
Use this sheet to understand the terms used in the audit process

Loss Control Planning
Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits
Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements
Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0

American Water Works Association.
Copyright © 2014, All Rights Reserved.

? Click to access definition
+ Click to add a comment

Water Audit Report for: City of Corona (CA3310037)
Reporting Year: 20/21 7/2020 - 6/2021

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: ACRE-FEET PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

WATER SUPPLIED

Volume from own sources:	7	31,465.843	acre-ft/yr	8			acre-ft/yr
Water imported:	7	1,320.554	acre-ft/yr	9			acre-ft/yr
Water exported:	7	447.552	acre-ft/yr	9			acre-ft/yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 32,338.845 acre-ft/yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

				Pcnt:	Value:	
Billed metered:	7	30,582.450	acre-ft/yr			
Billed unmetered:	n/a		acre-ft/yr			
Unbilled metered:	8	63.340	acre-ft/yr			
Unbilled unmetered:		404.236	acre-ft/yr	1.25%		acre-ft/yr

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

Use buttons to select percentage of water supplied OR value

AUTHORIZED CONSUMPTION: 31,050.026 acre-ft/yr

WATER LOSSES (Water Supplied - Authorized Consumption)

1,288.819 acre-ft/yr

Apparent Losses

				Pcnt:	Value:	
Unauthorized consumption:		80.847	acre-ft/yr	0.25%		acre-ft/yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	5	625.424	acre-ft/yr	2.00%		acre-ft/yr
Systematic data handling errors:		76.456	acre-ft/yr	0.25%		acre-ft/yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 782.728 acre-ft/yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 506.092 acre-ft/yr

WATER LOSSES: 1,288.819 acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER: 1,756.395 acre-ft/yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	7	851.0	miles
Number of active AND inactive service connections:	7	45,092	
Service connection density:		53	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: 7 93.3 psi

COST DATA

Total annual cost of operating water system:	10	$48,508,297	$/Year	
Customer retail unit cost (applied to Apparent Losses):	10	$2.38	$/100 cubic feet (ccf)	
Variable production cost (applied to Real Losses):	5	$689.17	$/acre-ft	☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 70 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Customer metering inaccuracies
3: Variable production cost (applied to Real Losses)

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.
Copyright © 2014, All Rights Reserved.

Water Audit Report for: City of Corona (CA3310037)
Reporting Year: 20/21 | 7/2020 - 6/2021

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 70 out of 100 ***

System Attributes:

	Apparent Losses:	782.728	acre-ft/yr
+	Real Losses:	506.092	acre-ft/yr
=	**Water Losses:**	**1,288.819**	acre-ft/yr
?	Unavoidable Annual Real Losses (UARL):	1,188.01	acre-ft/yr
	Annual cost of Apparent Losses:	$811,476	
	Annual cost of Real Losses:	$348,783	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	5.4%	
	Non-revenue water as percent by cost of operating system:	3.1%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	15.50	gallons/connection/day
	Real Losses per service connection per day:	10.02	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.11	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	506.09	acre-feet/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.43	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.
Copyright © 2014, All Rights Reserved.

Water Audit Report for:	City of Corona (CA3310037)	
Reporting Year:	20/21	7/2020 - 6/2021
Data Validity Score:	70	

		Water Exported 447.552	Billed Water Exported			Revenue Water 447.552
Own Sources (Adjusted for known errors) 31,465.843	System Input 32,786.397	Water Supplied 32,338.845	Authorized Consumption 31,050.026	Billed Authorized Consumption 30,582.450	Billed Metered Consumption (water exported is removed) 30,582.450	Revenue Water 30,582.450
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 467.576	Unbilled Metered Consumption 63.340	Non-Revenue Water (NRW) 1,756.395
					Unbilled Unmetered Consumption 404.236	
			Water Losses 1,288.819	Apparent Losses 782.728	Unauthorized Consumption 80.847	
					Customer Metering Inaccuracies 625.424	
					Systematic Data Handling Errors 76.456	
Water Imported 1,320.554				Real Losses 506.092	Leakage on Transmission and/or Distribution Mains Not broken down	
					Leakage and Overflows at Utility's Storage Tanks Not broken down	
					Leakage on Service Connections Not broken down	

AWWA Free Water Audit Software:
Dashboard

WAS v5.0

American Water Works Association.
Copyright © 2014, All Rights Reserved.

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

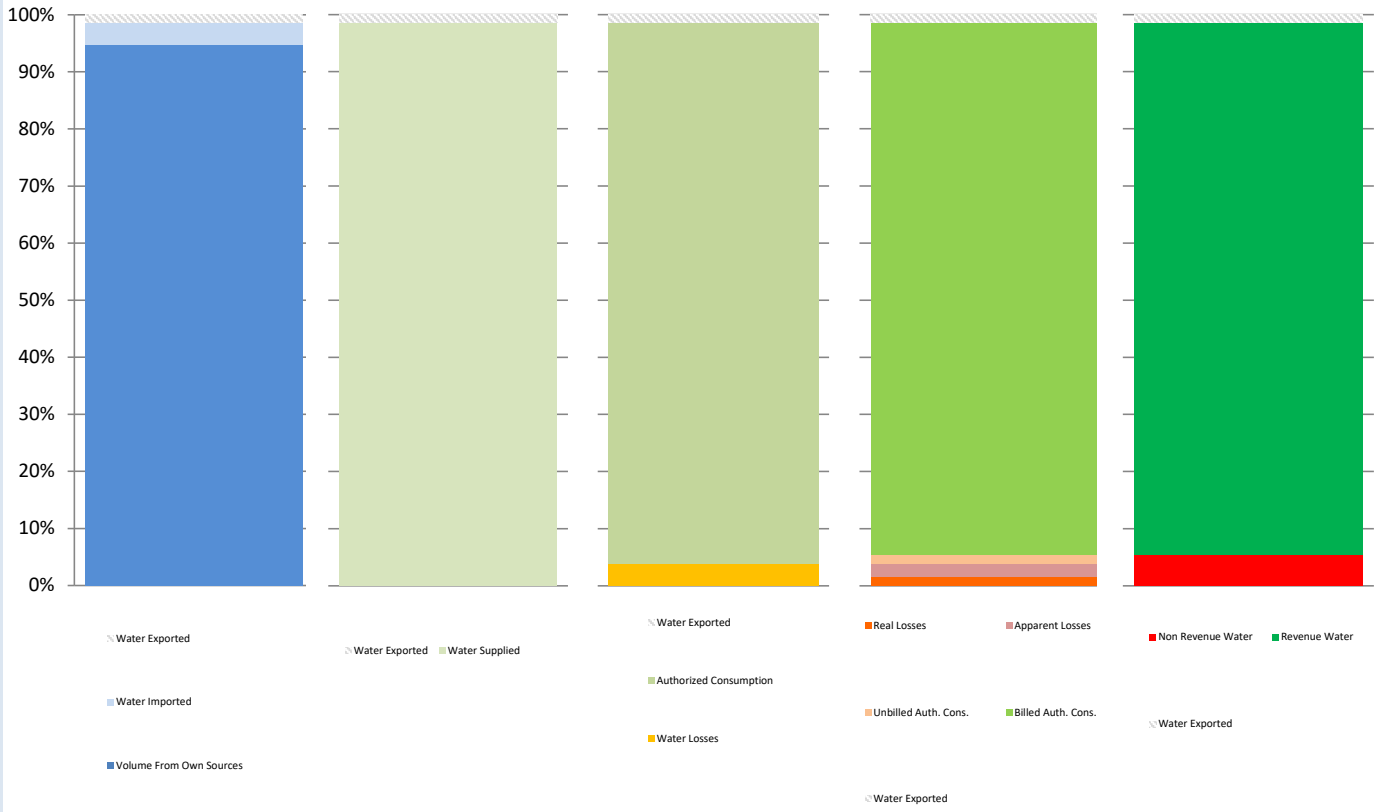
Water Audit Report for: City of Corona (CA3310037)

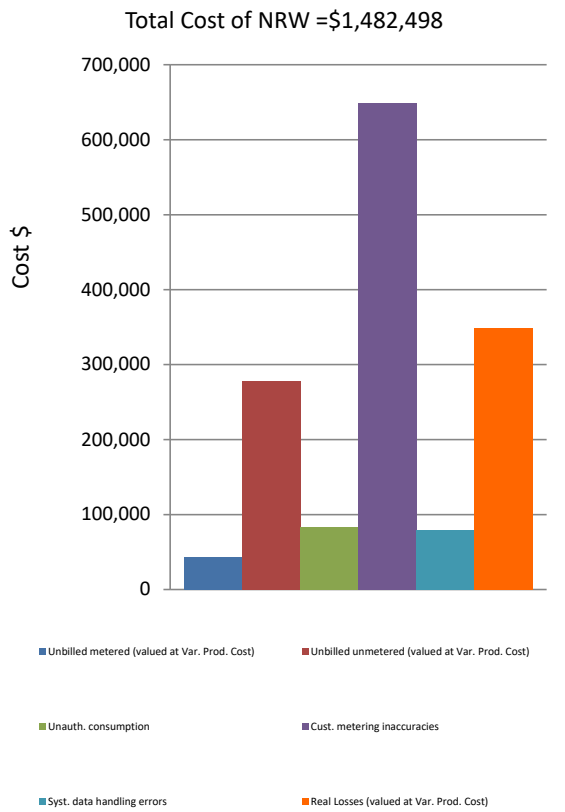
Reporting Year: 20/21 | 7/2020 - 6/2021

Data Validity Score: 70

○ Show me the VOLUME of Non-Revenue Water

◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software v5.0

American Water Works Association Copyright © 2014, All Rights Reserved.

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person:	Stacy Joyce	
Email Address:	Stacy.Joyce@CoronaCA.gov	
Telephone | Ext.:	951 736-2265	
Name of City / Utility:	City of Corona	
City/Town/Municipality:	Corona	
State / Province:	California (CA)	
Country:	US	
Year:	2022	Financial Year
Start Date:	07/2021	Enter MM/YYYY numeric format
End Date:	06/2022	Enter MM/YYYY numeric format
Audit Preparation Date:	12/13/2022	
Volume Reporting Units:	Acre-feet	
PWSID / Other ID:	CA3310037	

The following guidance will help you complete the Audit

All audit data are entered on the ***Reporting Worksheet***

- Value can be entered by user
- Value calculated based on input data
- These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions
The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet
Enter the required data on this worksheet to calculate the water balance and data grading

Comments
Enter comments to explain how values were calculated or to document data sources

Performance Indicators
Review the performance indicators to evaluate the results of the audit

Water Balance
The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard
A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix
Presents the possible grading options for each input component of the audit

Service Connection Diagram
Diagrams depicting possible customer service connection line configurations

Definitions
Use this sheet to understand the terms used in the audit process

Loss Control Planning
Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits
Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements
Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0

American Water Works Association.
Copyright © 2014, All Rights Reserved.

? Click to access definition
+ Click to add a comment

Water Audit Report for: City of Corona (CA3310037)
Reporting Year: 2022 | 7/2021 - 6/2022

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: ACRE-FEET PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

WATER SUPPLIED

<---------- Enter grading in column 'E' and 'J' ---------->

					Master Meter and Supply Error Adjustments Pcnt:	Value:	
Volume from own sources:	9	31,510.862	acre-ft/yr	8			acre-ft/yr
Water imported:	9	358.079	acre-ft/yr	10			acre-ft/yr
Water exported:	9	391.650	acre-ft/yr	9			acre-ft/yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 31,477.291 acre-ft/yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

			Pcnt:	Value:	
Billed metered:	7	29,974.930	acre-ft/yr		
Billed unmetered:	n/a	0.000	acre-ft/yr		
Unbilled metered:	8	83.857	acre-ft/yr		
Unbilled unmetered:		393.466	acre-ft/yr	1.25%	acre-ft/yr

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

Use buttons to select percentage of water supplied OR value

AUTHORIZED CONSUMPTION: 30,452.253 acre-ft/yr

WATER LOSSES (Water Supplied - Authorized Consumption)

1,025.038 acre-ft/yr

Apparent Losses

			Pcnt:	Value:	
Unauthorized consumption:		78.693	acre-ft/yr	0.25%	acre-ft/yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	6	613.445	acre-ft/yr	2.00%	acre-ft/yr
Systematic data handling errors:		74.937	acre-ft/yr	0.25%	acre-ft/yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 767.075 acre-ft/yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 257.963 acre-ft/yr

WATER LOSSES: 1,025.038 acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER: 1,502.361 acre-ft/yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	9	851.0	miles
Number of active AND inactive service connections:	9	46,256	
Service connection density:		54	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: 9 | 93.3 psi

COST DATA

Total annual cost of operating water system:	10	$46,485,087	$/Year
Customer retail unit cost (applied to Apparent Losses):	10	$2.60	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	7	$729.77	$/acre-ft

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 80 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Billed metered
3: Customer metering inaccuracies

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.
Copyright © 2014, All Rights Reserved.

Water Audit Report for: City of Corona (CA3310037)
Reporting Year: 2022 | 7/2021 - 6/2022

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 80 out of 100 ***

System Attributes:

	Apparent Losses:	767.075	acre-ft/yr
+	Real Losses:	257.963	acre-ft/yr
=	**Water Losses:**	**1,025.038**	acre-ft/yr
?	Unavoidable Annual Real Losses (UARL):	1,206.26	acre-ft/yr
	Annual cost of Apparent Losses:	$868,759	
	Annual cost of Real Losses:	$188,253	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	4.8%	
	Non-revenue water as percent by cost of operating system:	3.0%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	14.80	gallons/connection/day
	Real Losses per service connection per day:	4.98	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.05	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	257.96	acre-feet/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.21	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.
Copyright © 2014, All Rights Reserved.

Water Audit Report for:	City of Corona (CA3310037)	
Reporting Year:	2022	7/2021 - 6/2022
Data Validity Score:	80	

		Water Exported 391.650	Billed Water Exported			Revenue Water 391.650
Own Sources (Adjusted for known errors) 31,510.862	System Input 31,868.941	Water Supplied 31,477.291	Authorized Consumption 30,452.253	Billed Authorized Consumption 29,974.930	Billed Metered Consumption (water exported is removed) 29,974.930	Revenue Water 29,974.930
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 477.323	Unbilled Metered Consumption 83.857	Non-Revenue Water (NRW) 1,502.361
					Unbilled Unmetered Consumption 393.466	
			Water Losses 1,025.038	Apparent Losses 767.075	Unauthorized Consumption 78.693	
					Customer Metering Inaccuracies 613.445	
					Systematic Data Handling Errors 74.937	
Water Imported 358.079				Real Losses 257.963	Leakage on Transmission and/or Distribution Mains Not broken down	
					Leakage and Overflows at Utility's Storage Tanks Not broken down	
					Leakage on Service Connections Not broken down	

AWWA Free Water Audit Software:
Dashboard

WAS v5.0

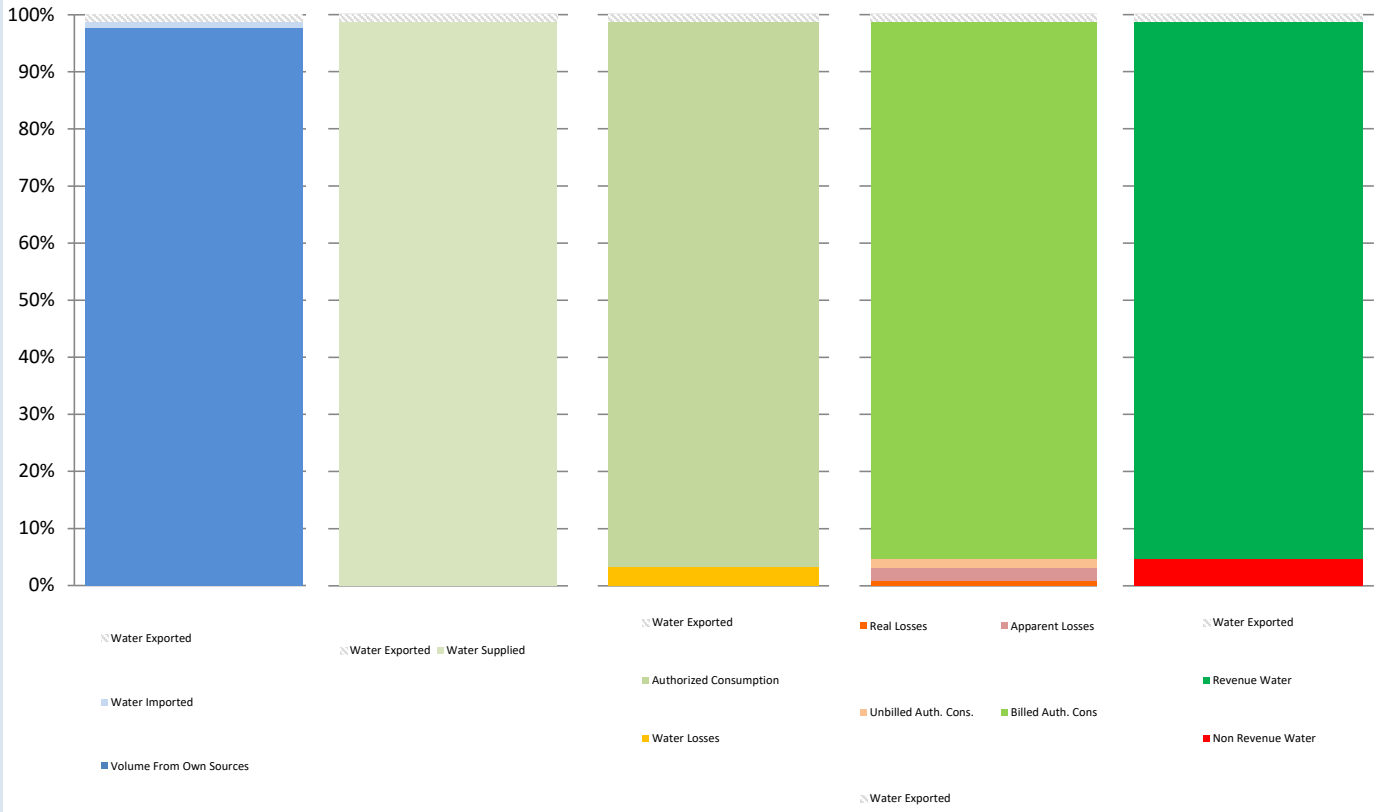
American Water Works Association.
Copyright © 2014, All Rights Reserved.

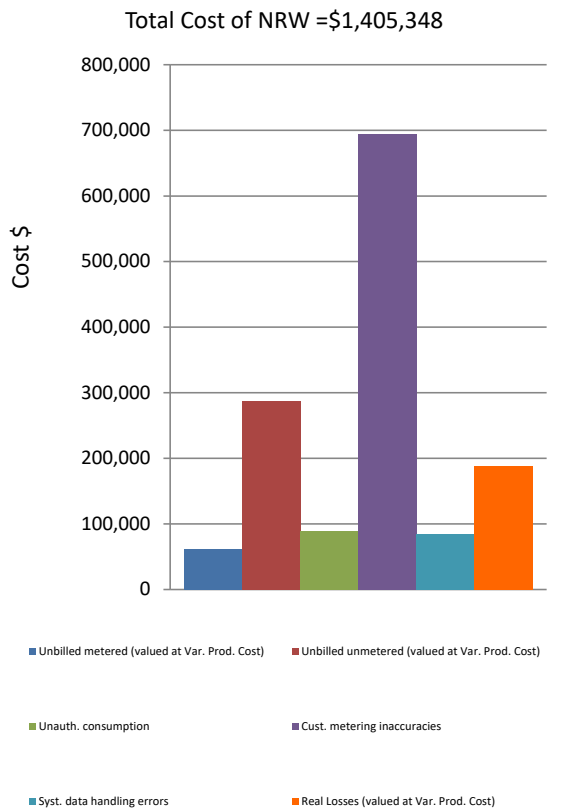
The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for:	**City of Corona (CA3310037)**	
Reporting Year:	**2022**	**7/2021 - 6/2022**
Data Validity Score:	**80**	

○ Show me the VOLUME of Non-Revenue Water

◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software v6.0

FWAS v6.0

American Water Works Association Copyright © 2020, All Rights Reserved.

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format and is not meant to take the place of a full-scale, comprehensive water audit format. Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targeting loss reduction levels. This tool contains several separate worksheets. Sheets can be accessed using the tabs at the bottom of the screen, or by clicking the TOC links below.

Table of Contents (TOC)

Start Page	The current sheet. Enter contact information and basic audit details.
Worksheet	Enter the required data on this worksheet to calculate the water balance and data grading.
Interactive Data Grading	Answer questions about operational practices for each audit input, and the data validity grades will automatically populate.
Dashboard	Review NRW components, performance indicators and graphical outputs to evaluate the results of the audit.
Notes	Enter notes to explain how values were calculated, document data sources, and related information about data management practices.
Blank Sheet	By popular demand! A blank sheet. The world is your canvas.
Water Balance	The values entered in the Worksheet automatically populate the Water Balance.
Loss Control Planning	Use this sheet to interpret the results of the audit validity score and performance indicators.
Definitions	Use this sheet to understand the terms used in the audit process.
Service Connection Diagram	Diagrams depicting possible customer service connection line configurations.
Acknowledgements	Acknowledgements for development of the AWWA Free Water Audit Software v6.0.

AWWA Web Resources for Water Loss Control

https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control

Items referenced in the Free Water Audit Software v6.0 on the web:

- Data Grading Matrix v6.0
- Example Water Audit v6.0
- Water Audit Compiler v6.0
- AWWA Reports on Performance Indicators
- M36 Manual

Enter Basic Information

Name of Utility:	City of Corona
Name of Contact Person:	Stacy Joyce
Email:	stacy.joyce@coronaca.gov
Telephone | Ext.:	951-736-2265
City/Town/Municipality:	Corona
State / Province:	California (CA)
Country:	United States
Audit Preparation Date:	Dec 13 2022
Audit Year:	2023
Audit Year Label:	Fiscal (Fiscal, Calendar, etc)
Audit Period Start Date:	Jul 01 2022
Audit Period End Date:	Jun 30 2023
Volume Reporting Units:	Acre-feet
Water System Structure:	Retail
Water Type:	Potable Water
System ID Number:	CA3310037
Validator Name/ID:	Damian Martinez
Validator Email:	damianm600@gmail.com
Estimated Total Population Served by Water Utility:	168,751

Key of Input Acronyms

In order of appearance in the Worksheet

VOS	Volume from Own Sources
VOSEA	VOS Error Adjustment
WI	Water Imported
WIEA	WI Error Adjustment
WE	Water Exported
WEEA	WE Error Adjustment
BMAC	Billed Metered Authorized Consumption
BUAC	Billed Unmetered Authorized Consumption
UMAC	Unbilled Metered Authorized Consumption
UUAC	Unbilled Unmetered Authorized Consumption
SDHE	Systematic Data Handling Errors
CMI	Customer Metering Inaccuracies
UC	Unauthorized Consumption
Lm	Length of mains
Nc	Number of service connections
Lp	Average length of (private) customer service line
AOP	Average Operating Pressure
CRUC	Customer Retail Unit Charge
VPC	Variable Production Cost

Color Key User input | Calculated | Optional default

Guidance for the Worksheet

Choosing to enter unit of **percent** or **volume** (applies to VOSEA, WIEA, WEEA, CMI)

choose entry option:

1.00%	percent	*or*
	volume	25.000

Choosing to enter **default** or **custom input** (applies to UUAC, SDHE, UC)

choose entry option:

0.25%	default	*or*
	custom	75.000

Guidance for the Interactive Data Grading

Use acronym buttons in IDG header to navigate among inputs. Acronym Key above. White = needs answers, orange = complete, clear = not required. Example below.

VOS	VOSEA	WI	WIEA	WE	WEEA	BMAC	BUAC	UMAC	UUAC
SDHE	CMI	UC	Lm	Nc	Lp	AOP	CRUC	VPC	

After clicking an acronym button, answer all visible questions in the order they're presented, choosing best-fit answer

Grade will populate when all visible questions are complete for an input: **7**

The limiting criteria will be labeled along the right. If only 1 limiting criterion is shown, improving on that criterion will achieve a higher data grade. If multiple limiting criteria are shown, improving on *each* limiting criterion is necessary to achieve a higher data grade. A complete inventory of data grading criteria is available in the Data Grading Matrix v6.0 (see web resources)

Limiting

If you have questions or comments regarding this software please contact us at: wlc@awwa.org

AWWA Free Water Audit Software: Worksheet

FWAS v6.0

American Water Works Association.

Water Audit Report for: City of Corona

Audit Year: 2023 | Jul 01 2022 - Jun 30 2023 | Fiscal

Click 'n' to add notes

Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: ACRE-FEET PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	9	26,664.749	Acre-ft/Yr	n	g	10	0.00%	percent	VOSEA
WI	Water Imported:	n	g	9	855.539	Acre-ft/Yr	n	g	9	0.00%	percent	WIEA
WE	Water Exported:	n	g	9	356.903	Acre-ft/Yr	n	g	7	0.00%	percent	WEEA

WATER SUPPLIED: 27,163.385 Acre-ft/Yr

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	8	26,087.000	Acre-ft/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000	Acre-ft/Yr			
UMAC	Unbilled Metered:	n	g	10	81.080	Acre-ft/Yr			
UUAC	Unbilled Unmetered:	n	g	3	65.218	Acre-ft/Yr	0.25%	default	

Default option selected for Unbilled Unmetered, with automatic data grading of 3

AUTHORIZED CONSUMPTION: 26,233.298 Acre-ft/Yr

WATER LOSSES

930.088 Acre-ft/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n	g	3	65.218	Acre-ft/Yr	0.25%	default		
CMI	Customer Metering Inaccuracies:	n	g	3	534.042	Acre-ft/Yr	2.00%	percent	under-registration	
UC	Unauthorized Consumption:	n	g	3	65.218	Acre-ft/Yr	0.25%	default		

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 664.477 Acre-ft/Yr

Real Losses

Real Losses: 265.610 Acre-ft/Yr

WATER LOSSES: 930.088 Acre-ft/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 1,076.385 Acre-ft/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	813.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	8	46,272		(active *and* inactive)
	Service connection density:				57	conn./mile main	

Are customer meters typically located at the curbstop/property line? Yes

Lp n g 10

Average length of customer service line has been set to zero and a data grading of 10 has been applied

AOP Average Operating Pressure: n g 9 93.3 psi

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$2.66	$/100 cubic feet (ccf)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	8	$740.68	$/acre-ft	$46,519,641	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Customer Metering Inaccuracies (CMI)

2: Billed Metered (BMAC)

3: Volume from Own Sources (VOS)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[^]:		gal/conn/day
Unit Real Losses[^]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

AWWA Free Water Audit Software
Water Balance

FWAS v6.0

American Water Works Association.
Copyright © 2020, All Rights Reserved.

Water Audit Report for: City of Corona
Audit Year: 2023 Jul 01 2022 - Jun 30 2023
Data Validity Tier: Tier IV (71-90)

Volume from Own Sources (VOS) (corrected for known errors) 26,664.749	System Input Volume 27,520.288	Water Exported (WE) (corrected for known errors) 356.903	Billed Water Exported			Revenue Water (Exported) 356.903
		Water Supplied 27,163.385	Authorized Consumption 26,233.298	Billed Authorized Consumption 26,087.000	Billed Metered Consumption (BMAC) (water exported is removed) 26,087.000	Revenue Water 26,087.000
					Billed Unmetered Consumption (BUAC) 0.000	
				Unbilled Authorized Consumption 146.298	Unbilled Metered Consumption (UMAC) 81.080	Non-Revenue Water (NRW) 1,076.385
					Unbilled Unmetered Consumption (UUAC) 65.218	
			Water Losses 930.088	Apparent Losses 664.477	Systematic Data Handling Errors (SDHE) 65.218	
					Customer Metering Inaccuracies (CMI) 534.042	
					Unauthorized Consumption (UC) 65.218	
Water Imported (WI) (corrected for known errors) 855.539				Real Losses 265.610	Leakage on Transmission and/or Distribution Mains Not broken down	
					Leakage and Overflows at Utility's Storage Tanks Not broken down	
					Leakage on Service Connections Not broken down	

American Water Works Association.
Copyright © 2020, All Rights Reserved.

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

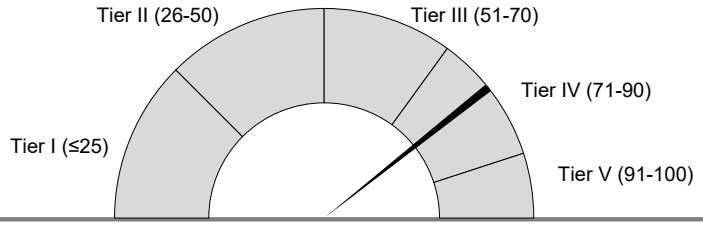
go to worksheet | go to grading | go to references

Water Audit Report for: City of Corona **Audit Year:** 2023 Fiscal Jul 01 2022 - Jun 30 2023

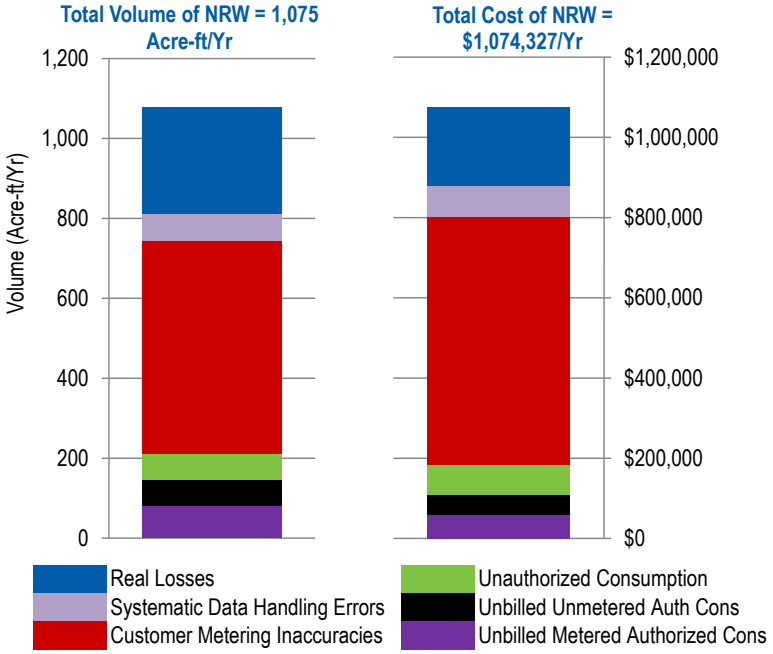
Data Validity

Data Validity Score: 78 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

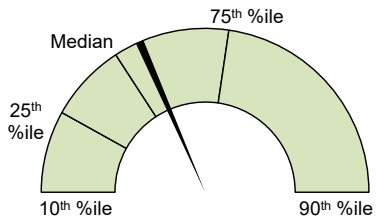


	Volume Acre-ft/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	664.5	$769,236	CRUC
Real Losses	265.6	$196,732	VPC
Unbilled Authorized Cons	146.3	$108,360	VPC
Non-Revenue Water	1,076.4	$1,074,327	Blended

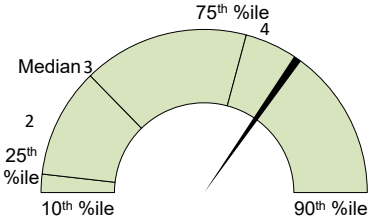
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

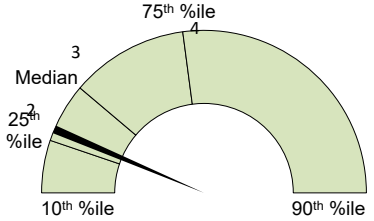
gauge %iles per validated industry ranges[2]



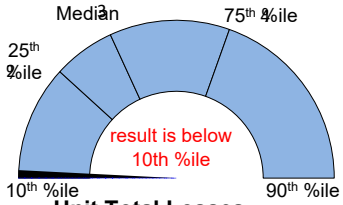
Total Loss Cost Rate
20.88 $/conn/year



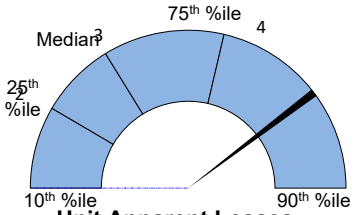
Apparent Loss Cost Rate
16.62 $/conn/year



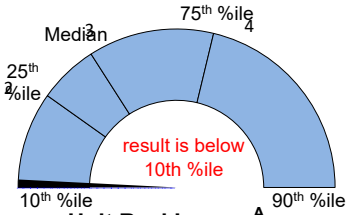
Real Loss Cost Rate
4.25 $/conn/year



Unit Total Losses
17.9 gal/conn/day

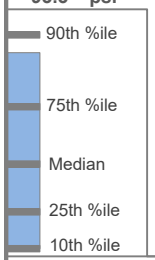


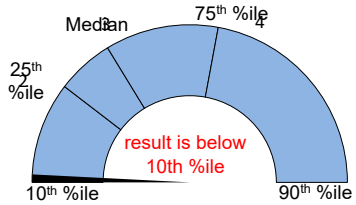
Unit Apparent Losses
12.8 gal/conn/day



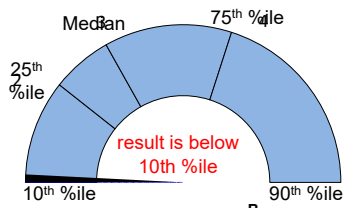
Unit Real Losses[A]
5.1 gal/conn/day

Average Operating Pressure
93.3 psi





Infrastructure Leakage Index (ILI)
0.2 dimensionless



Unit Real Losses[B]
292 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	1,185.0	Acre-ft/Yr	22.9	gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[5].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes					Uses and Limitations	Principal Users
			Assessment	Bench-Marking	Target-Setting	Planning	Tracking		
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software v6.0

FWAS v6.0

American Water Works Association Copyright © 2020, All Rights Reserved.

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format and is not meant to take the place of a full-scale, comprehensive water audit format. Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targeting loss reduction levels. This tool contains several separate worksheets. Sheets can be accessed using the tabs at the bottom of the screen, or by clicking the TOC links below.

Table of Contents (TOC)

Start Page	The current sheet. Enter contact information and basic audit details.
Worksheet	Enter the required data on this worksheet to calculate the water balance and data grading.
Interactive Data Grading	Answer questions about operational practices for each audit input, and the data validity grades will automatically populate.
Dashboard	Review NRW components, performance indicators and graphical outputs to evaluate the results of the audit.
Notes	Enter notes to explain how values were calculated, document data sources, and related information about data management practices.
Blank Sheet	By popular demand! A blank sheet. The world is your canvas.
Water Balance	The values entered in the Worksheet automatically populate the Water Balance.
Loss Control Planning	Use this sheet to interpret the results of the audit validity score and performance indicators.
Definitions	Use this sheet to understand the terms used in the audit process.
Service Connection Diagram	Diagrams depicting possible customer service connection line configurations.
Acknowledgements	Acknowledgements for development of the AWWA Free Water Audit Software v6.0.

AWWA Web Resources for Water Loss Control

https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control

Items referenced in the Free Water Audit Software v6.0 on the web:

- Data Grading Matrix v6.0
- Example Water Audit v6.0
- Water Audit Compiler v6.0
- AWWA Reports on Performance Indicators
- M36 Manual

Enter Basic Information

Name of Utility:	City of Corona
Name of Contact Person:	Stacy Joyce
Email:	stacy.joyce@coronaca.gov
Telephone | Ext.:	951-736-2265
City/Town/Municipality:	Corona
State / Province:	California (CA)
Country:	United States
Audit Preparation Date:	Dec 10 2024
Audit Year:	2024
Audit Year Label:	Fiscal (Fiscal, Calendar, etc)
Audit Period Start Date:	Jul 01 2023
Audit Period End Date:	Jun 30 2024
Volume Reporting Units:	Acre-feet
Water System Structure:	Retail
Water Type:	Potable Water
System ID Number:	CA3310037
Validator Name/ID:	Damian Martinez
Validator Email:	damianm600@gmail.com
Estimated Total Population Served by Water Utility:	169,245

Key of Input Acronyms

In order of appearance in the Worksheet

VOS	Volume from Own Sources
VOSEA	VOS Error Adjustment
WI	Water Imported
WIEA	WI Error Adjustment
WE	Water Exported
WEEA	WE Error Adjustment
BMAC	Billed Metered Authorized Consumption
BUAC	Billed Unmetered Authorized Consumption
UMAC	Unbilled Metered Authorized Consumption
UUAC	Unbilled Unmetered Authorized Consumption
SDHE	Systematic Data Handling Errors
CMI	Customer Metering Inaccuracies
UC	Unauthorized Consumption
Lm	Length of mains
Nc	Number of service connections
Lp	Average length of (private) customer service line
AOP	Average Operating Pressure
CRUC	Customer Retail Unit Charge
VPC	Variable Production Cost

Color Key User input | Calculated | Optional default

Guidance for the Worksheet

Choosing to enter unit of **percent** or **volume** (applies to VOSEA, WIEA, WEEA, CMI)

choose entry option:

1.00%	percent	*or*
	volume	25.000

Choosing to enter **default** or **custom input** (applies to UUAC, SDHE, UC)

choose entry option:

0.25%	default	*or*
	custom	75.000

Guidance for the Interactive Data Grading

Use acronym buttons in IDG header to navigate among inputs. Acronym Key above. White = needs answers, orange = complete, clear = not required. Example below.

VOS	VOSEA	WI	WIEA	WE	WEEA	BMAC	BUAC	UMAC	UUAC
SDHE	CMI	UC	Lm	Nc	Lp	AOP	CRUC	VPC	

After clicking an acronym button, answer all visible questions in the order they're presented, choosing best-fit answer

Grade will populate when all visible questions are complete for an input: **7**

The limiting criteria will be labeled along the right. If only 1 limiting criterion is shown, improving on that criterion will achieve a higher data grade. If multiple limiting criteria are shown, improving on *each* limiting criterion is necessary to achieve a higher data grade. A complete inventory of data grading criteria is available in the Data Grading Matrix v6.0 (see web resources)

Limiting

If you have questions or comments regarding this software please contact us at: wlc@awwa.org

AWWA Free Water Audit Software: Worksheet

FWAS v6.0

American Water Works Association.

Water Audit Report for: City of Corona

Audit Year: 2024 | Jul 01 2023 - Jun 30 2024 | Fiscal

Click 'n' to add notes

Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: ACRE-FEET PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	9	26,986.484	Acre-ft/Yr	n	g	10	0.00% percent	VOSEA
WI	Water Imported:	n	g	9	700.020	Acre-ft/Yr	n	g	9	0.00% percent	WIEA
WE	Water Exported:	n	g	9	349.439	Acre-ft/Yr	n	g	7	0.00% percent	WEEA
	WATER SUPPLIED:				27,337.065	Acre-ft/Yr					

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	8	26,049.000	Acre-ft/Yr		
BUAC	Billed Unmetered:	n	g	n/a	0.000	Acre-ft/Yr		
UMAC	Unbilled Metered:	n	g	10	82.096	Acre-ft/Yr		
UUAC	Unbilled Unmetered:	n	g	3	65.123	Acre-ft/Yr	0.25%	default

Default option selected for Unbilled Unmetered, with automatic data grading of 3

AUTHORIZED CONSUMPTION: 26,196.219 Acre-ft/Yr

WATER LOSSES

1,140.847 Acre-ft/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n	g	3	65.123	Acre-ft/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	3	533.288	Acre-ft/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	65.123	Acre-ft/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 663.533 Acre-ft/Yr

Real Losses

Real Losses: 477.314 Acre-ft/Yr

WATER LOSSES: 1,140.847 Acre-ft/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 1,288.065 Acre-ft/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	712.6	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	8	46,693		(active *and* inactive)
	Service connection density:				66	conn./mile main	

Are customer meters typically located at the curbstop/property line? Yes

Lp: n g 10

Average length of customer service line has been set to zero and a data grading of 10 has been applied

AOP: Average Operating Pressure: n g 9 96.8 psi

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$2.78	$/100 cubic feet (ccf)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	8	$901.89	$/acre-ft	$51,772,725	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Customer Metering Inaccuracies (CMI)

2: Billed Metered (BMAC)

3: Volume from Own Sources (VOS)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[^]:		gal/conn/day
Unit Real Losses[¤]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

AWWA Free Water Audit Software
Water Balance

FWAS v6.0

American Water Works Association.
Copyright © 2020, All Rights Reserved.

Water Audit Report for: City of Corona
Audit Year: 2024 Jul 01 2023 - Jun 30 2024
Data Validity Tier: Tier IV (71-90)



Volume from Own Sources (VOS)
(corrected for known errors)
26,986.484

Water Imported (WI)
(corrected for known errors)
700.020

System Input Volume
27,686.504

Water Exported (WE)
(corrected for known errors)
349.439

Water Supplied
27,337.065

Billed Water Exported

Authorized Consumption
26,196.219

Billed Authorized Consumption
26,049.000

Billed Metered Consumption (BMAC)
(water exported is removed)
26,049.000

Billed Unmetered Consumption (BUAC)
0.000

Unbilled Authorized Consumption
147.219

Unbilled Metered Consumption (UMAC)
82.096

Unbilled Unmetered Consumption (UUAC)
65.123

Water Losses
1,140.847

Apparent Losses
663.533

Systematic Data Handling Errors (SDHE)
65.123

Customer Metering Inaccuracies (CMI)
533.288

Unauthorized Consumption (UC)
65.123

Real Losses
477.314

Leakage on Transmission and/or Distribution Mains
Not broken down

Leakage and Overflows at Utility's Storage Tanks
Not broken down

Leakage on Service Connections
Not broken down

Revenue Water (Exported)
349.439

Revenue Water
26,049.000

Non-Revenue Water (NRW)
1,288.065

American Water Works Association.
Copyright © 2020, All Rights Reserved.

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

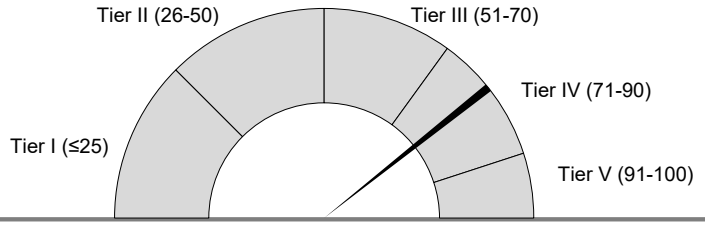
go to worksheet | go to grading | go to references

Water Audit Report for: City of Corona **Audit Year:** 2024 **Fiscal** Jul 01 2023 - Jun 30 2024

Data Validity

Data Validity Score: 78 **Data Validity Tier:** Tier IV (71-90)

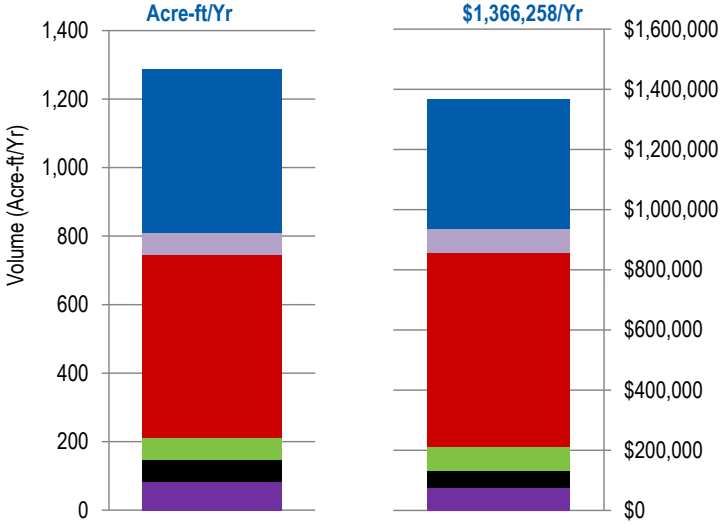
See Loss Control Planning for Tier Details



NRW Components Summary

Total Volume of NRW = 1,286 Acre-ft/Yr

Total Cost of NRW = $1,366,258/Yr



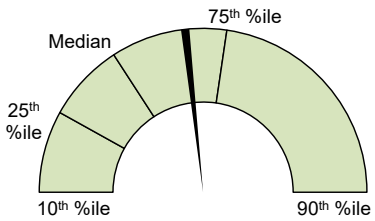
- Real Losses
- Systematic Data Handling Errors
- Customer Metering Inaccuracies
- Unauthorized Consumption
- Unbilled Unmetered Auth Cons
- Unbilled Metered Authorized Cons

	Volume Acre-ft/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	663.5	$802,999	CRUC
Real Losses	477.3	$430,485	VPC
Unbilled Authorized Cons	147.2	$132,775	VPC
Non-Revenue Water	1,288.1	$1,366,258	Blended

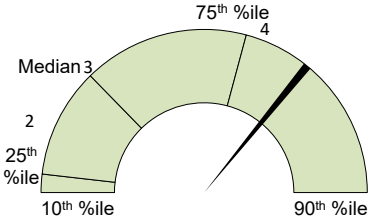
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

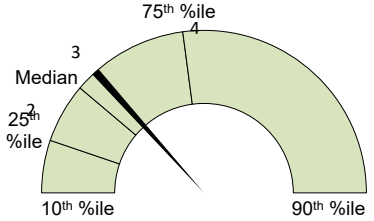
gauge %iles per validated industry ranges[2]



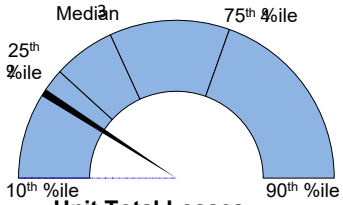
Total Loss Cost Rate
26.42 $/conn/year



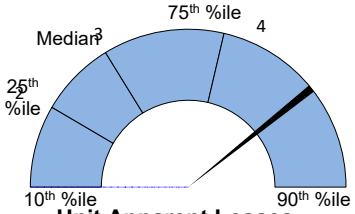
Apparent Loss Cost Rate
17.20 $/conn/year



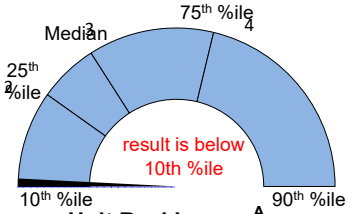
Real Loss Cost Rate
9.22 $/conn/year



Unit Total Losses
21.8 gal/conn/day

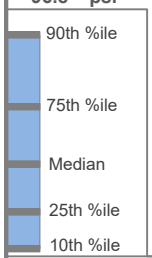


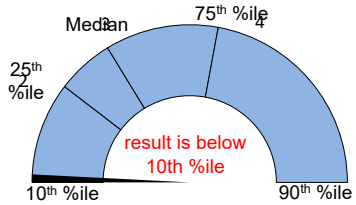
Unit Apparent Losses
12.7 gal/conn/day



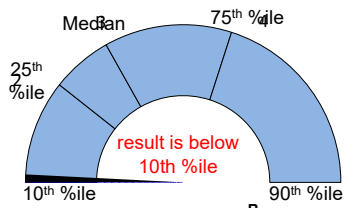
Unit Real Losses[A]
9.1 gal/conn/day

Average Operating Pressure
96.8 psi





Infrastructure Leakage Index (ILI)
0.4 dimensionless



Unit Real Losses[B]
598 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	1,177.5	Acre-ft/Yr	22.5	gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[5].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes					Uses and Limitations	Principal Users
			Assessment	Bench-Marking	Target-Setting	Planning	Tracking		
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software v6.0

FWAS v6.0

American Water Works Association Copyright © 2020, All Rights Reserved.

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format and is not meant to take the place of a full-scale, comprehensive water audit format. Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targeting loss reduction levels. This tool contains several separate worksheets. Sheets can be accessed using the tabs at the bottom of the screen, or by clicking the TOC links below.

Table of Contents (TOC)

Start Page	The current sheet. Enter contact information and basic audit details.
Worksheet	Enter the required data on this worksheet to calculate the water balance and data grading.
Interactive Data Grading	Answer questions about operational practices for each audit input, and the data validity grades will automatically populate.
Dashboard	Review NRW components, performance indicators and graphical outputs to evaluate the results of the audit.
Notes	Enter notes to explain how values were calculated, document data sources, and related information about data management practices.
Blank Sheet	By popular demand! A blank sheet. The world is your canvas.
Water Balance	The values entered in the Worksheet automatically populate the Water Balance.
Loss Control Planning	Use this sheet to interpret the results of the audit validity score and performance indicators.
Definitions	Use this sheet to understand the terms used in the audit process.
Service Connection Diagram	Diagrams depicting possible customer service connection line configurations.
Acknowledgements	Acknowledgements for development of the AWWA Free Water Audit Software v6.0.

AWWA Web Resources for Water Loss Control

https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control

Items referenced in the Free Water Audit Software v6.0 on the web:

- Data Grading Matrix v6.0
- Example Water Audit v6.0
- Water Audit Compiler v6.0
- AWWA Reports on Performance Indicators
- M36 Manual

Enter Basic Information

Name of Utility:	City of Corona
Name of Contact Person:	Stacy Joyce
Email:	stacy.joyce@coronaca.gov
Telephone | Ext.:	951-736-2265
City/Town/Municipality:	Corona
State / Province:	California (CA)
Country:	United States
Audit Preparation Date:	Nov 04 2025
Audit Year:	2025
Audit Year Label:	Fiscal (Fiscal, Calendar, etc)
Audit Period Start Date:	Jul 01 2024
Audit Period End Date:	Jun 30 2025
Volume Reporting Units:	Acre-feet
Water System Structure:	Retail
Water Type:	Potable Water
System ID Number:	CA3310037
Validator Name/ID:	Damian Martinez
Validator Email:	damianm600@gmail.com
Estimated Total Population Served by Water Utility:	169,245

Key of Input Acronyms

In order of appearance in the Worksheet

VOS	Volume from Own Sources
VOSEA	VOS Error Adjustment
WI	Water Imported
WIEA	WI Error Adjustment
WE	Water Exported
WEEA	WE Error Adjustment
BMAC	Billed Metered Authorized Consumption
BUAC	Billed Unmetered Authorized Consumption
UMAC	Unbilled Metered Authorized Consumption
UUAC	Unbilled Unmetered Authorized Consumption
SDHE	Systematic Data Handling Errors
CMI	Customer Metering Inaccuracies
UC	Unauthorized Consumption
Lm	Length of mains
Nc	Number of service connections
Lp	Average length of (private) customer service line
AOP	Average Operating Pressure
CRUC	Customer Retail Unit Charge
VPC	Variable Production Cost

Color Key User input | Calculated | Optional default

Guidance for the Worksheet

Choosing to enter unit of **percent** or **volume** (applies to VOSEA, WIEA, WEEA, CMI)

choose entry option:

1.00%	percent	*or*
	volume	25.000

Choosing to enter **default** or **custom input** (applies to UUAC, SDHE, UC)

choose entry option:

0.25%	default	*or*
	custom	75.000

Guidance for the Interactive Data Grading

Use acronym buttons in IDG header to navigate among inputs. Acronym Key above. White = needs answers, orange = complete, clear = not required. Example below.

VOS	VOSEA	WI	WIEA	WE	WEEA	BMAC	BUAC	UMAC	UUAC
SDHE	CMI	UC	Lm	Nc	Lp	AOP	CRUC	VPC	

After clicking an acronym button, answer all visible questions in the order they're presented, choosing best-fit answer

Grade will populate when all visible questions are complete for an input: **7**

The limiting criteria will be labeled along the right. If only 1 limiting criterion is shown, improving on that criterion will achieve a higher data grade. If multiple limiting criteria are shown, improving on *each* limiting criterion is necessary to achieve a higher data grade. A complete inventory of data grading criteria is available in the Data Grading Matrix v6.0 (see web resources)

Limiting

If you have questions or comments regarding this software please contact us at: wlc@awwa.org

AWWA Free Water Audit Software: Worksheet

FWAS v6.0

American Water Works Association.

Water Audit Report for: City of Corona

Audit Year: 2025 | Jul 01 2024 - Jun 30 2025 | Fiscal

Click 'n' to add notes

Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: ACRE-FEET PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	9	30,179.128	Acre-ft/Yr	n	g	10	0.00%	percent	VOSEA
WI	Water Imported:	n	g	9	565.543	Acre-ft/Yr	n	g	9	0.00%	percent	WIEA
WE	Water Exported:	n	g	9	365.045	Acre-ft/Yr	n	g	7	0.00%	percent	WEEA
	WATER SUPPLIED:				30,379.626	Acre-ft/Yr						

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	8	28,598.000	Acre-ft/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000	Acre-ft/Yr			
UMAC	Unbilled Metered:	n	g	10	87.141	Acre-ft/Yr			
UUAC	Unbilled Unmetered:	n	g	3	71.495	Acre-ft/Yr	0.25%	default	

Default option selected for Unbilled Unmetered, with automatic data grading of 3

AUTHORIZED CONSUMPTION: 28,756.636 Acre-ft/Yr

WATER LOSSES

1,622.990 Acre-ft/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n	g	3	71.495	Acre-ft/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	3	585.411	Acre-ft/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	71.495	Acre-ft/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 728.401 Acre-ft/Yr

Real Losses

Real Losses: 894.589 Acre-ft/Yr

WATER LOSSES: 1,622.990 Acre-ft/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 1,781.626 Acre-ft/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	715.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	8	46,569		(active *and* inactive)
	Service connection density:				65	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				Yes		
Lp		n	g	10			

Average length of customer service line has been set to zero and a data grading of 10 has been applied

AOP	Average Operating Pressure:	n	g	9	97.0	psi

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$3.00	$/100 cubic feet (ccf)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	8	$904.54	$/acre-ft	$56,242,713	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Customer Metering Inaccuracies (CMI)

2: Billed Metered (BMAC)

3: Volume from Own Sources (VOS)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[^]:		gal/conn/day
Unit Real Losses[^]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

AWWA Free Water Audit Software
Water Balance

FWAS v6.0

American Water Works Association.
Copyright © 2020, All Rights Reserved.

Water Audit Report for: City of Corona
Audit Year: 2025 Jul 01 2024 - Jun 30 2025
Data Validity Tier: Tier IV (71-90)

Volume from Own Sources (VOS) (corrected for known errors) 30,179.128	System Input Volume 30,744.671	Water Exported (WE) (corrected for known errors) 365.045	Billed Water Exported			Revenue Water (Exported) 365.045
		Water Supplied 30,379.626	Authorized Consumption 28,756.636	Billed Authorized Consumption 28,598.000	Billed Metered Consumption (BMAC) (water exported is removed) 28,598.000	Revenue Water 28,598.000
					Billed Unmetered Consumption (BUAC) 0.000	
				Unbilled Authorized Consumption 158.636	Unbilled Metered Consumption (UMAC) 87.141	Non-Revenue Water (NRW) 1,781.626
					Unbilled Unmetered Consumption (UUAC) 71.495	
			Water Losses 1,622.990	Apparent Losses 728.401	Systematic Data Handling Errors (SDHE) 71.495	
					Customer Metering Inaccuracies (CMI) 585.411	
					Unauthorized Consumption (UC) 71.495	
Water Imported (WI) (corrected for known errors) 565.543				Real Losses 894.589	Leakage on Transmission and/or Distribution Mains Not broken down	
					Leakage and Overflows at Utility's Storage Tanks Not broken down	
					Leakage on Service Connections Not broken down	

American Water Works Association.
Copyright © 2020, All Rights Reserved.

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

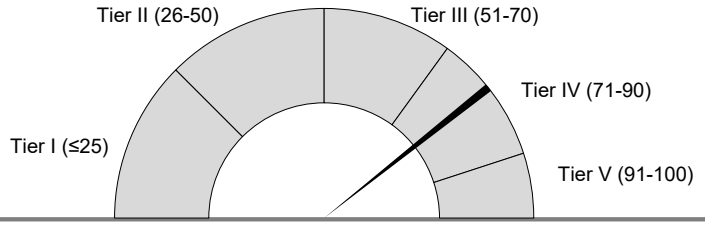
go to worksheet | go to grading | go to references

Water Audit Report for: City of Corona **Audit Year:** 2025 **Fiscal** Jul 01 2024 - Jun 30 2025

Data Validity

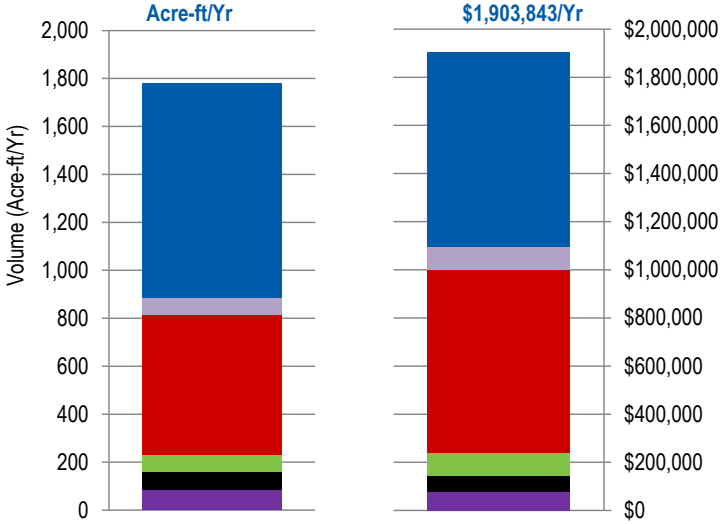
Data Validity Score: 78 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

Total Volume of NRW = 1,780 Acre-ft/Yr **Total Cost of NRW = $1,903,843/Yr**



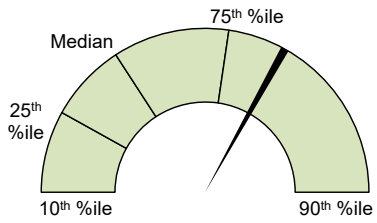
Real Losses
Systematic Data Handling Errors
Customer Metering Inaccuracies
Unauthorized Consumption
Unbilled Unmetered Auth Cons
Unbilled Metered Authorized Cons

	Volume Acre-ft/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	728.4	$951,159	CRUC
Real Losses	894.6	$809,191	VPC
Unbilled Authorized Cons	158.6	$143,493	VPC
Non-Revenue Water	1,781.6	$1,903,843	Blended

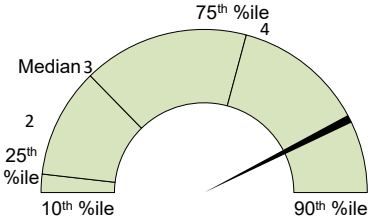
Key Performance Indicators

Actual KPI result — Target (see Worksheet)

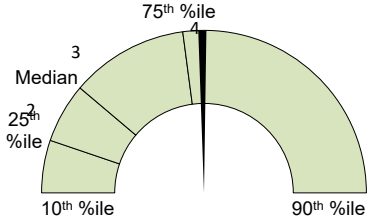
gauge %iles per validated industry ranges[2]



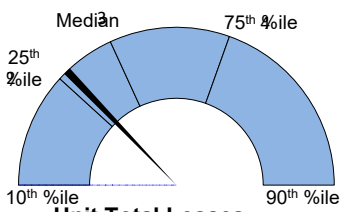
Total Loss Cost Rate
37.80 $/conn/year



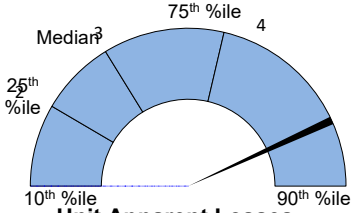
Apparent Loss Cost Rate
20.42 $/conn/year



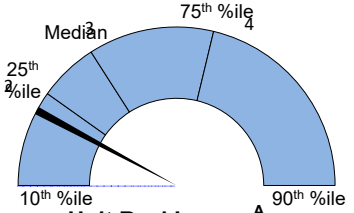
Real Loss Cost Rate
17.38 $/conn/year



Unit Total Losses
31.1 gal/conn/day

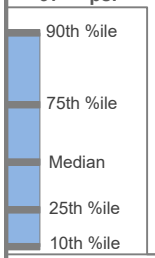


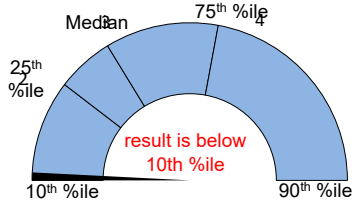
Unit Apparent Losses
14.0 gal/conn/day



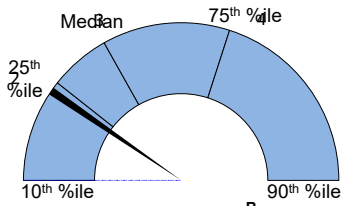
Unit Real Losses[A]
17.1 gal/conn/day

Average Operating Pressure
97 psi





Infrastructure Leakage Index (ILI)
0.8 dimensionless



Unit Real Losses[B]
1,117 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 1,179.3 Acre-ft/Yr 22.6 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4895 Guidance Manual, Appendix B (2019)[5].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes					Uses and Limitations	Principal Users
			Assessment	Bench-Marking	Target-Setting	Planning	Tracking		
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

Appendix G – SB X7 Standardized Tables

SB X7-7 Table 0: Units of Measure Used in 2020 UWMP* *(select one from the drop down list)*
Acre Feet
**The unit of measure must be consistent throughout the UWMP, as reported in Submittal Table 2-3.*
NOTES:

SB X7-7 Table 2: Method for 2020 Population Estimate	
Method Used to Determine 2020 Population (may check more than one)	
☐	**1. Department of Finance** (DOF) or **American Community Survey** (ACS)
☐	**2. Persons-per-Connection Method**
☑	**3. DWR Population Tool**
☐	**4. Other** DWR recommends pre-review
NOTES:	

SB X7-7 Table 3: 2020 Service Area Population	
2020 Compliance Year Population	
2020	170,100
NOTES:	

SB X7-7 Table 4: 2020 Gross Water Use							
Compliance Year 2020	**2020 Volume Into Distribution System** *This column will remain blank until SB X7-7 Table 4-A is completed.*	**2020 Deductions**					**2020 Gross Water Use**
		Exported Water *	**Change in Dist. System Storage*** (+/-)	**Indirect Recycled Water** *This column will remain blank until SB X7-7 Table 4-B is completed.*	**Water Delivered for Agricultural Use***	**Process Water** *This column will remain blank until SB X7-7 Table 4-D is completed.*	
	34,244	429		-		-	**33,815**
*** Units of measure (AF, MG , or CCF)** must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.							
NOTES:							

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s), Meter Error Adjustment

Complete one table for each source.

Name of Source	WMWD
This water source is *(check one)* **:**	
☐	The supplier's own water source
☑	A purchased or imported source

Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional (+/-)*	Corrected Volume Entering Distribution System
	18,005	-	18,005

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s) Meter Error Adjustment

Complete one table for each source.

Name of Source	Groundwater
This water source is *(check one)* **:**	
☑	The supplier's own water source
☐	A purchased or imported source

Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional (+/-)*	Corrected Volume Entering Distribution System
	16,239		16,239

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] ***Meter Error Adjustment -*** *See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES:

SB X7-7 Table 4-B: 2020 Indirect Recycled Water Use Deduction *(For use only by agencies that are deducting indirect recycled water)*

2020 Compliance Year	2020 Surface Reservoir Augmentation					2020 Groundwater Recharge			Total Deductible Volume of Indirect Recycled Water Entering the Distribution System
	Volume Discharged from Reservoir for Distribution System Delivery[1]	Percent Recycled Water	Recycled Water Delivered to Treatment Plant	Transmission/ Treatment Loss[1]	Recycled Volume Entering Distribution System from Surface Reservoir Augmentation	Recycled Water Pumped by Utility[1,2]	Transmission/ Treatment Losses[1]	Recycled Volume Entering Distribution System from Groundwater Recharge	
			-		-			-	-

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.*

[2] *Suppliers will provide supplemental sheets to document the calculation for their input into "Recycled Water Pumped by Utility". The volume reported in this cell must be less than total groundwater pumped - See Methodology 1, Step 8, section 2.c.*

NOTES: N/A

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C: 2020 Process Water Deduction Eligibility **(For use only by agencies that are deducting process water) Choose Only One**	
☐	**Criteria 1**- Industrial water use is equal to or greater than 12% of gross water use. Complete SB X7-7 Table 4-C.1
☐	**Criteria 2** - Industrial water use is equal to or greater than 15 GPCD. Complete SB X7-7 Table 4-C.2
☐	**Criteria 3** - Non-industrial use is equal to or less than 120 GPCD. Complete SB X7-7 Table 4-C.3
☐	**Criteria 4** - Disadvantaged Community. Complete SB x7-7 Table 4-C.4
NOTES: N/A	

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.1: 2020 Process Water Deduction Eligibility *(For use only by agencies that are deducting process water using Criteria 1)*

Criteria 1
Industrial water use is equal to or greater than 12% of gross water use

2020 Compliance Year	2020 Gross Water Use Without Process Water Deduction	2020 Industrial Water Use	Percent Industrial Water	**Eligible for Exclusion Y/N**
	33,815		0%	NO

NOTES: N/A

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.2: 2020 Process Water Deduction Eligibility *(For use only by agencies that are deducting process water using Criteria 2)*

Criteria 2
Industrial water use is equal to or greater than 15 GPCD

2020 Compliance Year	2020 Industrial Water Use	2020 Population	2020 Industrial GPCD	**Eligible for Exclusion Y/N**
		170,100	-	NO

NOTES: N/A

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.3: 2020 Process Water Deduction Eligibility *(For use only*
by agencies that are deducting process water using Criteria 3)

Criteria 3
Non-industrial use is equal to or less than 120 GPCD

2020 Compliance Year	2020 Gross Water Use Without Process Water Deduction *Fm SB X7-7 Table 4*	2020 Industrial Water Use	2020 Non-industrial Water Use	2020 Population *Fm SB X7-7 Table 3*	Non-Industrial GPCD	**Eligible for Exclusion Y/N**
	33,815		33,815	170,100	177	NO

NOTES:

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.4: 2020 Process Water Deduction Eligibility ***(For** use only by agencies that are deducting process water using Criteria 4)*

Criteria 4

Disadvantaged Community. A "Disadvantaged Community" (DAC) is a community with a median household income less than 80 percent of the statewide average.

SELECT ONE

"Disadvantaged Community" status was determined using one of the methods listed below:

1. IRWM DAC Mapping tool https://gis.water.ca.gov/app/dacs/

☐	If using the IRWM DAC Mapping Tool, include a screen shot from the tool showing that the service area is considered a DAC.

2. 2020 Median Income

	California Median Household Income*		Service Area Median Household Income	Percentage of Statewide Average	**Eligible for Exclusion? Y/N**
☑	**2020**	**$75,235**	$86,790	115%	NO

*California median household income 2015 -2019 as reported in US Census Bureau QuickFacts.

NOTES

Data from these tables will not be entered into WUEdata. Instead, the entire tables will be uploaded to WUEdata as a separate upload in Excel format.

This table(s) is only for Suppliers that deduct process water from their 2020 gross water use.

SB X7-7 Table 4-D: 2020 Process Water Deduction - Volume *Complete a separate table for each industrial customer with a process water exclusion*

Name of Industrial Customer	*Enter Name of Industrial Customer 1*				
Compliance Year 2020	Industrial Customer's Total Water Use *	Total Volume Provided by Supplier*	% of Water Provided by Supplier	Customer's Total Process Water Use*	Volume of Process Water Eligible for Exclusion for this Customer
					-

*** Units of measure (AF, MG , or CCF)** must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.

NOTES: N/A

SB X7-7 Table 5: 2020 Gallons Per Capita Per Day (GPCD)		
2020 Gross Water *Fm SB X7-7 Table 4*	**2020 Population** *Fm SB X7-7 Table 3*	**2020 GPCD**
33,815	170,100	**177**
NOTES:		

SB X7-7 Table 9: 2020 Compliance

Actual 2020 GPCD[1]	Optional Adjustments to 2020 GPCD				Adjusted 2020 GPCD [1] *(Adjusted if applicable)*	2020 Confirmed Target GPCD [1, 2]	**Did Supplier Achieve Targeted Reduction for 2020?**
	Enter "0" if Adjustment Not Used			TOTAL Adjustments[1]			
	Extraordinary Events[1]	Weather Normalization[1]	Economic Adjustment[1]				
177	-	-	-	-	177	213	**YES**

[1] *All values are reported in GPCD*

[2] ***2020 Confirmed Target GPCD*** *is taken from the Supplier's SB X7-7 Verification Form Table SB X7-7, 7-F.*

NOTES:

Appendix H – Energy Intensity Tables

Optional Submittal Table O-1A: Recommended Energy Reporting - SINGLE DELIVERY PRODUCT - WATER SUPPLY PROCESS APPROACH

Water Delivery Product drop down list (If delivering more than one type of product recommend using Table O-1C)	Retail Potable Deliveries	Only for Water Delivery Products Under the Urban Water Supplier's Operational Control							
Start Date of Reporting Period	1/1/2025	Water Management Process						Non-Consequential Hydropower (if applicable)	
End Date of Reporting Period	12/31/2025								
Is upstream embedded energy included in the values reported?	No								
		Units for Water Volume	Extract and Divert	Place into Storage	Conveyance	Treatment	Distribution	**Total Utility** See DWR NOTES	Hydropower	Net Utility
Volume of Water Entering Process		AF	5,475			16,254	29,589	29,589		29,589
Energy Consumed (kWh)		N/A	6,735,400			12,427,020	23,185,661	42,348,081		42,348,081
Energy Intensity (kWh/vol. converted to MG)		N/A	3,775	-	-	2,346	2,405	4,392	-	4,392

DWR NOTES: Total Utility: The volume of water entered in the "Total Utility" column should equal the volume of water entering the distribution system (excluding recycled water); in most cases, this is the total volume calculated in UWMP Table 4-1: 2025 Actual Total Uses for Potable and Non-Potable Water. Note if recycled water is included in your Submittal Table 4-1, you must exclude it from your volume in this table.

Quantity of Self-Generated Renewable Energy

0 kWh

Data Quality (Estimate, Metered Data, Combination of Estimates and Metered Data)

Metered Data

Data Quality Narrative:

All energy and water volume data are metered. Often, a single energy meter records all energy consumption at a site or facility, making it impossible to distinguish the energy consumed by individual processes when multiple processes are present at one site.

Narrative:

The following sources of potable supply have similar operational control: imported untreated surface water, imported treated surface water, groundwater, and groundwater with high TDS.
Delivery of imported untreated surface water from WMWD undergoes conveyance (source water pumped from wholesaler's transmission pipeline to the City's surface water treatment facilities), treatment (conventional surface water treatment, as well as energy consumed at the facilities for security, lighting, SCADA, and domestic uses at onsite buildings), and distribution (gravity flow to storage facilities where it is pumped as necessary to the various distribution system pressure zones).
Delivery of imported treated surface water from WMWD undergoes conveyance (pressure reduction) and distribution (pumped as necessary to various distribution system pressure zones).
Delivery of low TDS groundwater from the Temescal Basin undergoes extraction (pumped to nearby storage facilities or diverted to blending facilities) and distribution (pumped as necessary to various distribution system pressure zones).
Delivery of groundwater with high TDS from the Temescal Basin undergoes extraction (pumped to Temescal Desalter), treatment (reverse osmosis and blending), and distribution (pumped as necessary to various distribution system pressure zones).

NOTES:

Optional Submittal Table O-2: Recommended Energy Reporting - WASTEWATER AND RECYCLED WATER					
Start Date of Reporting Period	1/1/2025	Only for Water Delivery Products Under the Urban Water Supplier's Operational Control			
End Date of Reporting Period	12/31/2025				
Is upstream embedded energy in the values reported?		Water Management Process			
Units of Measure for Water	AF	Collection / Conveyance	Treatment	Discharge / Distribution	Total
Volume of Wastewater Entering Process (volume units selected above)		7,621	1,198	7,367	16186
Wastewater Energy Consumed (kWh)		628,743	13,804,533	0	14433276
Wastewater Energy Intensity (kWh/volume converted to MG)		253.2	35362.9	0.0	2736.6
Volume of Recycled Water Entering Process (volume units selected above)		4,554	0	3,910	8464
Recycled Water Energy Consumed (kWh)		3,512,937	0	0	3512937
Recycled Water Energy Intensity (kWh/volume converted to MG)		2367.3	0.0	0.0	1273.7

Quantity of Self-Generated Renewable Energy related to recycled water and wastewater operations

kWh

Data Quality (drop down)

Data Quality Narrative:

All energy and water volume data are metered. Natural gas is used at several facilities.

Narrative:

Energy use for reclaimed water consists of conveyance and distribution. For purposes of this table, these processes have been aggregated. Energy use for wastewater consists of collection, primary/secondary/tertiary treatment, dewatering/drying of biomass, and diversion/disposal of effluent. For purposes of this table, these processes have also been aggregated.

NOTES:

Appendix I – DWR Bulletin 118

Upper Santa Ana Valley Groundwater Basin, Temescal Subbasin

- Groundwater Basin Number: 8-2.09
- County: Riverside
- Surface Area: 23,500 acres (37 square miles)

Basin Boundaries and Hydrology

The Temescal Subbasin underlies the southwest part of upper Santa Ana Valley. On the north, the subbasin is bounded by the Chino Subbasin, marked by the Santa Ana River and a set of low hills of crystalline rock near Norco. The eastern part of the subbasin is bounded by nonwater-bearing crystalline rocks of the El Sobrante de San Jacinto and La Sierra Hills. The subbasin is bounded on the west by the Santa Ana Mountains and the south by the Elsinore Groundwater Basin at a constriction in the alluvium of Temescal Wash. Average annual precipitation ranges from 14 to 16 inches per year.

Hydrogeologic Information

Water Bearing Formations

The water-bearing materials are dominantly composed of Holocene age alluvium deposited by streams draining the northeast slopes of the Santa Ana Mountains. The Santa Ana River has from time to time contributed deposits through the Arlington Gap along the northern margin of the subbasin (DWR 1934).

The specific yield varies from about 6 percent along the southwestern and southern margins of the subbasin to about 13 percent beneath the Santa Ana River and more than 14 percent beneath Temescal Wash near Corona (DWR 1934).

Restrictive Structures

The Elsinore fault zone lies along the western boundary of the subbasin, and the Chino fault zone crosses the northwestern tip of the subbasin. These fault zones are possible groundwater barriers (SBVWCD 2000).

Recharge Areas

Dominant recharge to the groundwater reservoir is from percolation of precipitation on the valley floor and infiltration of stream flow within tributaries exiting the surrounding mountains and hills.

Groundwater Level Trends

Groundwater flows toward the center of the subbasin and then northeast toward the Santa Ana River (SBVWCD 2000).

Groundwater Storage

Groundwater Storage Capacity. Unknown.

Groundwater in Storage. Unknown.

Groundwater Budget (Type C)

No information is available.

Groundwater Quality

Characterization. Water within the subbasin is predominantly calcium-sodium bicarbonate and has an average TDS content of 790 mg/L (SBVWCD 2000). Water from 20 public supply wells in the subbasin has an average TDS content of 753 mg/L and a range or 373 to 950 mg/L.

Impairments.

Water Quality in Public Supply Wells

Constituent Group[1]	Number of wells sampled[2]	Number of wells with a concentration above an MCL[3]
Inorganics – Primary	20	2
Radiological	17	1
Nitrates	20	13
Pesticides	17	0
VOCs and SVOCs	17	0
Inorganics – Secondary	20	2

[1] A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in *California's Groundwater – Bulletin 118* by DWR (2003).
[2] Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.
[3] Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

Well Characteristics

	Well yields (gal/min)	
Municipal/Irrigation	Range:	Average:
	Total depths (ft)	
Domestic	Range:	Average:
Municipal/Irrigation	Range:	Average:

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
USGS	Groundwater levels	2
USGS	Miscellaneous water quality	2
Department of Health Services and cooperators	Title 22 water quality	20

Basin Management

Groundwater management:	The City of Corona is developing a groundwater management plan for the Temescal Basin.
Water agencies	
Public	
Private	

References Cited

California Department of Water Resources (DWR). 1934. South Coastal Basin Investigation.

San Bernardino Valley Water Conservation District (SBVWCD). 2000. *Engineering Investigation of the Bunker Hill Basin 1999-2000.*

Additional References

Wildermuth Environmental, Inc. (Wildermuth). 2000. *TIN/TDS Study - Phase 2A of the Santa Ana Watershed; Final Technical Memorandum*. San Clemente, California, July 2000.

Errata

Updated groundwater management information and added hotlinks to applicable websites. (1/20/06)

8-004.02 ELSINORE - BEDFORD-COLDWATER

Basin Boundaries

Summary

The Bedford-Coldwater groundwater subbasin is located in western Riverside County. The basin is separated from the Temescal subbasin to the northwest by a groundwater divide near Bedford Wash. The Bedford-Coldwater subbasin is bound on the east and west by consolidated rocks of Estelle Mountain and the Santa Ana Mountains, respectively. The southern boundary adjoins the Elsinore Valley subbasin and follows a jurisdictional boundary separating the two subbasins. The boundary is defined by 19 segments detailed in the descriptions below.

Segment Descriptions

Segment Label	Segment Type	Description	Ref
1-2	E Alluvial	Begins from point (1) and follows the contact of Quaternary alluvium with Cretaceous metamorphic rocks of the Santa Ana Mountains to point (2).	{a}
2-3	I Groundwater Divide	Continues from point (2) and follows a groundwater divide to point (3).	{b}
3-4	E Alluvial	Continues from point (3) and generally follows the contact of Quaternary alluvium with early Pleistocene alluvial fan deposits, Paleocene Silverado Formation, Cretaceous volcanic rocks, various Cretaceous plutonic rocks, and Triassic metasedimentary and metavolcanic rocks to point (4).	{c}
4-5	I Management Area	Continues from point (4) and follows the jurisdictional boundary separating the Temescal Valley Water District from the Elsinore Valley Municipal Water District to point (5).	{d}
5-6	E Alluvial	Continues from point (5) and follows the contact of Quaternary alluvium with Cretaceous Estelle Mountain volcanics to point (6).	{c}
6-7	I Management Area	Continues from point (6) and follows the jurisdictional boundary separating the Temescal Valley Water District from the Elsinore Valley Municipal Water District to point (7).	{d}
7-1	E Alluvial	Continues from point (7) and follows the contact of Quaternary alluvium with Jurassic Bedford Canyon Formation and various Cretaceous plutonic rocks of the Santa Ana Mountains and ends at point (1).	{c}
8-8	E Alluvial	Island within the basin boundary: begins from point (8) and follows the contact of Quaternary alluvium or artificial fill with Paleocene Silverado Formation, Cretaceous plutonic rocks, and Triassic metasedimentary and metavolcanic rocks to point (8).	{c}
9-9	E Alluvial	Island within the basin boundary: begins from point (9) and follows the contact of Quaternary alluvium with Tertiary Topanga group of marine sediments and Tertiary Vaqueros, Sespe, and Silverado Formations to point (9).	{c}
10-10	E Alluvial	Island within the basin boundary: begins from point (10) and follows the	{c}

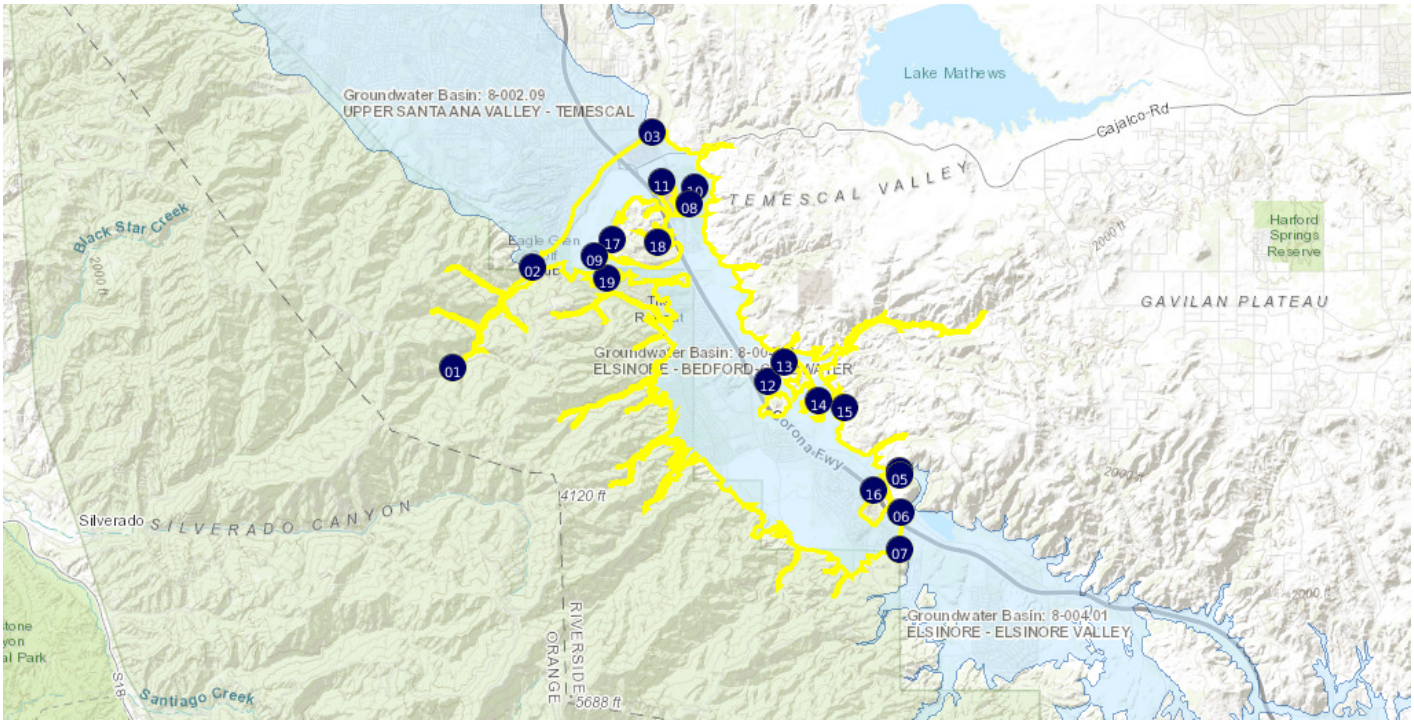
		contact of Pleistocene alluvium with Paleocene Silverado Formation to point (10).	
11-11	E Alluvial	Island within the basin boundary: begins from point (11) and follows the contact of Quaternary alluvium or artificial fill with Paleocene Silverado Formation to point (11).	{c}
12-12	E Alluvial	Island within the basin boundary: begins from point (12) and follows the contact of Quaternary alluvium with Paleocene Silverado Formation to point (12).	{c}
13-13	E Alluvial	Island within the basin boundary: begins from point (13) and follows the contact of Quaternary alluvium with Paleocene Silverado Formation and Triassic metasedimentary and metavolcanic rocks to point (13).	{a}
14-14	E Alluvial	Island within the basin boundary: begins from point (14) and follows the contact of Quaternary alluvium with Cretaceous Estelle Mountain volcanic rocks and Triassic metasedimentary and metavolcanic rocks to point (14).	{c}
15-15	E Alluvial	Island within the basin boundary: begins from point (15) and follows the contact of Quaternary alluvium with Cretaceous Estelle Mountain volcanic rocks and Triassic metasedimentary and metavolcanic rocks to point (15).	{c}
16-16	E Alluvial	Island within the basin boundary: begins from point (16) and follows the contact of Quaternary alluvium with Tertiary Topanga group of marine sediments and Tertiary Vaqueros and Sespe Formations to point (16).	{c}
17-17	E Alluvial	Island within the basin boundary: begins from point (17) and follows the contact of Quaternary alluvium with Paleocene Silverado Formation to point (17).	{c}
18-18	E Alluvial	Island within the basin boundary: begins from point (18) and follows the contact of Quaternary alluvium with Paleocene Silverado Formation to point (18).	{c}
19-19	E Alluvial	Island within the basin boundary: begins from point (19) and follows the contact of Quaternary alluvium or landslide deposits with Tertiary Vaqueros and Sespe Formations to point (19).	{c}

Significant Coordinates

Point	Latitude	Longitude
1	33.779617348	-117.56234861
2	33.800555285	-117.542432974
3	33.828576167	-117.512654588
4	33.758400757	-117.450700384
5	33.757619077	-117.450701841
6	33.749834798	-117.450456486
7	33.742171922	-117.45081152
8	33.813657348	-117.503401425
9	33.80298986	-117.527206161
10	33.817083315	-117.502061053
11	33.818382037	-117.510322081
12	33.776853859	-117.483852061
13	33.780899405	-117.479699934
14	33.773035679	-117.471238502
15	33.771565887	-117.464605454
16	33.754488258	-117.457271385
17	33.806376258	-117.522498483
18	33.805755342	-117.511387199
19	33.798413174	-117.523900357

Map

8-004.02 ELSINORE - BEDFORD-COLDWATER



https://sgma.water.ca.gov/webgis/?appid=160718113212&subbasinid=8-004.02

References

Ref	Citation	Pub Date	Global ID
{a}	United States Geological Survey (USGS), Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, 1:100,000, D.M. Morton and F.K. Miller.URL: http://pubs.usgs.gov/of/2006/1217/	2006	69
{b}	BBMRS	varies	45
{c}	California Geological Survey (CGS), Geologic Compilation of Quaternary Surficial Deposits in Southern California, T.L. Bedrossian, P. Roffers, C.A. Hayhurst, J.T. Lancaster, and W.R. Short.URL: http://www.conservation.ca.gov/cgs/fwgp/Pages/sr217.aspx	2012	50
{d}	California Department of Water Resources (DWR), Water Agencies Dataset.URL: https://gis.water.ca.gov/app/bbat/	2016	48

Footnotes

- I: Internal
- E: External

Appendix J – Corona 2008 Groundwater Management Plan



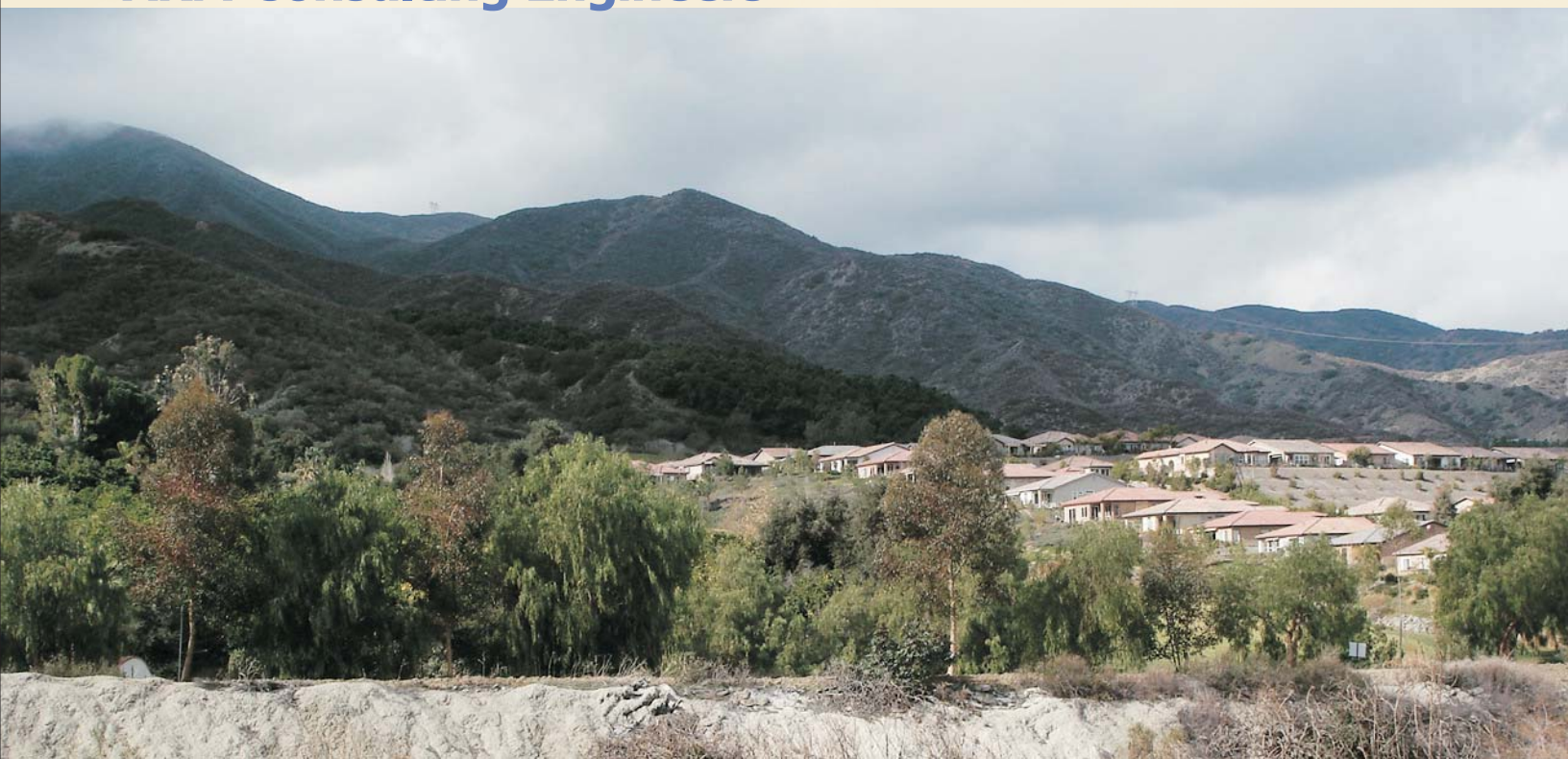
AB3030

Groundwater Management Plan

Prepared for
City of Corona

June 2008

Todd Engineers
AKM Consulting Engineers



Final

AB3030 Groundwater Management Plan

Prepared for:

City of Corona

Department of Water and Power

755 Corporation Yard Way

Corona, CA 92880

Prepared by:

Todd Engineers

2490 Mariner Square Loop, Suite 215

Alameda, CA 94501-1080

AKM Consulting Engineers

553 Wald

Irvine, CA 92618

June 2008

Table of Contents

1. Introduction 1

1.1. GWMP Plan Goals and Objectives 1

1.2. Scope of Work 1

1.3. GWMP Organization and Preparation 2

1.4. Public Outreach 3

1.4.1. Notice of Intent to Prepare an AB3030 GWMP 3

1.4.2. Neighboring Agencies and Service Areas 3

1.4.3. Public Meetings 4

1.4.4. Meetings with Neighboring Agencies 4

1.5. Environmental Review 4

2. Data Compilation and Management 5

2.1. Study Area 5

2.1.1. Subbasin Boundaries 6

2.1.2. Contributing Watersheds 7

2.2. Study Period 7

2.3. Data Types and Sources 8

2.4. Hydrologic Data 9

2.4.1. Climate Data 9

2.4.2. Streamflow 10

2.4.3. Reservoir Storage 10

2.5. Water System Data 10

2.5.1. Pumping Data 10

2.5.2. Imported Water Data 11

2.5.3. Water Demand 11

2.5.4. Wastewater Treatment Plant (WWTP) Data 11

2.6. Groundwater Data 12

2.6.1. Basin and Watershed Boundaries 12
2.6.2. Well Data 13
2.6.3. Water Level Data 14
2.6.4. Water Quality Data 14
2.6.5. Regulated Facilities 14
2.6.6. Land Use Data 15
2.7. Geologic Data 16
2.7.1. Geology Maps 16
2.7.2. Lithologic Data 16
2.7.3. Soils Data 16
2.8. GIS Files and Layers 16
2.9. Data Management System (DMS) 16
3. State of the Groundwater Basins 19
3.1. Land Use 19
3.2. Physical Setting 20
3.2.1. Topography 20
3.2.2. Precipitation and Evapotranspiration (ET) 21
3.2.3. Streamflow 21
3.2.4. Geology 23
3.3. Aquifers and Hydrostratigraphy 24
3.3.1. Channel Aquifer 25
3.3.2. Alluvial Fan Aquifers 26
3.3.3. Sandstone Aquifer 27
3.4. Water Supply 27
3.4.1. Pumping 27
3.4.2. Imported Water 30
3.4.3. Wastewater 31
3.5. Groundwater 32
3.5.1. Water Levels 32

3.5.2. Groundwater Flow Directions 34
3.5.3. Groundwater Quality 36
3.6. Water Balance 40
3.6.1. Approach 41
3.6.2. Temescal Subbasin Water Balance 42
3.6.3. Coldwater Subbasin Water Balance 54
3.6.4. Water Balance Discussion 59
4. City of Corona Water Demand and Supply 61
4.1. Current and Future Demand 61
4.2. Water Conservation and Demand Management 63
4.3. Supply 64
4.3.1. Groundwater Basins 66
4.3.2. Imported Water 67
4.3.3. Recycled Water 69
5. Basin Management Objectives 70
5.1. Manage Groundwater Basin in a Sustainable Manner 70
5.2. Prevent Substantial Water Level Declines in Channel Aquifer 70
5.3. Protect Groundwater Quality in Unconfined Aquifers 71
5.4. Maintain Required Outflow at Prado Dam 71
5.5. Monitor Groundwater Levels, Quality, and Storage 71
6. Basin Management Strategies 72
6.1. Identification of Management Strategies 72
6.1.1. New and Replacement Water Supply Wells and Wellhead Treatment 73
6.1.2. Groundwater Treatment Process Improvements 75
6.1.3. Groundwater Monitoring Program 75
6.1.4. Enhanced Groundwater Recharge 76
6.1.5. Expanded Use of Recycled Water 78
6.1.6. Use of Imported Water 80

6.1.7. Wastewater Pond Maintenance 81
6.1.8. Coordination with Regulatory Agencies 81
6.1.9. Water Conservation and Demand Management 82
6.2. Evaluation of Management Strategies using AB3030 Checklist 83
6.2.1. Control of Saline Water Intrusion 83
6.2.2. Identification and Management of Wellhead Protection and Recharge Areas 83
6.2.3. Regulation of the Migration of Contaminated Groundwater 84
6.2.4. Administration of a Well Abandonment and Well Destruction Program. 84
6.2.5. Mitigation of Overdraft Conditions 84
6.2.6. Replenishment of Groundwater Extracted by Water Producers 85
6.2.7. Monitoring of Groundwater Levels and Storage 85
6.2.8. Facilitating Conjunctive Use Operations 85
6.2.9. Identification of Well Construction Policies 85
6.2.10. Construction and Operation of Groundwater Contamination Cleanup, Recharge, Storage, Conservation, Water Recycling, and Extraction Projects 86
6.2.11. Development of Relationships with State and Federal Regulatory Agencies 86
6.2.12. Review of Land Use Plans and Coordination with Land Use Planning Agencies to Assess Activities which Create a Reasonable Risk of Groundwater Contamination 86
6.3. Evaluation of Management Strategies 86
6.3.1. Baseline Evaluation 87
6.3.2. Scenario 1 - Pumping Redistribution 88
6.3.3. Scenarios 2 and 3 - Enhanced Recharge at Detention Basins 89
6.3.4. Scenarios 4a and 4b - Upgradient Injection Wells in Channel Aquifer 92
6.3.5. Recycled Water Recharge 94
6.4. Recommended Management Strategies 95
7. Implementation Plan 96

7.1. Prioritization of Strategies 96
7.2. Implementation Plan and Schedule 96
7.3. Annual Re-evaluation of Management Performance 98
8. References 99

List of Tables

		Page No.
2-1	Groundwater Basins and Watersheds	6
2-2	Data Tables in the Data Management System (DMS)	17
3-1	Major Groundwater Users Data Review Period 1947-2004	29
3-2	Groundwater Areas for Water Quality Assessment	36
3-3	Total Dissolved Solids in Groundwater	38
3-4	TCE Detections in City Well Samples Data Review Period 1999-2002	40
3-5	Water Balance Summary for Temescal Subbasin	43
3-6	Water Balance Summary for Coldwater Subbasin	55
4-1	City Current and Future Demand (AFY)	63
4-2	City Water Production and Purchases (AFY)	65
4-3	Imported Water Service Connections	68
6-1	List of Management Strategies	73
6-2	Baseline Evaluation Water Balance (AFY)	87
6-3	Scenario 1 Pumping Redistribution Water Balance (AFY)	89
6-4	Scenario 2 Recharge at Oak Avenue Basin Water Balance (AFY)	91
6-5	Scenario 3 Recharge at Main Street Basin Water Balance (AFY)	91
6-6	Scenario 4a Recharge near Arlington Gap (4 wells) Water Balance (AFY)	93
6-7	Scenario 4b Recharge near Arlington Gap (7 wells) Water Balance (AFY)	93
7-1	Implementation Plan and Schedule	97

List of Figures (following text)

1. DWR Groundwater Basins
2. Regional Setting
3. Study Area
4. Water Agencies
5. Precipitation and Cumulative Departure Curve
6. Average Annual Rainfall

7. Stream Gage Locations
8. Land Use 1984 and 2004
9. Geologic Map
10. Basin Geometry - Depth to Bedrock
11. Cross Section Location Map
12. Cross Section A-A'
13. Cross Section B-B'
14. Cross Section C-C'
15. Cross Sections D-D' and E-E'
16. Distribution of Hydraulic Conductivity for Subbasin Aquifers
17. Study Area Groundwater Pumping
18. Production Wells 1947-2004
19. City of Corona Water Supply
20. Pumping in Temescal and Coldwater Subbasins
21. Wastewater Discharge to Ponds
22. Location of Key Hydrographs
23. Temescal Subbasin Hydrograph
24. Coldwater Subbasin Hydrograph
25. Bedford Canyon Hydrograph
26. Water Levels Spring 1964
27. Water Levels Spring 1984
28. Water Quality Analysis and Coldwater Subbasin Water Chemistry
29. Variability of Water Chemistry Among Aquifers – Temescal Subbasin
30. Distribution of Total Dissolved Solids Concentrations in Groundwater
31. Distribution of Nitrate Concentrations in Groundwater
32. Regulated Facilities and Underground Storage Tanks (UST)
33. Water Balance Units
34. Water Balance Elements
35. Soil Categories for Water Balance

36. Groundwater Pumping by Water Use

37. Potential Groundwater Management Strategies

List of Appendices

A. Public Notice and Outreach

B. Monitoring Program and Protocols

C. Model Development

D. Feasibility Study, Recycled Water Recharge, Bedford Subbasin, prepared for Lee Lake Water District, May 2008

1. Introduction

The City of Corona relies on three groundwater subbasins within their water service area for a portion of their water supply. In order to more actively manage this limited resource, the City and its technical consultants have prepared this Groundwater Management Plan (GWMP). The plan follows guidelines set forth in Assembly Bill (AB) 3030, which was promulgated in 1992 and allows local agencies to prepare and adopt GWMPs (California Water Code Sections 10750 through 10756). The bill was amended in 2002 by Senate Bill (SB) 1938, providing additional GWMP requirements. Such a plan allows the City to address issues of groundwater recharge and storage, critical components for effective management of the local subbasins and the City's water supply. This GWMP will be considered by the City for adoption on June 18, 2008 in accordance with AB3030 timelines (the press release for the public hearing is included in Appendix A).

1.1. GWMP Plan Goals and Objectives

The Goals of the GWMP include:

- Operate the groundwater basin in a sustainable manner for beneficial uses
- Increase the reliability of water supply for basin users

To support these goals, the City has determined the need to better understand the hydrogeology and groundwater conditions of the underlying basins and, based on this understanding, develop appropriate management objectives and strategies to achieve these goals.

The Plan area covers three groundwater subbasins within the City's water service area and sphere of influence. The City has conducted groundwater production and management activities in these subbasins for more than 40 years. These three subbasins, Temescal, Coldwater, and Bedford, are located in western Riverside County in the Santa Ana River Watershed as shown on Figures 1 and 2 (all figures are at the end of the text in this document).

1.2. Scope of Work

The City, along with input from Todd Engineers and AKM Consulting Engineers, developed a scope of work for the preparation of the GWMP including a series of nine tasks as listed below:

- Provide Public Outreach
- Identify Study Area and Compile Data
- Develop Data Management System

- Assess the State of the Basins
- Construct a Groundwater Model
- Develop Groundwater Basin Management Objectives (BMOs)
- Develop Groundwater Management Strategies
- Evaluate Management Alternatives
- Prepare a GWMP

The City took the lead on the public outreach process, described in more detail in the following section. The Study Area is defined as the groundwater subbasins underlying the City's water service area and covers approximately 30,000 acres (47 square miles) (Figure 3). To support the development of an AB3030 GWMP, relevant hydrologic and hydrogeologic data for the Study Area, as well as the contributing watersheds, were compiled and analyzed. The analysis provides for an historical assessment of available data as well as more detailed analysis over a 15-year Study Period.

Collectively, these analyses are used to describe the "state of the basins" with respect to groundwater use, water levels, quality, and storage. Based on this assessment, basin management objectives and management strategies to achieve those objectives were developed. The management strategies were further evaluated by the development, calibration, and application of a numerical groundwater flow model. The GWMP also includes a schedule for implementation of the management strategies.

1.3. GWMP Organization and Preparation

The organization of this GWMP generally follows the tasks described above. Tables are incorporated into the text and numbered within each chapter of the document. All figures are provided at the end of the text in a separate section to allow referencing throughout the text and to prevent duplication of figures. This introductory chapter provides the background and context for the GWMP. Chapter 2 describes the data compilation process for the analyses conducted. Chapter 3 describes the hydrogeologic assessment of the state of the groundwater basins. A brief description of the City's current and projected water demand, along with water sources, is included in Chapter 4 to provide context for the City's future reliance on groundwater as one of the sources of water supply. Basin Management Objectives and strategies to meet those objectives are provided in Chapters 5 and 6, respectively. Chapter 7 provides an implementation schedule for the GWMP. References are summarized in Chapter 8. Appendix A contains documentation of the stakeholder process. Appendix B summarizes the City's current monitoring program and makes recommendations for future improvement. Appendix C describes the development of a numerical groundwater model to assist with the evaluation of key management strategies. Appendix D contains a feasibility study for recycled water recharge in the Bedford

Subbasin conducted separately for Lee Lake Water District (LLWD) and included as part of this GWMP.

The development of the GWMP was a collective effort by the City and its technical consultants. The City provided key data and led the public outreach program. Todd Engineers led the data compilation and hydrogeologic assessment of the groundwater subbasins. Todd Engineers also constructed, calibrated, and applied a numerical groundwater model of the Temescal Subbasin for the analysis of selected groundwater management strategies. AKM assisted with details on the City's water supply and wastewater systems, future water demand, and the identification of key management strategies.

1.4. Public Outreach

In order to encourage public participation and keep local agencies informed, the City conducted a public outreach program associated with the GWMP. The City developed a stakeholder list to specifically invite interested parties to public meetings and inform them on plan preparation. Public notices, a Stakeholder List, and an adopted resolution to prepare the GWMP are provided in Appendix A. Public outreach activities are summarized in the following sections.

1.4.1. Notice of Intent to Prepare an AB3030 GWMP

On June 6, 2006, the City notified the public that a public meeting was scheduled to consider whether the City should prepare a GWMP. In the public notice, provided in Appendix A, the City invited all landowners and interested parties to attend the hearing and express their interest in the GWMP process. The City also made available advance copies of the resolution that was being considered. The notice described how interested parties could participate in the GWMP development by either attending the hearing or submitting a written request to the City.

At the public hearing on June 21, 2006, the City invited the public to comment on the GWMP process and pending resolution. No comments were made, and the Resolution of Intent to Prepare a Groundwater Management Plan was adopted. A copy of the signed resolution is provided in Appendix A.

1.4.2. Neighboring Agencies and Service Areas

Figure 4 shows the service areas of agencies in the region that provide water supply to the area. The City shares the three groundwater subbasins with the City of Norco, Home Gardens County Water District, Lee Lake Water District (LLWD), and Elsinore Valley Municipal Water District (EVMWD). LLWD is participating in the GWMP and is proposing a groundwater recharge project with recycled water in the Bedford Subbasin. This project is included as a groundwater management strategy in this GWMP and is evaluated separately in Appendix D.

1.4.3. Public Meetings

In addition to the public hearings held in accordance with the GWMP process, two public workshops were conducted on December 11, 2007 and May 20, 2008. At the December workshop, the assessment of the groundwater basin was presented along with preliminary basin management objectives (BMOs) and potential management strategies to achieve those objectives. Representatives from LLWD, Western Municipal Water District (WMWD), Orange County Water District (OCWD), EVMWD, Chandler's Sand and Gravel, Riverside County Waste Management Department (RCWMD), and other parties attended the workshop. GWMP information and a copy of the technical presentation were posted on the City's website prior to the meeting.

In the May workshop, the Draft GWMP was reviewed including the final BMOs, evaluation of the management strategies, and the implementation schedule. Representatives of WMWD, EVMWD, Santa Ana Watershed Protection Agency (SAWPA), Chandler's Sand and Gravel, Riverside County Flood Control and Water Conservation District (RFCWCD) and Inland Empire Waterkeeper attended the workshop. The Draft GWMP was posted on the City's website prior to the meeting. Written comments on the Draft GWMP were provided by WMWD, RFCWCD, RCWMD, and Inland Empire Waterkeeper. Those comments have been incorporated into this GWMP, or in some cases, marked for further review during the EIR process.

1.4.4. Meetings with Neighboring Agencies

Two informal meetings were also held with neighboring agencies on the GWMP process. On January 22, 2008, City consultants provided an update of the GWMP development to the Lee Lake Water District (LLWD) Board of Directors at their request. The City and consultants also met with consultants of the Chino Basin Watermaster at their request on March 18, 2008 to discuss the GWMP progress and mutual interests with respect to data sharing and groundwater modeling.

1.5. Environmental Review

In compliance with the California Environmental Quality Act, the City has embarked on an environmental review of the GWMP. The process will evaluate the strategies included in the adopted GWMP in a Programmatic Environmental Impact Report (PEIR). The City has already retained the services of Environmental Science Associates (ESA) to prepare the PEIR, which will commence after the GWMP has been adopted. Preparation of the PEIR will involve public notification and hearings on potential environmental impacts of the GWMP. The City may decide to update or modify components of the GWMP in the future based on the environmental review process.

2. Data Compilation and Management

To support the development of an AB3030 GWMP for the City, relevant hydrologic and hydrogeologic data for the groundwater basins and contributing watersheds have been compiled. A Study Area and Study Period were defined early in the process to guide the data collection effort. The data collection process occurred mainly in 2006 and resulted in relatively complete data sets through 2004. In addition, data collected since 2006 are incorporated as noted throughout the GWMP. The City's water production and purchases are updated through the end of Calendar Year 2007 in Chapter 4. Other historical data were collected when available, but a focused effort was made to compile data covering an approximate 20-year period dating back to the mid-1980s.

A Data Management System (DMS) was designed to organize available data, support technical analyses, and identify data gaps. This system includes a relational database in Access format with individual tables for each data type. A project Geographical Information System (GIS) has also been maintained as a repository for regionally-available GIS files and for viewing and analyzing spatial data. The database and GIS were also used to facilitate the construction of a numerical model to assist in the evaluation of management strategies. Collectively, the GIS and project database provide a framework that will allow additional data to be incorporated and analyzed in the future. The Study Area, Study Period, and data collection efforts are described in the following sections.

2.1. Study Area

A Study Area for the Groundwater Management Plan was defined by the groundwater subbasins of interest, the contributing watersheds, and portions of the adjoining groundwater basins (Figure 3). The Study Area is larger than the groundwater subbasins to be managed in order to incorporate inflows from other groundwater basins and evaluate the subbasins of interest in a regional context.

Subbasin nomenclature and boundaries follow those included in the California Department of Water Resources (DWR) document, *California's Groundwater*, commonly referred to as DWR Bulletin 118 (DWR, 2003). Portions of Bulletin 118, including descriptions of individual groundwater basins, are updated periodically by DWR. The Study Area subbasins were updated on February 27, 2004 and those descriptions are used in this document (DWR February 27, 2004a; 2004b; 2004c). Subbasins and contributing watershed areas, as determined through GIS, are summarized in the table below.

Table 2-1
Groundwater Basins and Watersheds

DWR Groundwater Basin (Basin No.)*	Subbasin (Basin No.)*	Subbasin Area (acres)	Contributing Watersheds (acres)	
			Western	Eastern
Upper Santa Ana Valley (8-2)	Temescal (8-2.09)	23,500	13,999	12,549
Elsinore (8-4)	Coldwater (none)	2,176	9,525	0
	Bedford (none)	4,133	0	11,858
	Total	29,809	23,524	24,407

*DWR Bulletin 118, February 27, 2004a., b., c.

The Temescal Subbasin is a recognized subbasin in Bulletin 118. The Elsinore Groundwater Basin, the adjoining basin to the southeast, is not formally divided into subbasins in Bulletin 118. However, two areas within the northern portion of the Elsinore Basin, Coldwater and Bedford, have been designated as subbasins in past investigations (DWR, 1959). Because these subbasins can be readily defined as distinct from the remaining subbasins to the south, they are included as separate subbasins in the Study Area for the purposes of this GWMP.

2.1.1. Subbasin Boundaries

The Temescal Subbasin as defined by DWR is bounded on the west by the Santa Ana Mountains and the east by low-lying El Sobrante de San Jacinto and La Sierra hills. The subbasin is connected to three adjacent groundwater basins. The boundary with the Chino Subbasin (DWR Basin No. 8-2.01) to the north is generally marked by the Santa Ana River and a series of low-lying hills in the Norco area (Figure 3). Groundwater flows into the subbasin from the Riverside-Arlington Subbasin (DWR Basin No. 8-2.03) through the Arlington Gap, a restriction in the southwestern arm of the Riverside-Arlington Subbasin (Figure 3). The southern boundary of Temescal Subbasin is located at a constriction of the alluvium along Temescal Wash at Bedford Canyon where it connects with the Bedford Subbasin of the Elsinore Groundwater Basin (DWR Basin No. 8-4).

The subbasin also includes a small subarea west of the La Sierra Hills and east of the Santa Ana River (DWR, February 2004a). This northeastern arm of the Temescal Subbasin, referred to as the Norco area, consists of relatively low permeability alluvium and bedrock residuum flanked on the east and west by bedrock outcrops. Investigators in the Chino Subbasin include a portion of this area within the boundary of the Chino Basin (WE, July 2005). This division may be technically supported by a groundwater divide indicated by water level data in

the Norco area with groundwater in the northern portion flowing toward the bluff along the Santa Ana River.

The Bedford Subbasin connects to the Temescal Subbasin near the base of Bedford Canyon. The connection occurs where the alluvium along Temescal Wash thins as the wash leaves the subbasin and traverses northward through bedrock (a reach referred to as Temescal Canyon) before entering Temescal Subbasin.

The Coldwater Subbasin connects to the Bedford Subbasin along a trace of the Glen Ivy Fault zone, a locally named fault related to the larger basin-bounding Chino-Elsinore Fault zone. Since the delineation between the two subbasins has historically been the surface trace of a groundwater-impeding fault, the fault trace mapped by the U. S. Geological Survey (USGS) was used as the subbasin boundary (USGS, 2004).

2.1.2. Contributing Watersheds

The Temescal Subbasin receives runoff and recharge from almost 14,000 acres of uplands in the adjacent Santa Ana Mountains. Watersheds contributing runoff from the east are almost as large, but contribute less runoff because of lower elevations and corresponding precipitation. Watersheds contributing runoff to Coldwater and Bedford subbasins cover 9,525 acres and 11,858 acres, respectively, more than three times the area of the subbasins. Although the watershed contributing runoff to Bedford Subbasin is more than 2,000 acres larger than the Coldwater watershed, the Coldwater Subbasin receives more runoff due to the higher watershed elevations.

2.2. Study Period

An initial review of documents and data was used to define a Study Period to guide ongoing data collection and the water balance. Study Period selection considered significant changes that may have an effect on the groundwater basin such as land use, population growth, imported water, and groundwater production. The availability and quality of historical data were also considered. Selecting a relatively recent period makes good use of available data and represents the current state of the basin, including changing land use and management.

Rainfall patterns and hydrologic cycles were also reviewed to select a representative Study Period. Average annual rainfall within the Temescal Subbasin, along with a cumulative departure curve is provided on Figure 5. Based on the data review and rainfall patterns, a Study Period from water year 1990 through water year 2004 (15-year period) was selected for focused data collection. This period contains a range of wet and dry cycles and approximates long-term average precipitation. The average annual rainfall for the Study Period is about 15 inches per year, in good agreement with the average of 15.7 inches per year at the Chase precipitation station (Figure 5). The Study Period begins in drought conditions when water levels in the basin are

relatively stable. The period also contains a full wet and dry cycle (as indicated by the cumulative departure curve) to allow assessment of climatic variations in the water balance (Figure 5).

The Study Period also allows for evaluation of changes in water demand and supply. Although the City has grown steadily in population since its inception in 1896, significant population increases occurred between 1960 and 1970 and between 1985 and 1995. During each of these two decades, population doubled (AKM, April 2005). From 1985 to 2004, the population more than tripled, increasing from 45,750 to 144,274. Current population is approximately 149,400 (2008). Accompanying this growth was a change from predominantly agriculture to more urban land uses and a large increase in urban water demand. Much of the demand increase through the 1990s was met with an increase in imported surface water supplies. However, over the last five years, groundwater production increased from about one-third of the City's supply to about one-half, an increase contained within the Study Period.

Although the more quantitative assessments including the groundwater basin water balance and numerical modeling were conducted for the Study Period, additional historical data were also compiled. These documents and data provide useful information on the conceptual model of the three subbasins and changes in groundwater conditions over a relatively long time period.

2.3. Data Types and Sources

Data collected for the GWMP are summarized below by data type and are described in more detail in following sections.

- **Hydrologic** – Climatic data (e.g., precipitation and evapotranspiration), reservoir storage, and streamflow.
- **Land Use** – Land use maps over time indicating areas of agriculture, urban growth, and open space corresponding to changing water use, irrigation, and pumping patterns.
- **Geology** – Maps of geologic units and faults, lithologic information from wells, and soil types.
- **Groundwater** – Subbasin boundaries, well locations and construction, pumping tests, water levels, and ambient groundwater quality.
- **Water Quality** – Data included water quality analyses from municipal wells compiled from the City and the California Department of Public Health (DPH) (formerly the Department of Health Services). Data were also collected for Regulated Facilities in the Study Area. These data include water quality analyses conducted and compiled by the City as required by state regulations. Data were obtained from the Regional Water

Quality Control Board (RWQCB) and other local agencies relating to basin water quality from monitoring at commercial or industrial activities.

- **Water Supply** – Drinking water and other water uses from groundwater pumping (by the City and others), imported water, and recycled water.
- **GIS Base Maps and Layers** – Supporting physical and cultural information were compiled for use in the project GIS such as roads, freeways, city limits, parcels, sphere of influence, building footprints, digital elevation models, streams, rivers and lakes, and other data.

Primary sources of data for this GWMP were local and state public agencies including the City, County of Riverside, RWQCB, USGS, DWR, and the Santa Ana Watershed Protection Agency (SAWPA). SAWPA, in particular, was a helpful resource for filling key data gaps and acquiring physical and cultural data for the GIS base maps. SAWPA was first formed in 1968 as a planning agency, and reformed in 1972 with a mission to plan and build facilities to protect the water quality of the Santa Ana River Watershed (SAWPA, 2006). Within SAWPA, the Information Systems and Data Management team develops and maintains water-related data that are used by SAWPA staff for data analysis and dissemination. These data are available online through the Santa Ana Watershed Data Management System (SAW DMS, 2006).

2.4. Hydrologic Data

The main sources for hydrologic data in the Study Area included the California Irrigation Management Information System (CIMIS), County of Riverside, National Weather Service, and USGS as described in more detail below.

2.4.1. Climate Data

Precipitation data were available for four stations in the Santa Ana River Watershed as shown on Figure 2. Location data for each station are also included in the DMS. Data for the University of California Riverside Station # 44 were downloaded from the California Irrigation Management Information System (CIMIS) website. Data for the Chase, Norco, and Elsinore stations were obtained from the County of Riverside. Data are available monthly from June 1965 to the present for the three county stations (Chase, Norco, and Elsinore) and from June 1985 to the present for the CIMIS station.

The spatial distribution of average rainfall (isohyetal maps) in the Study Area was available from several sources. SAWPA files contained an isohyetal over the entire Santa Ana River Watershed (Figure 2). A long-term average isohyetal map was also obtained from the Oregon Climate Service (OCS) and Oregon State University using PRISM (parameter-elevation regressions on independent slopes model), a climate modeling and mapping system (OCS, January 8, 2007). The PRISM Group, supported by numerous agencies and used by DWR,

models complex precipitation patterns over large areas to develop a more accurate predictive precipitation tool. This PRISM isohyetal map was used in the basin water balance and is shown on Figure 6.

Monthly evapotranspiration (ET) data were available from June 1985 to May 2006 for the CIMIS station. Long term pan evaporation data from 1948 to 2005 were compiled from an additional station in Riverside County (Riverside Citrus Exp. St. Station). These data, along with other information such as annual ET coefficients for various crops were downloaded from the DWR Division of Planning and Local Assistance (DPLA) website. The DWR DPLA divides the state into Detailed Analysis Units (DAU) for purposes of data reporting. The City is located in the North Riverside DAU. Both reference ET data and crop coefficients were added to the DMS.

2.4.2. Streamflow

Surface water gage data for Temescal Wash were available from the USGS National Water Information System (NWIS) as shown on Figure 7. Data from one active and several inactive gages were compiled. For the gage located along Temescal Wash between Bedford and Temescal subbasins (USGS Station no. 11072000), daily data were available from October 1928 to June 1980. For the active gage in the City near Main Street (11072100), daily flows from October 1980 to April 2007 were downloaded and added to the DMS as a separate table.

2.4.3. Reservoir Storage

Lake Mathews is used to store much of the imported water that supplies the City (Figure 3). Monthly reservoir storage data from October 1961 to May 2006 were downloaded from the California Data Exchange Center (CDEC) and included in the DMS.

2.5. Water System Data

2.5.1. Pumping Data

The City provided numerous pumping summary tables in pdf format on a compact diskette (CD). This CD contained annual pumping data by well from 1964 to 1999 for City wells, with some data gaps (e.g., data for years 1994 to 1999 appear to only include Wells 1-4, 20, and 21). In addition to the annual data, monthly data were available for calendar year 1988 and from January 1990 through December 2004 (except for July 1996 through December 1996). Monthly data were summed to yield annual pumping by well and combined with the available annual data.

City production data were also available from a consulting firm, Water Master Support Services (WMSS), which compiles production data with the WMWD service area (including the City of Corona). These data were provided by the WMSS on a CD. Data included both tabulated reports in pdf format as well as an electronic table of production data in MS Access format. Data include pumping by the City and 56 other users in the Study Area from 1947 to 2004.

Production totals from the City tables were compared to production amounts contained in the WMSS data in acre-feet per year (AFY). Pumping totals were almost identical from 1995 to present, but varied somewhat in the earlier years (1964-1995). The total production error between these two data sets was judged to be relatively small when using known City wells (amounting to a discrepancy of a few percent of AFY produced), and the City's monthly pumping data were used when available.

The largest discrepancy in the WMSS data was the large number of production wells that were allocated to the water supply system, but are not necessarily City wells. This discrepancy was more prevalent during the early portion of the Study Period than later years. Research conducted on several of these wells indicated that they were irrigation wells at parks throughout the City and/or older wells previously owned by others that were subsequently obtained by the City and abandoned. For example, two older wells thought to be previously owned by Orange Heights Water System (and designated MAIN 3 and MAIN 4) were on the property obtained by the City for the construction of City Hall. While there were no records to independently verify historical production totals from these wells, locations and pumping totals were reviewed for reasonableness and generally left unmodified in the production database.

2.5.2. Imported Water Data

The City imports water through WMWD from the Colorado River and the State Water Project. Data on imported water volumes at the main treatment plants and system interties were provided by the City for this project. Annual data were provided from 1964 through 1999 and monthly data were available from 1990 through 2004. These data are included in the DMS with the pumping data.

2.5.3. Water Demand

The City's 2005 update of its Urban Water Management Plan (UWMP) contains statistics on water demand (including population, number of housing units, and population per household) in 5-year increments from 1970 to 2003 (AKM, December 2005). Population data for various time periods from 1900 to 1960 are also available in the UWMP.

2.5.4. Wastewater Treatment Plant (WWTP) Data

Information from the City of Corona's three WWTPs and the volume of discharge to ponds and Temescal Creek were provided by the City from 1997 to present. Earlier data were apparently destroyed accidentally and were estimated for this GWMP using verified methods and City information on discharge locations. Additional operation and location information was available in the National Pollutant Discharge Elimination System (NPDES) permits issues by the RWQCB.

2.6. Groundwater Data

Groundwater data were compiled from multiple sources including DWR, SAWPA, Riverside County, and the City. Groundwater data available from SAWPA includes groundwater elevations, general analytical chemistry, and well construction information compiled from 37 local agencies (water districts, cities, counties). However, complete data, including well construction and water levels or quality, were available for only a few wells in the Study Area.

2.6.1. Basin and Watershed Boundaries

DWR publishes maps and descriptions of California groundwater basins in DWR Bulletin 118. This document and the accompanying basin descriptions are updated periodically. Basin descriptions for the Study Area were updated in February 2004. The last update for the basin map was in 2003. Groundwater basin boundaries are available in GIS-compatible data files and were obtained from DWR for groundwater basins in the Study Area. Since Temescal is a DWR-defined subbasin, the delineation of this subbasin was available in the files and has been used unmodified in this study.

Because Coldwater and Bedford subbasins are not delineated in the DWR files, GIS shape files were created for these subbasins. Subbasin boundaries were based on previously-defined boundaries and the location of geologic faults (DWR, 1959; MWH, 2004; USGS, 2004). The Coldwater Subbasin was delineated from the larger Elsinore Groundwater Basin boundaries on the west, north and south, and the location of the North Glen Ivy fault on the east as mapped by USGS (2004). The Bedford Subbasin boundaries are coincident with the Elsinore Groundwater Basin boundaries on the north and east and the North Glen Ivy fault on the west. The southern boundary was based on the narrowing of Temescal Wash through surface bedrock outcrops, and checked for similarity to boundaries previously published (DWR, 1959). These modified subbasin boundaries are shown on Figures 1 and 3 and used in calculating subbasin areas in this GWMP.

The contributing watershed areas for the subbasins in the Study Area were delineated digitally by Todd Engineers, using GIS software to create shape files of the defined watersheds. Watershed delineation relied on electronic USGS Digital Elevation Models (DEM) (10-meter resolution) and topographic elevation contours of the Santa Ana quadrangle provided by USGS (2004). DEM files were processed in ArcView to provide shaded relief maps, slope percentage maps, slope aspect maps, and elevation contour maps at varying contour intervals. These maps were combined with the USGS elevation contours, hydrologic features, and DWR groundwater basin boundaries to manually delineate watershed boundaries. Watersheds were defined to include those areas that could potentially contribute surface runoff to the three main Study Area subbasins and are shown on Figure 3.

2.6.2. Well Data

Well locations and construction information tie key data (e.g., pumping, water levels, and water quality) to spatial and vertical locations within the groundwater basin. Sources of well locations and construction include SAWPA, DWR, the City, and Riverside County.

SAWPA provided a list of 312 wells in the Study Area, 174 of which contained detailed location data (latitude/longitude) and 60 of which contained some well completion information (e.g., depth, screen intervals, and casing). SAWPA well data were included in the DMS as a separate table maintaining the format from the original data source.

A database was created by Todd Engineers of selected DWR Driller's Log data for approximately 325 wells. These data are included as a separate table in the DMS. Completion dates for these wells range from 1905 to 2004, but approximately half of these wells were drilled after 2000. Locations of 131 of the wells with Driller's Logs were estimated using the state well number and added to the DMS. The Master Well table within the DMS contains a field for each record indicating the method used to locate the well. The method of the DWR wells location is noted as "manual" to indicate the approximate nature of the placement. An older DWR document (1959) lists 112 wells in the Temescal, Coldwater, and Bedford subbasins that were drilled before 1959, most of which are listed as irrigation or domestic wells. The earliest completion date is 1912, but completion dates are unavailable for most wells in the document. Because key hydrologic and hydrogeologic data cannot be tied to these individual wells, these well data have not been included in the electronic DMS.

Construction information for the City's 31 wells (including inactive and abandoned wells) were compiled from several documents including the Water Master Plan (AKM, April 2005), the Drinking Water Source Assessment and Protection Plan (DSWAP) (Kennedy/Jenks, 2002), and a focused hydrogeologic assessment document prepared for the City's desalter facility (Fox/Roberts, 2004). Data were entered into Excel spreadsheets and re-formatted into a separate table in the DMS.

The U.S. Geological Survey compiles and publishes well information such as well location, construction, and available water level data through a web based portal, the National Water Information System (NWIS). The system was queried for wells in the Study Area, and 18 wells with location data were identified and added to the DMS.

Well construction data were also available from a limited database that Riverside County initiated in 1990. Any well drilled after 1990 in the County is included in the database and earlier wells are being added as resources become available. The County database contains 683 wells in the Corona area, most of which are relatively shallow monitoring wells (551 wells or 81 percent). The remaining 132 wells are listed as municipal (2 percent), domestic (5 percent), irrigation (3 percent), or unknown (9 percent) wells. The County well database was also included as a table in the DMS.

Well location and construction data from all sources were compiled into one table in the DMS. Some wells may be duplicated in this table as it difficult to match wells between sources. Data from each source were also retained as a separate table in the DMS for updating and archiving purposes.

2.6.3. Water Level Data

Water level data in the Study Area were available from SAWPA and the City. Approximately 100 wells contain at least one water level measurement ranging from June 1919 to September 2004. The number of groundwater elevation measurements per well varies from 1 to 1,083 distinct monitoring events. Each well with water level data has been assigned a unique ID that links the water level data to other well information, such as location and construction, if available. Water level data were also available for City wells from 1998 to 2005. Water level data from both SAWPA and the City were re-formatted and entered into the DMS.

No historical water level contour maps could be found in previously published documents that covered the Study Area. A few water level contour maps were available for relatively small portions of the Study Area for a few time periods. The earliest available water level contour map is a DWR map for March 1957 water levels (DWR, 1959). The map covers the northern portion of the Study Area and small sections of the Elsinore Groundwater Basin to the south. Wells used to construct the map are provided in a summary table, but actual water level measurements in each well were not included in the report and therefore are not included in the DMS.

2.6.4. Water Quality Data

Ambient groundwater quality data were available from the City, SAWPA, and DPH. SAWPA water quality data were available from 101 wells. The number of monitoring events per well varied from 1 to 180. The average number of constituents analyzed per event per well ranged from 2 to 50.

DPH requires water quality sampling of drinking water systems larger than six connections. The Division of Drinking Water and Environmental Management (DDWEM) compiles these data into a statewide database. The database was obtained from DPH and queried for all wells, surface water, and intermediate system connections in the Corona area. Water quality data were available for 69 stations, 39 of which were operated by City of Corona. Other owners include the City of Norco, Glen Eden, Home Gardens, and California Rehabilitation Center. The number of monitoring events per well ranged from 1 to 567. Most monitoring events included the full suite of Title 22 drinking water constituents.

2.6.5. Regulated Facilities

Potential threats to groundwater quality are regulated by RWQCB, Department of Toxic Substance Control (DTSC), and the Riverside County Department of Environmental Health. A

review of the RWQCB database identified 30 major sites that are regulated for possible environmental releases in the Corona area and approximately 75 Underground Storage Tank (UST) investigations. Of non-UST sites, 18 are regulated by the Spills, Leaks, Investigations, and Cleanup (SLIC) Program at the Santa Ana RWQCB and two are landfills. The remaining 10 sites are regulated by DTSC.

Data collection has focused on facilities whose discharge is regulated by the RWQCB, sites that are being investigated for impacting groundwater, and leaking underground storage tank sites. Data include location, site characterization, water quality, and other information.

A file review was conducted at the Santa Ana RWQCB in July 2006. Groundwater quality and other environmental data were copied from 11 sites. Electronic databases were unavailable and data were evaluated from paper copies and not hand entered into the DMS. Water quality data for four UST investigations are available from the State Water Resources Control Board (SWRCB) online through their data management system, Geotracker. These data were included as a table in the DMS.

2.6.6. Land Use Data

Land use maps in the form of GIS shape files were available from the DWR DPLA and the Department of Conservation Division of Land Resource Protection (DC DLRP). DWR DPLA conducts complete land use surveys approximately once every ten years for the Upper Santa Ana River Drainage Area. The most recent survey, 1993, was available from the DWR website as a GIS shape file. A summary table of this map, which includes the total area by land use type within the basin and watershed area, was added to the DMS. Additional surveys (years 1957, 1964, 1975, 1984) were available on paper from DWR, but were not converted to electronic format and are not included in the DMS.

In addition to land use data, DWR DPLA also publishes data on applied irrigation rates for specific crop types in each DAU. Data were available on the DWR website for 1998 through 2001. A table of the water use (AFY per acre) for each crop type for the North Riverside DAU was included in the DMS.

The Farmland Mapping and Monitoring Program (FMMP) of the DC DLRP determines the area of farmland in the state on a biennial basis. In Riverside County, maps showing farmland and urban areas are available for the even years 1984 to 2004 in GIS (shape file) format. Summary tables with the total amount of agricultural land by year for DWR and FMMP are included in the DMS.

The City provided a detailed parcel map for the project GIS with information regarding the zoning of each parcel. These parcels, differentiated by zoning type, were compared with the other sources of land use to confirm areas of urban and agricultural land.

2.7. Geologic Data

USGS data provided the primary source of geologic units and faulting in the Study Area. Additional documents and data were used as described below.

2.7.1. Geology Maps

A digital geologic map of the Santa Ana 30' x 60' quadrangle was obtained from USGS (2004) and imported into GIS. A summary table, including the total area of each geologic unit, was added to the DMS.

2.7.2. Lithologic Data

Subsurface lithologic data were available from DWR Driller's Logs (400 paper logs compiled), available City well-completion reports, and geophysical logs for six City wells. Lithologic information was also available for 10 wells in the SAWPA database.

2.7.3. Soils Data

Soil type and the respective soil moisture holding capacity governs the amount of recharge and runoff that occurs in an area. Digital soil maps and a database of physical properties for soils in Riverside and Orange counties were downloaded from the Natural Resources Conservation Service's (NRCS, formally the Soil Conservation Service) website. In addition, the NRCS also provides a methodology for estimating the amount of runoff that occurs based on land use type. A summary table of the acreage associated with each soil type was added to the DMS.

2.8. GIS Files and Layers

The City maintains a GIS and provided numerous shape files in support of this project including parcels, city limits and sphere of influence, roads, storm detention basin locations, production well locations, and a high resolution aerial photograph. In addition, numerous GIS files were obtained from the Santa Ana Watershed Project Authority (SAWPA) from an online user system. These files included physical and cultural features as well as limited groundwater data sets such as water levels and water quality. Additional GIS files were downloaded from various sources as previously mentioned.

2.9. Data Management System (DMS)

The DMS includes one main relational database in Access format with individual tables for data types summarized above. A summary of the tables included in the DMS relational database is provided on Table 2-2 below. This database provides a flexible framework, allowing additional data to be incorporated as available. The project GIS was populated with shape files generated from selected data sets as well as selected publicly- or commercially-available GIS layers as described above.

Table 2-2
Data Tables in the Data Management System (DMS)

DMS Table Name	Description	Source(s)
Geo_Geology	A summary table for the geologic map containing formation names and area in subbasins and watersheds	USGS
Geo_Lithology	Lithologic information for select wells in the area	SAWPA
Geo_Soils	A summary table of the soils map containing soil types and associated areas within the subbasins and watersheds	NRCS
GW_AB County	Abandoned wells as documented by Riverside County	COUNTY
GW_County Wells	Wells from the Riverside County Well Database	COUNTY
GW_DWRLOGS	Information from DWR Driller's Logs	DWR
GW_Master Wells	A composite table of wells from all available sources. Includes a unique ID for each well and location information	DWR, COUNTY, SAWPA, CITY, WATERMASTER
GW_Water Quality	Ambient groundwater quality for select wells in the area	SAWPA
GW_Well Construction	Well construction information for wells in the area	SAWPA, CITY
GW_Well_Perf	Screened interval information for select wells in the area	SAWPA
GW_WL_ALL	Groundwater elevations for select wells in the area	SAWPA, CITY
HY_ET_CIMIS	Monthly reference evapotranspiration data	CIMIS
HY_ET_K	Annual evapotranspiration and crop coefficients for the DAU	DWR DLPA
HY_Precip	Monthly precipitation data from 4 stations	CIMIS, COUNTY
HY_Precip_Stations	Location information for the precipitation stations	CIMIS, COUNTY
HY_Res_Storage	Monthly reservoir storage in Lake Mathews	CDEC
HY_Streamflow_Temescal	Streamflow on Temescal Wash	USGS
LU_Applied Water Use	Applied water use (AFY/acre) for crop types in the North Riverside DAU	DWR
LU_DWR_SUMMARY	A summary table of the DWR 1993 land use map containing land use areas within the subbasins and watersheds	DWR DPLA
LU_Summary_Farm Mapping	A summary table of the farmland mapping program land use maps, contains land use areas with the basin and watershed by year	DC
RF_Locations	Location data for regulated facilities in the area	RWQCB
WS_Annual Pumping	Annual pumping from the City of Corona by well	CITY
WS_Monthly Pumping	Monthly pumping from the City of Corona by well	CITY
WS_Watermaster_Pumping	Annual pumping for the groundwater basins	WATERMASTER

This process was the City's first effort to compile numerous types of hydrologic and hydrogeologic data into a comprehensive database for future updating, revision, and use. Numerous inconsistencies and duplicative data types were noted as data were compiled from various sources. Data sets were evaluated for quality control as needed, but only minimal deletions or modification have been made to preserve data that may be potentially important in the future.

3. State of the Groundwater Basins

The groundwater subbasins of the Study Area have undergone significant changes since groundwater development began in the early 1900s (DWR, 1959). Since that time, the groundwater subbasins have supported a variety of uses including extensive agricultural irrigation (especially citrus), industrial demand from mining and citrus packaging, and increasing urban use. Early agricultural activities in the subbasins were supplemented by diversions of surface water imported into the basin. Agricultural reliance on groundwater increased through the 1940s and 1950s, apparently peaking in the early 1960s but continuing into the 1970s. Increasing urban use has replaced most of that early agricultural demand.

The Study Area subbasins occupy a small portion of the upland Santa Ana River watershed, which covers more than 1.5 million acres in San Bernardino and Riverside counties (Figure 2).The Study Area subbasins cover about 47 square miles (about 30,000 acres) in western Riverside County (Figures 2 and 3) and include portions of townships/ranges 3S/6W, 3S/7W, 4S/6W, 4S/7W, and 5S/6W. The subbasins and the local watersheds that contribute runoff are contained within an approximate 400-square mile area outlined in Figure 3.

3.1. Land Use

Current and historical land use in the Study Area is shown on the land use maps on Figure 8. Two maps, one from 1984 and one from 2004 illustrate changes in land use over the last 20 years. As shown on Figure 8, land use on the Study Area subbasins, especially Temescal Subbasin, is predominantly urban (shown by the pink color). The urbanization has progressed mainly over the last 35 years as population in the subbasin has risen and agriculture has moved out. A comparison of the two maps on Figure 8 illustrates the change from agriculture (green) to urban (pink) land use for large portions of Temescal, Coldwater, and Bedford subbasins.

In the 1950s and 1960s, the subbasins consisted mainly of irrigated agricultural lands with a variety of crops, especially citrus. In 1957, approximately 7,000 acres of Temescal Subbasin were under cultivation, 1,100 of which were devoted to citrus and avocado production near Corona (DWR, 1959). During that year, approximately 17,000 acre-feet per year (AFY) of groundwater were pumped from the basin, primarily for irrigation and citrus processing facilities with some municipal use (DWR, 1959). At that time, less than 10,000 people lived in the subbasin.

Agriculture and native vegetation were the predominant historical land uses in both Coldwater and Bedford subbasins. In 1957, about 1,700 acres were irrigated in the two subbasins. Although some urbanization has occurred in both subbasins, much of the land remains

undeveloped. Sand and gravel mining has been the predominant industrial land use in Coldwater Subbasin, an activity that continues today.

Groundwater production data suggest that the peak of agricultural pumping in Temescal Subbasin was from about 1959 through about 1966, but irrigation continued through most of the 1970s. By about 1980, most of the growers and citrus processors had left the basin. The 1984 land use map on Figure 8 suggests that large portions of southern Temescal Subbasin continue to be used for agriculture, but most of this land was likely fallow or non-irrigated pasture by 1984. Groundwater production totals for the 1980s indicate that irrigation had decreased significantly in the subbasin.

The contributing watersheds that surround the subbasins consist mostly of native vegetation or grasslands used for grazing. With the exception of urbanization of the small watershed on the northeastern side of Temescal Subbasin, land use on the contributing watersheds has not changed significantly over the last 20 years.

The northern edge of the Study Area contains a portion of the Prado Dam Management Area, shown as native on the land use maps (see also Figure 7). The management zone, operated by the U.S. Bureau of Reclamation, is a 6,800-acre area generally defined by a ground surface elevation of 560 feet above mean sea level (msl) and serves as flood control for the Santa Ana River at Prado Dam.

3.2. Physical Setting

The groundwater basins are in a high desert setting in the rain shadow of the Santa Ana Mountains in western Riverside County. The basins are at the downstream portion of the Santa Ana River watershed.

3.2.1. Topography

The elevation of the ground surface in the Study Area ranges from below 500 feet msl at Prado Dam to more than 5,600 feet msl at the highest peak in the Santa Ana Mountain watersheds west of Coldwater Subbasin. The floor of Temescal Subbasin slopes from about 1,500 feet msl along the base of the Santa Ana Mountains in the southwest to about 500 feet msl in the northwest. The ground surface elevation in the city center is about 650 feet msl. In Coldwater Subbasin, elevations along the western mountain front are about 1,500 feet msl, similar to the Temescal Subbasin mountain front. The Coldwater Subbasin floor slopes to an approximate elevation of 1,000 feet msl near the eastern subbasin boundary along the Elsinore-Glen Ivy Fault zone. Bedford Subbasin slopes from about 1,100 feet msl on the south and west to about 850 feet msl on the northeast where Temescal Wash exits the subbasin (Figure 3).

Surface elevations increase significantly from the mountain front at the groundwater basin boundaries (about 1,500 feet msl) to the higher elevations in the contributing watersheds.

For the contributing watersheds in the Santa Ana Mountains to the west, elevations range from about 2,500 feet msl in the north to more than 5,600 feet msl in the south. The watershed west of Coldwater Subbasin rises above 5,600 feet msl. Watersheds east of the subbasins are significantly lower in elevation and rise only to about 1,800 feet in the highest areas east of Bedford and Temescal subbasins.

3.2.2. Precipitation and Evapotranspiration (ET)

Annual precipitation varies from below 12 inches to more than 26 inches over the Study Area. As shown on the isohyetal map on Figure 6, long-term average annual rainfall is between 12 and 14 inches per year on the basin floor and increases to more than 20 inches along the top of the local watersheds in the Santa Ana Mountains to the west.

The variability of rainfall on an annual basis is illustrated by the rainfall records from the Chase precipitation station, located in the southwestern portion of Temescal Subbasin (Figure 6). Over the last 40 years, annual rainfall at the Chase Station has ranged between about 4 inches per year to 34 inches per year with an average of 15.7 inches per year (Figure 5). Although the average rainfall of 15.7 inches per year since 1965 is slightly higher than predicted by the long-term isohyets on the figure, the Chase Station data illustrate the variability of rainfall in the Study Area. Annual rainfall totals range from less than 5 inches per year to more than 30 inches per year. Rainfall patterns indicate several wet and dry cycles persisting from about 4 to 8 years.

Data from the Chase Station are plotted as a cumulative departure curve on the lower portion of Figure 5. The graph relates annual rainfall to average rainfall as a percentage and indicates dry cycles with downward slopes and wet cycles with upward slopes. This plot more clearly demonstrates the wet and dry cycles that have occurred since 1965 and shows that only a few time periods can be characterized as average rainfall conditions.

Long term pan evaporation data from 1948 to 2005 were compiled from a station in Riverside (Riverside Citrus Exp. St. Station). These data indicate an annual potential evaporation of 75.66 inches per year ranging from 3.03 inches per month in December to 10.88 inches per month in July.

3.2.3. Streamflow

Temescal Wash (also referred to as Temescal Creek) is the primary surface water drainageway traversing from south to north across the Study Area draining the Temescal Valley (Figure 7). Originating south of the Study Area, the wash flows north through Bedford Subbasin, cuts through bedrock outcrops in Temescal Canyon, flows through Temescal Subbasin, and discharges to the Santa Ana River near Prado Dam. Streamflow in Temescal Wash is fed by storm water runoff and discharges from wastewater treatment plants within and upstream (south) of the Study Area. For example, Lee Lake Water District is currently allowed to discharge up to

about 1,000 AFY of tertiary treated wastewater (although some is recycled for reuse) (RWQCB, September 6, 2001).

Temescal Wash is lined through most of the Corona city limits. The concrete lining begins around Magnolia Avenue, about 1.5 miles after Temescal Wash enters the Temescal Subbasin (from Temescal Canyon to the south, see Figure 7). The lined portion of the channel is indicated on Figure 7 and continues from Magnolia Avenue to the City's wastewater treatment ponds near the Prado Management Area. The only unlined portion in Temescal Subbasin is the 1.5-mile area where the wash emerges from Temescal Canyon. This area is characterized by high groundwater, likely the result of infiltration of streamflow and relatively fine-grained surficial deposits. Other than limited infiltration in this narrow section of the subbasin, Temescal Wash does not contribute significant recharge to the Temescal Subbasin.

The Study Area is also crossed by numerous drainageways originating in the surrounding watersheds to the east and west of the groundwater subbasins and draining toward the basin center. Drainageways originating in the Santa Ana Mountains west of the Study Area carry relatively large amounts of runoff into the subbasins.

Runoff from the Santa Ana Mountains into Temescal Subbasin has only limited opportunity for percolation into the groundwater basin. Drainageways are lined across the subbasin floor and funnel runoff into the lined portion of Temescal Wash. From there, runoff generally leaves the basin and provides surface discharge at Prado Dam. Some infiltration occurs in two large detention basins used for flood control near the western Temescal Subbasin boundary (Figure 7). These two basins, operated by the Riverside County Flood Control and Water Conservation District (RCFCWCD) and referred to as the Oak Avenue and Main Street detention basins, detain peak runoff from large storm events and allow for some infiltration to groundwater. Runoff into Coldwater Subbasin has the opportunity to percolate into the relatively permeable surface sediments. In addition, berms along washes, diversions of surface water, and the presence of large gravel pits enhance groundwater recharge of runoff in Coldwater Subbasin.

Stream gage data exist along Temescal Wash but are insufficient to document inflows and outflows at each of the subbasin boundaries. Streamflow data were available at only three locations along Temescal Wash within the Study Area as shown on Figure 7. The southernmost gage is an inactive USGS gage that measures flow in Temescal Wash in the bedrock outcrop between Bedford Subbasin and Temescal Subbasin. The northernmost stream gages are located in northern Corona before Temescal Wash enters the Prado Management Area.

Although currently inactive, the stream gage in the bedrock south of Temescal Subbasin (Site No. 11072000, Figure 7) provides data on the amount of runoff available for infiltration into the groundwater basin north of the gage. Daily measurements from October 1928 through June 1980 indicate an average annual discharge of 4,062 AFY. Annual averages vary significantly from less than 80 AFY during dry periods to more than 8,000 AFY. Discharge during several

more recent wet and dry cycles (water years 1966 through 1979) averaged 4,488 AFY, in general agreement with the long-term average.

An active stream gage in the City of Corona (Site No. 11072100, Figure 7) measures runoff in the lined portion of Temescal Wash after additional stormwater discharge has entered the culvert. As such, flows at this gage are significantly higher than streamflow recorded to the south. Average discharge for the entire gaged period (1980-2006) is 19,575 AFY. This runoff leaves the subbasin and contributes to surface water outflow at Prado Dam.

3.2.4. Geology

The Study Area is located within one of the structural blocks of the Peninsular Ranges of Southern California. The groundwater basins occur in a linear low-lying block, referred to as the Elsinore-Temecula trough, between the Santa Ana Mountains on the west and the Perris Plain on the east (Norris and Webb, 1990). The trough extends from Corona to the southeast some 30 miles and was formed along an extensive northwest-southeast trending fault zone including the Elsinore, Chino, and related faults. The Elsinore and Chino fault zones bound the subbasins on the west and trend along the mountain front.

The oldest rocks in the Study Area crop out in the Santa Ana Mountains. These uplands are composed principally of volcanic (including the Santiago Peak Volcanics) and metamorphic rocks (including the Bedford Canyon Formation) of Jurassic and Cretaceous age. A thin rim of younger sedimentary units of Tertiary age crops out along the mountain front generally lying between the Elsinore and Chino faults. This zone of sedimentary units broadens to the north and contains numerous mapped formations of Cretaceous and Tertiary age. The northeastern side of the valley is flanked primarily by granitic rocks of Cretaceous age. Erosion of these units has filled in the trough over time resulting in quaternary-age alluvial fan, channel, and other deposits making up the permeable portions of the groundwater subbasins.

The geologic map on Figure 9 shows the distribution of these units in the Study Area. The original map was constructed by the USGS (2004), but several similar geologic units have been combined on Figure 9 to simplify the display. The main surficial deposits on the floor of Temescal Subbasin include younger and older alluvial fans deposited from the erosion of volcanic rocks and Bedford Canyon Formation to the west. These units prograde across the basin to the northeast and are truncated by channel deposits along Temescal Wash.

The Coldwater Subbasin is also composed of alluvial fan deposits, mainly from the Bedford Canyon Formation and adjacent granitic rocks. Volcanic rocks are essentially absent from the uplands adjacent to Coldwater Subbasin so the character of the deposits and groundwater chemistry differ from the alluvial fans to the north. The alluvial fan deposits in Coldwater Subbasin continue into Bedford Subbasin and appear to have been disrupted by faulting. Channel deposits along Temescal Wash define the eastern boundary of Bedford

Subbasin. In northern Bedford Subbasin, a variety of Tertiary sedimentary units crop out including the Silverado (Paleocene), Vaqueros (Miocene), Topanga (Miocene), and Puente (Miocene) formations.

3.3. Aquifers and Hydrostratigraphy

The basin-fill alluvial deposits and, to some extent, the underlying sedimentary units make up the aquifers in the basin. The thicknesses of these units vary significantly across the Study Area.

To further evaluate aquifer thickness and basin geometry, the base of the unconsolidated sediments was mapped as part of this GWMP. Lithologic descriptions from driller's logs were reviewed for evidence of consolidated sedimentary or igneous units (generally referred to in this document as bedrock) throughout the Study Area. These data were plotted in GIS and evaluated with surface topography and geologic outcrops to estimate a depth to bedrock beneath the subbasins. This surface was produced as a GIS raster file and color coded according to depth. The resulting map is shown on Figure 10.

As shown on the figure, the thickest portion of the alluvial basin (the deepest depth to bedrock) occurs in the central-west portions of the subbasins. The formation of a trough along the Elsinore-Chino Fault zone is indicated by the asymmetric basin geometry. The deepest depths occur along this zone as indicated by the orange and red colors. Unconsolidated sediments are estimated to be more than 1,000 feet thick in this area. Bedrock is much shallower in the eastern portion of the basin as indicated by the blue color on Figure 10. A slight deepening of the basin is indicated in the Arlington Gap by the lighter blue to green color. Here, unconsolidated sediments are approximately 250 feet thick. This area is interpreted to have been eroded by a branch of the ancestral Santa Ana River, accounting for the deeper base. Sediments throughout most of the Bedford Subbasin and in the Norco area are about 100 feet thick. Outcropping bedrock in the northern and eastern portions of the Bedford Subbasin is further evidence of the thin alluvial sediments.

Aquifer packages composed of various geologic units have been defined for this study based on depositional environment, degree of consolidation, groundwater production, and location throughout the Study Area. Three aquifer packages provide water supply to wells in Temescal Subbasin: the Channel Aquifer, the Alluvial Fan aquifers, and, to a lesser extent, consolidated sandstone aquifers. The thickness and geometry of these units were evaluated through the construction of hydrostratigraphic cross sections through the Study Area. The locations of five of the sections are shown on Figure 11. Three cross sections in Temescal Subbasin are provided on Figures 12 through 14 (A-A' through C-C') and two cross sections covering portions of Coldwater and Bedford subbasins (D-D' and E-E') are provided on Figure

15. Each of the aquifer units and the cross sections on which they are illustrated are described in more detail below.

3.3.1. Channel Aquifer

A package of relatively homogeneous and highly permeable sands approximately 200 feet thick have been encountered in many of the City wells in the northern half of Temescal Subbasin. This sand package is interpreted as channel deposits of an ancestral arm of the Santa Ana River and, as such, is referred to as the Channel Aquifer in this document. The alignment of the aquifer suggests that an ancestral river channel had entered the Temescal Subbasin at Arlington Gap, eroding the sedimentary units and possibly older alluvial fan deposits in the area. Permeable channel sands were deposited in the eroded channel over time. From the gap, the Channel Aquifer meanders northwest toward Prado Dam. The Channel Aquifer is limited in extent and is not present in the Coldwater or Bedford subbasins. The general extent of Channel Aquifer is shown by the dashed line on Figure 16, which also shows the distribution of hydraulic conductivity in various aquifer units.

The Channel Aquifer is illustrated on cross sections A-A', B-B', and C-C' on Figures 12, 13, and 14, respectively. Cross Section A-A' extends from the Santa Ana Mountains to the northeast across Temescal Wash to the bedrock high in the northeast. As shown on the section, the Channel Aquifer occurs in the northeastern portion of the subbasin and has a saturated thickness that ranges from 125 to 150 feet along this section. As illustrated on the section, Channel Aquifer sediments lie directly above granitic bedrock beneath Temescal Wash and above the Sandstone Aquifer in other areas (Figure 12).

Cross-section B-B' is located north of A-A' and extends from the Santa Ana Mountains through the Norco area (Figure 13). The Channel Aquifer is shown on the western side of the section southeast of the Prado Management Area. Similar to Cross Section A-A', the saturated thickness of the Channel Aquifer is about 100 to 150 feet thick. The cross section also shows the absence of the Channel Aquifer in the Norco area and illustrates the shallow depth to bedrock there (generally less than 100 feet). The saturated thickness of alluvial sediments in Norco is generally less than 50 feet. Also indicated on the section is a groundwater divide in the Norco area (near well 53-499) indicating possible groundwater outflow from the Norco area to the Santa Ana River (Figure 13).

The Channel Aquifer at Arlington Gap is shown on Cross Section C-C' (Figure 14). Here the saturated thickness is approximately 200 feet and well data indicate a thick and permeable sand package. The Channel Aquifer is underlain by the Sandstone Aquifer throughout most of this area.

Figure 16 shows estimated values of hydraulic conductivity (K) derived from test data on driller's logs and/or City well aquifer testing data. The K value is an indicator of the aquifer's

permeability and is expressed in gallons per day per square foot (gpd/ft^2) or feet per day (ft/day). As shown in the figure, the wells within the limits of the Channel Aquifer have the highest hydraulic conductivity values in the Study Area (Figure 16). The lower K values shown within the extent of the Channel Aquifer area on Figure 16 are generally from deeper wells tapping the underlying Sandstone Aquifer. The average K value of City of Corona production wells screened solely in the Channel Aquifer (Wells 7A, 8A, 9A, 17, 25, and 28) is 2,062 gpd/ft^2 (276 ft/day).

3.3.2. Alluvial Fan Aquifers

Both older and recent alluvial fans have been deposited through time along the mountain front on the western edge of the subbasins. These fans have prograded across both Temescal and Coldwater subbasins from west to east (Figure 9). Although these deposits are relatively thick, the entire unit is heterogeneous and cannot be considered one single aquifer. Rather, sand lenses within the deposits collectively form the Alluvial Fan Aquifers. Lithologic data from wells are insufficient to map out the extent of the aquifers or characterize the deposits. Limited data indicate relatively fine-grained textures throughout much of the area, especially with depth.

The geometry of these units in the subsurface, including the contact with the Channel Aquifer, is illustrated on Cross Section A-A' on Figure 12. The section illustrates the alluvial fan deposits that have infilled the basin. The fans have prograded across the basin and a thin veneer of these deposits likely overlies the Channel Aquifer at the surface (not shown on the section). Wells that penetrate the entire thickness of the Channel Aquifer in the east do not appear to encounter alluvial fan deposits on top of the Sandstone Aquifer. The total thickness of the deposits is unknown, but appears to exceed 1,400 feet in the central subbasin.

Only limited data exist for estimating K values in the alluvial fan deposits of Temescal Subbasin. Sparse data from a few wells indicate a K value of generally less than 50 gpd/ft^2 in the Alluvial Fan aquifers and in the Norco area (Figure 16). Specific capacity data from a City of Corona production well (Well 27), drilled in the Alluvial Fan, indicated a lower K value of about 7 ft/day (PBS&J, 2004).

Alluvial fan deposits in the Coldwater and Bedford subbasins are shown on Figure 15. The cross section on the left side of the figure shows the subbasin geometry and separation at the North Glen Ivy fault. The section on the right side is a north-south profile through the main portion of the Coldwater Subbasin where much of the subbasin production is located (Figure 11).

As shown on Figure 15, alluvial fan deposits in the Coldwater Subbasin range up to approximately 800 feet in thickness (consistent with the depth to bedrock map on Figure 10). Although the alluvial fan deposits here originate from the same mountain range as those in Temescal Subbasin, sediments have been eroded from different source rocks and have different textures and water quality. These alluvial fan aquifers are interpreted to be more permeable overall than the fan deposits in Temescal Subbasin and contain less mineralized groundwater.

However, aquifers are not as permeable as the Channel Aquifer in Temescal Subbasin. Hydraulic conductivity values for the Coldwater Alluvial Fan aquifers are generally less than 100 gpd/ft^2 (Figure 16).

3.3.3. Sandstone Aquifer

Some of the sedimentary units underlying the alluvial basin provide sufficient well yields to categorize them as aquifers. Although generally grouped with other bedrock units, the subsurface sedimentary rocks of Tertiary age in northeast Temescal Subbasin contain sandstone layers that are screened in several City wells (see Corona 24 on Figure 12). The estimated K value is 22 gpd/ft^2 (3 ft/day) for one City of Corona production well (Well 24) screened solely in the Sandstone Aquifer (below the Channel Aquifer). Due to the limited production, small areal extent, increasing depths, and relatively low permeability in most areas, the Sandstone Aquifer is not considered a primary source of water supply.

3.4. Water Supply

For more than 100 years, Study Area subbasins have been an important component of water supply. More than 650 wells have been drilled in the Study Area dating back to the early 1900s according to various DWR and Riverside County documents. Well uses include irrigation and domestic pumping, municipal wells, and shallow monitoring wells associated with commercial and industrial environmental investigations. A DWR study conducted in 1959 lists 112 wells in the Temescal, Coldwater, and Bedford subbasins, almost all of which were used as irrigation or domestic wells. Only limited data are available from the older wells and it is unknown if historical wells still exist. Riverside County files indicate that a large percentage of existing wells have been drilled as shallow monitoring wells in the Study Area, but files do not contain location or construction data for most of these wells, limiting their use for this study.

The City has operated as many as 31 municipal wells in the Study Area over time. Some of the older wells were purchased from the Temescal Water Company, a former irrigation water provider in the basin. Over the last few years, the City has obtained its groundwater supply from about 18 active wells. Most of the Temescal Subbasin wells are screened in the Channel Aquifer (generally shallower than 300 feet deep), but three wells also produce groundwater from the deeper Sandstone Aquifer. Three wells are located in the Coldwater Subbasin and produce groundwater from the local Alluvial Fan aquifers.

3.4.1. Pumping

A groundwater production database was developed from City records and data from a private firm, Water Master Support Services (WMSS). The WMSS data included production records from WMWD (including the City of Corona) and 56 other producers in the three subbasins from 1947 to 2004. Data are provided as annual totals, but monthly pumping totals

were available for City wells from 1990 (with missing data in 1996). Total groundwater production by subbasin from 1947 to 2004 is shown on Figure 17. The location of pumping wells is shown on Figure 18.

As shown on the graph on Figure 17, groundwater pumping has varied over time and by subbasin. In the late 1940s, the total amount of groundwater pumping in the Study Area was about 20,000 AFY. That amount increased to between 25,000 AFY and 32,000 AFY from the late 1950s to the mid-1970s. Total groundwater pumping decreased to below 20,000 AFY in the 1980s and early 1990s due to a decrease in agricultural irrigation, but has increased to about 25,000 AFY in recent years due to municipal pumping. Most of the pumping occurred in Temescal Subbasin. Production in Coldwater Subbasin increased and accounted for more than one-half of Study Area production during a few years in the 1970s and 1980s, but has been less than 25 percent in recent years. Bedford Subbasin production is relatively minor and has decreased somewhat over time.

Most of the historical groundwater production (extending into the 1970s) was used for irrigation. During that time, groundwater supply was also supplemented with surface water and groundwater from adjacent basins conveyed by irrigation water companies. Data on sources and amounts of imports were generally unavailable, but some summary data were documented in an older DWR study (1947). After about 1980, agriculture lands had decreased significantly and almost all of the Study Area pumping was used for municipal supply.

Since 1980, the City has been the largest producer and currently pumps about 80 percent of all groundwater extracted from Study Area subbasins. The City also imports surface water from various sources to supplement the groundwater supply. The City has increased both groundwater production and imported supply over time, especially over the last 20 years, to meet increasing demands. The City's increase in groundwater and imported water supply is illustrated on Figure 19. As shown on the graph, the total water supply from 1964 to 1984 remained relatively consistent at an average of 10,138 AFY, with about 72 percent from groundwater (average 7,296 AFY) and 28 percent from imported water (2,842 AFY). From 1984 to 2004, groundwater pumping has averaged about 12,000 AFY, but has generally increased along with total supply. Since 2002, total water demand has been over 40,000 AFY, with groundwater production at about 20,000 AFY.

In addition to City pumping, approximately 56 other well owners have produced groundwater in the Study Area since 1947. The largest producers are listed on the following table.

Table 3-1
Major Groundwater Users
Data Review Period 1947-2004

Well Owner	Number of Wells	Last Year of Production	2004* Production (AFY)
City of Corona**	39	current	20,435
Ellsinore Valley Municipal Water District	19	current	2,344
Foothill Ranch	15	2000	0
Sunkist Growers Lemon Product	12	1980	0
City of Norco	6	current	1,856
Home Gardens County Water District	5	current	272
Henry Smith	5	1999	0
Cold Water Aggregates	3	current	360
Joy Water Company	3	2000	0

Source: WMSS Data 1947-2004
*Calendar Year
**Includes several inactive park irrigation wells and other non-municipal supply wells. As noted in subsequent sections and in Table 4-2, the City's production in 2007 was 22,317 AFY

3.4.1.1. Pumping in Temescal Subbasin

The graph on Figure 20 re-plots the pumping totals from Temescal and Coldwater Subbasins (from Figure 17) separately to examine pumping in each subbasin more closely. As shown on the graph, production exceeded 15,000 AFY in Temescal Subbasin from 1951 to 1978 in support of agriculture irrigation with peak production occurring from 1959 through 1964. Production declined generally to below 10,000 AFY by 1979 and averaged about 9,419 AFY over the next 17 years (1979-1996). During this time period, agriculture pumping had significantly declined, but municipal pumping had not yet increased. Since 2002, pumping has exceeded 20,000 AFY for the first time since the 1960s peak irrigation totals.

Almost all of this recent pumping is for municipal use. Industrial groundwater pumping is conducted by three companies in Temescal Subbasin (Minnesota Mining, Dart Container, and All American Asphalt) and accounts for about 700 AFY. There has been almost no agriculture pumping in Temescal Subbasin over the last few years.

3.4.1.2. Pumping in Coldwater Subbasin

As shown on Figure 20, groundwater production in Coldwater Subbasin has generally ranged from less than 3,000 AFY to more than 10,000 AFY. Since 1980, production has averaged 7,018 AFY.

There have been relatively few pumpers in Coldwater Subbasin over time. Most of the production has been by the City and EVMWD, the only municipal pumpers in the subbasin. Historically, City and EVMWD production has averaged 61 percent (3,538 AFY) and 31 percent (1,932 AFY), respectively, of the total subbasin production. Most of the production in the basin is exported for out-of-basin use.

Coldwater Aggregates extracts water to support sand and gravel mining and is the only industrial pumper in the subbasin. Their pumping amounts have ranged from about 100 AFY to 300 AFY, except for a period of increased production from 1975 through 1980 when production averaged about 450 AFY.

A few well owners have also produced small amounts of groundwater to support agriculture and domestic use. Until the last few years, agriculture pumping was relatively consistent, averaging about 200 AFY since 1947. However, there has been no agriculture pumping recorded in Coldwater Subbasin since 2001. Agriculture pumping occurred mainly in the foothills along the western edge of the subbasin. Municipal and industrial pumping is clustered along the basin-bounding fault on the eastern side of the subbasin (Figure 18).

3.4.1.3. Pumping in Bedford Subbasin

As shown on Figure 17, production from Bedford Subbasin has been less than in Temescal or Coldwater subbasins. Since 1947, Bedford production has ranged from 373 AFY to 4,658 AFY and has declined slightly over time with decreasing agriculture land use. Several pumping wells exist at the mouth of Bedford Canyon, just north of the subbasin boundary (Figure 18). These wells are just outside of the Temescal subbasin boundary and are included in Bedford Subbasin pumping for convenience.

Most of the early production in Bedford Subbasin supplied irrigation on local ranches. In the late 1940s, agricultural pumping represented more than 70 percent of the total subbasin pumping. Since 1984, irrigation pumping has accounted for less than 20 percent (average 421 AFY) of total production. EVMWD has been the largest single pumper over the last 20 years, producing about two-thirds of the water extracted from the subbasin (or just outside the subbasin boundary, at Bedford Canyon on Figure 18). The City has also produced small quantities of groundwater in that area (abandoned City Well 4 east of Bedford Canyon). Historically, production associated with Bedford Subbasin by the City and EVMWD has averaged 194 AFY and 1,200 AFY, respectively. Almost all of the municipal production occurs just outside of the northern edge of the subbasin at Bedford Canyon (Figure 18).

3.4.2. Imported Water

The City imports water through WMWD, a member agency of the Metropolitan Water District of Southern California (Metropolitan). Water is supplied from both the Colorado River and the State Water Project (SWP). Figure 19 shows the annual amount of water imported over

time. From 1964 to 2004, water demand has increased by a factor of four and imported water has been an increasingly important component of the City's water supply. Since 2000, an average of 23,126 AFY has been imported, accounting for more than one-half of the City's total water supply. Additional information on the City's water supply is provided in Chapter 4.

LLWD also imports water from WMWD for potable supply in Bedford and Coldwater subbasins. In 2004, LLWD provided 1,174 AFY of imported supply to local residential customers.

3.4.3. Wastewater

For more than 40 years, industrial and municipal wastewater discharge has occurred in the northern portion of the Temescal Subbasin. Prior to 1963, Sunkist Growers was discharging about 790 AFY of wastewater to land along Temescal Wash in the northern portion of the subbasin (DWR, 1965), a discharge that apparently continued into the 1970s. Since the 1950s, the City has been discharging municipal wastewater effluent into ponds along the wash or directly into Temescal Wash in compliance with their wastewater discharge permits (RWQCB December 19, 2001; September 26, 2001; April 17, 1998a). From 1955 to 1963, discharges averaged about 1,000 AFY (DWR, 1965).

The City operates three wastewater treatment plants (WWTPs), two of which provide recharge to groundwater in the Temescal Subbasin. WWTP No.1 and No. 2 are located in the northern portion of the subbasin. Prior to 1997, all of the wastewater effluent was discharged to one or more of 13 percolation ponds, 10 of which were at the western end of Rincon Street in the vicinity of the Corona Airport and three of which are located along Temescal Creek between Lincoln Avenue and Cota Street. Discharge to the ponds near the Airport have been discontinued and only the three ponds referred to as the Lincoln, Cota North, and Cota South ponds are currently in use for discharge percolation (Figure 7). After 1997, WWTP No. 1 also discharged a portion of the wastewater into Temescal Wash. Beginning in 2002, the City began recycling a portion of the tertiary treated wastewater from WWTP No. 1 for landscape irrigation, reducing the overall discharge. WWTP No. 3 is located at the southeastern corner of Temescal Subbasin and provides recycled water for irrigation. The plant also discharges a small amount of tertiary treated effluent into Temescal Wash when effluent exceeds the irrigation demand.

Detailed data on wastewater volumes discharged to Temescal Wash and Lincoln and Cota ponds were available only dating back to 1997. According to City personnel, earlier records are no longer available. Files at RWQCB only date back to 1993, and efforts to recover historical RWQCB file archives were unsuccessful. As such, historical amounts of discharge to the groundwater basin were estimated using a factor of wastewater generation per household as described below.

Population data, provided in five-year increments in the City's Water Master Plan (AKM, April 2005), were evaluated on an annual basis from 1984 using a linear extrapolation. An

average household was assumed to be 3.3 persons. Based on current wastewater generation, a factor of 270 gallons per day (gpd) per household was used (AKM, September 2005). This method was applied to years where actual data existed to evaluate the accuracy of the methodology. The difference between estimated and actual total wastewater generation during those years was less than three percent, verifying the method for predicting total wastewater from 1984 through 1996. Operational information provided by the City indicated that all wastewater generated before 1997 was discharge to percolation ponds only. The decline from 1996 to 1997 reflects the beginning of discharge to Temescal Wash.

Using this methodology for historical estimates and recent City data, the amount of wastewater discharged to the ponds was graphed from 1984 to 2004 as shown on Figure 21. Over this time period, wastewater discharge to the ponds averaged 6,574 AFY.

3.5. Groundwater

Groundwater occurs under unconfined conditions in the unconsolidated sediments of the subbasins including the Channel Aquifer and Alluvial Fan Aquifers. Water level data from the underlying consolidated sedimentary units are limited, but groundwater is likely more confined in the deeper units. Water levels and groundwater flow in the subbasins are described in the following sections.

3.5.1. Water Levels

Groundwater data dating back to 1916 were compiled into a water level database from multiple sources, including DWR, SAWPA, USGS, Riverside County, and the City. At least five water level measurements in the Study Area were available for each year since 1924 with one or two measurements in 1916, 1919, and 1922. Hydrographs were generated for most of the wells containing five or more measurements to examine water level trends and fluctuations throughout the basin. Three key hydrographs were selected to represent long term water levels in each subbasin. Locations of the three wells used to construct the key hydrographs are shown on Figure 22 and hydrographs are presented on Figures 23, 24, and 25. A discussion of water level trends and fluctuations in each subbasin is provided below.

3.5.1.1. Water Levels in Temescal Subbasin

Water level changes in the Temescal Subbasin from 1953 to 2004 are shown on the long-term hydrograph on Figure 23. The graph shows the time period 1947 through 2004 for easy comparison to the pumping graph on Figure 20. The hydrograph combines water level data recorded during both pumping and static conditions in City Well No. 8, resulting in the somewhat spiking nature of the data, especially since 1987. Recent data from the City identified levels recorded during or immediately after pumping, but most of the data were not so designated. Filtering out designated pumping water levels removed data that appeared consistent with static

conditions and left many data points remaining that appeared to be lower than static water levels. As such, all levels are shown on Figure 23 to preserve the overall trend.

Since 1953, water levels have fluctuated a total of about 45 feet, from an elevation of 580 feet msl to about 535 feet msl (assuming the spikes below that level are influenced by local drawdown in the pumping well). In general, water levels correlate to wet and dry hydrologic cycles as shown by annual precipitation on Figure 5. The highest water levels were measured in the early 1980s in response to a wet hydrologic cycle that began in 1978. These higher levels also correlate to a period of relatively low pumping in the subbasin (Figure 20). During a later wet cycle from 1992 to 1998, water levels did not recover to 1980s levels, likely due in part to an increase in subbasin pumping (Figure 20).

Current levels appear to be near record lows with levels falling below 540 feet msl over the last few years. With precipitation data indicating near-average conditions in the basin, the declining water levels may be indicative of over-pumping conditions in the subbasin.

3.5.1.2. Water Levels in Coldwater Subbasin

Water levels in the Coldwater Subbasin are illustrated by the hydrograph from City Well No. 3 on Figure 24. As shown on the graph, water levels have fluctuated dramatically over the last 40 years in response to wet and dry cycles in the basin. In contrast to the 45-foot water level fluctuations noted in Temescal Subbasin, water levels in Coldwater Subbasin have varied more than 300 feet over approximately the same time period. The highest water level was recorded during 1983 at an elevation of 1,112 feet msl within 20 feet of the ground surface. During 2004, water levels fell below 800 feet msl for the first time in at least 40 years, possibly representing an all-time low water level for the subbasin.

The wide water level fluctuations over time in Coldwater Subbasin reflect the relatively small footprint and compartmentalization of the subbasin (Figure 21). The basin covers only about 2,000 acres and is surrounded on the west, north, and south by bedrock. In addition, communication with the adjacent Bedford Subbasin is impeded by the North Glen Ivy fault (associated with the Elsinore-Chino fault zone). Although the subbasin is capable of receiving large amounts of recharge from mountain runoff, it has a relatively limited storage capacity. However, it is unknown whether the recent steep decline in City Well No. 3 is reflective of water level conditions on a subbasin basis. Water level data are mainly available only in or near active pumping wells in the subbasin.

3.5.1.3. Water Levels in Bedford Subbasin

An analysis of groundwater conditions in Bedford Subbasin was conducted in support of a recycled water feasibility study conducted for LLWD and provided in Appendix D. This analysis incorporates and builds on data presented in the main portion of the GWMP. The recharge project is a groundwater management strategy for potentially increasing subbasin yield.

As described in detail in Appendix D, very few wells in the Bedford Subbasin contain a sufficient water level record to analyze long term trends. However several wells near the northeast outflow of the subbasin allow for an analysis of water levels at that location (Figure 22). One well, City No. 4, is located about 950 feet north of the northeast corner of Bedford Subbasin at the mouth of Bedford Canyon. Wells pumping in this area receive recharge from runoff in adjacent Bedford Canyon (Temescal Subbasin) as well as surface and subsurface outflow from Bedford Subbasin. The location is also downgradient from any subsurface outflow that occurs from Coldwater Subbasin (Figure 22). As such, water levels in this area are indicative of the total groundwater and surface water discharge where Temescal Wash temporarily leaves the subbasins. A hydrograph from this Bedford Canyon well is shown on Figure 25.

As shown on the hydrograph, water levels have fluctuated only about 60 feet over the last 40 years. The hydrograph is plotted at the same scale as the Coldwater Subbasin hydrograph (Figure 23) for comparison to the 300 feet of change seen just south of this well. In the Bedford Canyon well, water levels have been recorded as high as 782 feet, but have remained above about 770 feet for most of the period of record. Water levels dropped to around 720 feet during the relatively dry cycle from 1987 to 1995.

The ground surface elevation at this well is reported to be about 791 feet msl (Figure 24) indicating that water levels are within 10 feet of the ground surface during times of high water levels. Downstream ground surface elevations are around 780 feet, similar to water levels in the well. These surface elevations indicate the level at which the groundwater basin is likely discharging to Temescal Wash as the Wash leaves the subbasins and traverses north across consolidated sediments in Temescal Canyon. Production wells in this area are expected to reduce surface flows in Temescal Wash, but do not appear to have significantly impacted groundwater in any of the subbasins.

3.5.2. Groundwater Flow Directions

Groundwater flow in the Study Area is generally from the surrounding uplands toward Temescal Wash and then north and northwestward toward the groundwater and surface water discharge location at Prado Dam.

Only a few water level contour maps exist in available documents and none of them covers the entire area of the subbasins. As such, water level data were plotted for various time periods to analyze groundwater flow directions over time. Water level contour maps are presented on Figures 26 and 27 for representative periods of low water levels and high water levels in the basin, respectively. These maps are discussed in more detail below.

3.5.2.1. Groundwater Flow – Spring 1964

Figure 26 shows a water level contour map based on water levels from Spring 1964 and represents a time period when water levels were at relatively low levels in each of the subbasins

as indicated on the key hydrographs (Figures 23, 24, and 25). Very few data points were available in Bedford or Coldwater subbasins during this time period, and water levels there are highly interpretive. In addition, almost no water level data are available in the alluvial fan deposits in southwestern Temescal Subbasin, so contours have been interpreted to mirror topography.

In the Bedford Subbasin, groundwater flows northward in the thin alluvial sediments. Given the narrow alluvial constriction at the southern corner of the subbasin, there is unlikely to be significant subsurface inflow of groundwater into the Study Area from the south. Almost no water level data are available from the central portion of the subbasin and contours were interpreted using geology and ground surface elevations.

Groundwater in Coldwater Subbasin flows from recharge areas in the west toward the North Glen Ivy fault that separates Coldwater and Bedford subbasins. Outflow does not likely occur during times of low water levels when significant differences in water levels are noted across the fault. When groundwater outflow does occur from Coldwater Subbasin, flow likely follows subsurface channels beneath the surface water drainageways at the central portion of the subbasin boundary. Dissected outcrops of older, semi-consolidated deposits indicate a few pathways of incised surface water drainages emanating from Coldwater Subbasin and crossing Bedford Subbasin in this area. Once in Bedford Subbasin, both groundwater and surface water flow continue northward to the subbasin boundary where flow converges with groundwater flow out of Bedford Canyon. Here water levels rise and partially discharge to Temescal Wash as it enters Temescal Canyon.

An area of uncertainty is in southeastern Temescal Subbasin north of Bedford Canyon where a groundwater divide may be present. Highly dissected alluvial fan deposits and bedrock outcrops of various Miocene-age formations indicate complex geology and thin alluvial deposits north of Bedford Canyon (Figures 9 and 10). A groundwater divide is interpreted in this area, defined by northerly flow north of the divide and northeasterly flow in Bedford Canyon south of the divide.

In the southwestern portions of the Temescal Subbasin, groundwater flows northeast in alluvial fan deposits toward the area of the Channel Aquifer. Groundwater then flows northwesterly toward the subbasin outflow at the Prado Management Area. Groundwater rises and leaves the basin as surface water discharge at Prado Dam.

3.5.2.2. Groundwater Flow - Spring 1984

Groundwater elevation contours estimated for conditions in Spring 1984 are shown on Figure 27. Spring 1984 represents the end of an extended wet hydrologic cycle and water levels are at relatively high water levels throughout the Study Area. In general water levels in northern Temescal Subbasin are about 25 to 40 feet higher than in 1964. In Coldwater Subbasin, water levels are almost 200 feet higher than in 1964. In Bedford Subbasin, water levels appear to be

similar to 1964, constrained somewhat by the ground surface elevations. Groundwater discharge to Temescal Wash is likely occurring in northern Bedford Subbasin during times of high water levels. Groundwater flow directions are generally similar to those in 1964. However, outflow from Coldwater Subbasin is likely occurring in 1984, adding recharge to the Bedford Subbasin.

3.5.3. Groundwater Quality

Groundwater quality data for this study were sourced from SAWPA, the California DPH Drinking Water Program (DHS DDWEM, July 2006), and the City of Corona. Data were combined into a comprehensive database and used to identify the chemical signature of groundwater and concentrations of constituents of concern within the Study Area.

3.5.3.1. Inorganic Groundwater Chemistry

Inorganic water quality data from 102 wells in the Temescal, Bedford, and Coldwater subbasins were used to evaluate the general groundwater chemistry across the Study Area. Well locations are shown on Figure 28 and are color-coded by general areas of similar water quality. The water quality in these areas may be impacted by inflows from different source areas based on the hydrogeologic analysis of the Study Area. These areas are summarized on the following table.

Table 3-2
Groundwater Areas for Water Quality Assessment

Subbasin	Groundwater Areas	Number of Wells
Temescal	Southwestern Alluvial Fan	6
	Arlington Gap	15
	Norco Area	16
	Upgradient (southeast) of Norco	16
	Downgradient (southwest) of Norco	33
	Temescal Wash - Bedford Canyon	5
Coldwater	Coldwater Subbasin	10
Bedford	Bedford Subbasin	1

To characterize groundwater quality in these various areas, water quality data were evaluated using a geochemical plotting technique known as a Trilinear Diagram (Piper, 1944). This technique plots the major anions and cations in percent milliequivalents per liter (% meq/L) to characterize inorganic water chemistry and differentiate samples of varying water quality. Cations in % meq/L are plotted on the lower left triangle and anions in % meq/L are plotted in the lower right triangle. Data are projected onto the central diamond to evaluate overall water type.

Water samples of similar quality plot together in a cluster. Water samples that are a mix of two different source waters plot between the two source type end members.

Figures 28 and 29 show trilinear diagrams of the groundwater chemical signatures in Coldwater and Temescal subbasins, respectively. Only the most recent reported groundwater quality data for each well are plotted. This methodology combines data from 1953 to 2005, but a comparison of historical and recent data indicates no significant changes in inorganic water chemistry over time.

Overall, most of the water quality data indicate similar inorganic chemistry. As shown on the figures, data points for most of the wells generally cluster in the central portion of the diamond (shaded areas on the plots on Figures 28 and 29), indicating primarily a sodium/calcium-bicarbonate water type. However, variability of water types can be correlated to specific areas and indicate the following relationships:

- Groundwater in the Coldwater Basin (Figure 28) has a relatively high calcium-to-sodium ratio compared to groundwater in Temescal Subbasin (with the exception of groundwater in the western alluvial fan). This relationship is likely caused by the chemical interaction of rainfall and outcropping granitic bedrock (and the lack of outcropping volcanic bedrock) in the Coldwater Basin watershed.
- Groundwater in wells located in the Bedford Canyon portion of Temescal Wash or Temescal Canyon (Figure 28) has a higher ratio of calcium-to-sodium and sulfate-to-chloride than wells located in Arlington Gap. Relative cation concentrations indicate that groundwater in the Temescal Wash area upgradient of the Norco area is a mixture of waters from both the Temescal Canyon area and Arlington Gap, but are most similar to the water in Arlington Gap.
- Groundwater in wells located in the Norco area has a lower ratio of calcium-to-sodium and sulfate/bicarbonate-to-chloride than most other areas.
- Groundwater in wells located in the southwestern alluvial fan has the highest ratio of calcium-to-sodium and sulfate-to-chloride/bicarbonate compared to groundwater in other areas. The water type in the alluvial fan may result from geochemical interaction between rainfall runoff and the outcropping Santiago Peak volcanics in the western catchment area of Temescal Subbasin prior to aquifer recharge along the base of the mountains.
- Cation concentrations indicate that groundwater in wells located in Temescal Wash downgradient of the Norco area appear to be mixtures of groundwater from three sources: Temescal Wash upgradient of the Norco area, Arlington Gap, and the western alluvial fan.

This water quality source assessment indicates the major sources of water by analyzing the blending of different water quality from different areas. Identifying major areas of inflow and outflow is critical in developing a strong conceptual model of the aquifer. Based on water

quality type, the groundwater in the Channel Aquifer appears to be derived mainly from Arlington Gap and to lesser extent Temescal Wash. In addition to these sources, the western Channel Aquifer also receives inflow from the Alluvial Fan.

3.5.3.2. Total Dissolved Solids (TDS) Concentrations in Groundwater

Groundwater in the Study Area tends to be highly mineralized. Figure 30 shows the range of total dissolved solids (TDS) concentrations across the Study Area. Data represent the most recent concentration of TDS from 89 wells. The map indicates that groundwater in the Temescal Subbasin generally exceeds the secondary maximum contaminant level (MCL) of 500 mg/L for drinking water. TDS concentrations greater than 1,000 mg/L are observed beneath Temescal Wash and in the Norco area. Groundwater in the Norco area is also characterized by elevated hardness.

TDS concentrations in the Coldwater and Bedford subbasins are generally lower in TDS and range from 300 to 650 mg/L. Average TDS concentrations for each subbasin are summarized below.

Table 3-3
Total Dissolved Solids in Groundwater

Subbasin	Number of Wells	TDS (mg/L)	
		Range	Geometric Mean
Temescal	80	307 - 1,950	894
Bedford	1	630	630
Coldwater	8	300 - 650	477

3.5.3.3. Nitrate Concentrations in Groundwater

Elevated nitrate concentrations have been documented in the Temescal Subbasin since at least the 1950s. The latest reported nitrate concentrations (as NO_3) for 78 wells in the Study Area are shown on Figure 31. Water quality data indicate nitrate concentrations ranging from 0.3 to 124 mg/L. Although the average nitrate concentration in the subbasin is 41 mg/L, nitrate concentrations in 28 of the 72 subbasin wells do not meet the primary MCL standard of 45 mg/L for drinking water. The highest nitrate concentrations are those associated with wells at the Arlington Gap where concentrations of groundwater entering Temescal Subbasin exceed 100 mg/L. Elevated nitrate concentrations are also generally located along Temescal Wash and on the western alluvial fan.

Groundwater quality in City wells typically does not meet federal or state drinking water standards for nitrate (45 mg/L). Nitrate concentrations (as NO_3) measured in the City production

wells typically range from 4.0 to 110 mg/L. Most wells require treatment and/or blending to meet regulatory requirements.

In the Coldwater Subbasin, groundwater nitrate concentrations (as NO_3) for six water supply wells range from 0.4 to 6.5 mg/L, significantly below the MCL. Although data were generally unavailable for the Bedford Subbasin, DWR reports historical elevated nitrate and sulfate concentrations in the area (DWR, 1959). However, one recent sample (2007) from a Bedford Subbasin well indicated a relatively low nitrate (as N) concentration of 1.2 mg/L (LLWD, 2007).

3.5.3.4. Additional Water Quality Concerns

As urbanization has increased in the Study Area, the potential for groundwater quality impacts from anthropogenic (human-influenced) sources has also increased. Numerous underground storage tanks (USTs), dry cleaners, and industrial facilities are located across the subbasins and in adjacent basins. Potential impacts from historical anthropogenic sources are also a concern. For example, years of wastewater discharge by citrus processing facilities occurred in areas where locally elevated chloride concentrations have been detected. In addition, the U.S. Navy operated an ordnance laboratory in the Norco area in 1957 (DWR, 1959). Data were compiled from regulatory agencies in the Study Area to identify areas of concern.

Regulated Facilities

Potential threats to groundwater quality are regulated by RWQCB, Department of Toxic Substance Control (DTSC), and the Riverside County Department of Environmental Health (DEH). A review of the RWQCB database identified 30 major sites that are regulated for possible environmental releases in the Corona area and approximately 75 Underground Storage Tank (UST) investigations. These sites are shown on Figure 32. Regulated facilities and USTs that overlie the areal extent of the Channel Aquifer are of highest concern, given the permeable nature, shallow depth, and the reliance on the aquifer for water supply.

Corona Sanitary Landfill

One regulated facility, the Corona Sanitary Landfill, has impacted local groundwater quality and remains a potential threat to existing city wells and the Channel Aquifer. Riverside County Waste Management Department (RCWMD) operates the closed sanitary landfill on an 80-acre site identified on Figure 32. Groundwater impacted by trichloroethene (TCE) has been mapped offsite and downgradient of the landfill. The TCE plume, as interpreted in a 1999 study, indicates that elevated TCE concentrations are migrating toward City wells (RCWMD, 1999). The study also concludes that more than one source of TCE exists in the area.

Three City wells downgradient of the landfill plume have already detected low concentrations of TCE in micrograms per liter (ug/L) as summarized in the following table. One

additional nearby well not has not yet detected TCE, but does not appear to be directly downgradient from the TCE-impacted groundwater.

Table 3-4
TCE Detections in City Well Samples
Data Review Period 1999-2002

City Well	Number of Detections	Highest TCE Concentration
Well 6	7	1.0 ug/L
Well 7	12	2.2 ug/L
Well 17	10	2.4 ug/L

Although none of the detections have exceeded the MCL of 5 ug/L, the occurrence of TCE at the wells indicates a continuing threat to water quality. Strategies developed for this GWMP consider options to address specific water quality concerns.

3.6. Water Balance

Preliminary water balances have been prepared for the two subbasins that provide City water supply, Temescal and Coldwater, to evaluate current conditions and future sustainability of the groundwater resource. Data are generally inadequate for a rigorous assessment, and many simplifying assumptions have been made; nonetheless, the water balances presented here provide useful information for basin management and address the sustainability of the groundwater resource.

Data gaps and uncertainties associated with the Bedford Subbasin limit the ability to quantify inflows and outflows. In addition, Bedford Subbasin is relatively shallow, characterized by thin alluvial sediments and relatively high water levels with very little water use. Only one groundwater management strategy was identified with the Bedford Subbasin (groundwater recharge by LLWD) and that strategy was analyzed based on water level data and did not require a detailed water balance. Further analysis of the Bedford Subbasin in a feasibility study of the LLWD management strategy is provided in this document as Appendix D.

The water balances for Temescal and Coldwater subbasins are useful beyond application to GWMP management strategies. The evaluation provides a tool to improve the understanding of the groundwater system and to refine the conceptual model. It also supports improved monitoring in the basin, identifying where additional data would be most useful. The water balance will continue to be refined and updated in the future as additional data become available. In addition, the water balance provided a foundation of the development of the numerical model used to assess some management scenarios.

The water balance relies on data presented in the previous sections of the GWMP. Groundwater subbasin conditions and analyses are not repeated in this section, but previous figures are referenced where applicable. A more complete explanation of each figure is contained in the section where each was first introduced.

3.6.1. Approach

The water balance for Study Area subbasins examines inflow into the subbasins, outflow from the basins, and change in groundwater storage in the basin, recognizing the following relationship:

Inflows – Outflows = Change in Storage

To examine how these components change through time with varying amounts of recharge and pumping, the balance was conducted over a 15-year period, 1990 through 2004, covering a full hydrologic cycle of wet and dry conditions as well as significant changes in groundwater pumping. Change in groundwater storage over that time period was estimated independently using water level data, and compared to the net difference between estimated inflows and outflows to check for inconsistencies and to identify simplifying assumptions or data gaps of concern. For the Temescal Subbasin, the balance was further evaluated with the construction and calibration of a numerical groundwater model. These steps allow for a reasonable range of values to be determined for each element of the water balance and highlight the sensitivity of the water balance to specific elements.

To evaluate water balance components, the contributing watersheds and subbasins were subdivided and designated as water balance units to assist in the analysis. These units are shown on Figure 33 and allow for grouping areas together of similar land use, soil type, and/or other water balance factors within each unit. The delineation of similar areas within the water balance units are referred to in this document as water balance elements. These elements are shown on Figure 34 and represent areas of similar land use, soil type and precipitation zones.

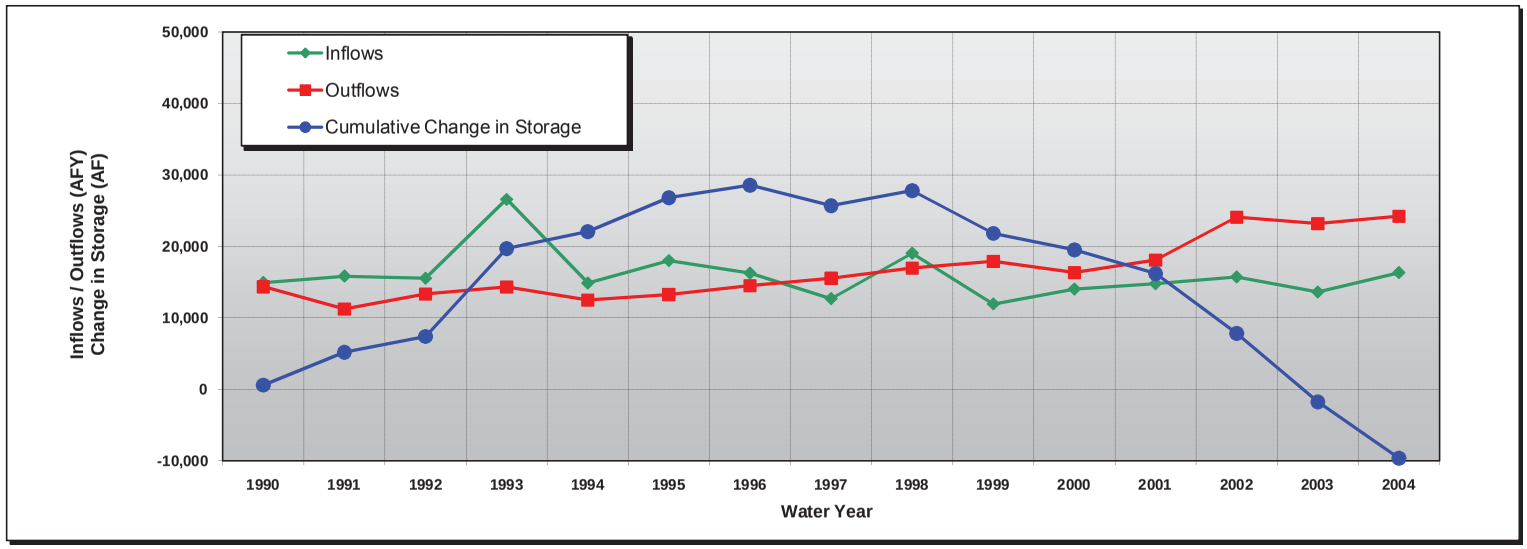
Throughout this report, areas are shown to the nearest acre, and water budget items are shown to the nearest AF. As a result, large numbers may appear to be accurate to four or five significant digits, which is not the case. Values for data that are measured directly, such as water levels, streamflow, and groundwater pumping, are probably accurate to two or possibly three significant digits. Values for data that are estimated, such groundwater storage changes and groundwater inflows and outflows, are probably accurate to only one or two significant digits. All digits are retained in the text and tables to preserve correct column totals in tables and to maintain as much accuracy as possible when converting units or conducting subsequent calculations.

3.6.2. Temescal Subbasin Water Balance

The water balance for the Temescal Subbasin was initially conducted through an independent evaluation of the different components of inflow and outflow from the subbasin. The resultant change in storage was checked for reasonableness by estimating the change in storage indicated by water level fluctuations over the Study Period. These inflows and outflows were then incorporated into a numerical groundwater model based on the hydrogeologic conceptual model of the basin. Inflows and outflows were adjusted during calibration to provide a better fit to measured water levels in key areas of the basin. The methodology for each of these steps is summarized in the following sections. Table 3-5 summarizes the water balance results as modified through groundwater model calibration. Documentation of the development of the groundwater model is provided in Appendix C.

Table 3-5
Water Balance Summary for Temescal Subbasin

Water Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Ave.
INFLOWS																
Deep Percolation from Precipitation	0	653	1,122	12,694	0	1,766	0	0	3,753	0	0	1,714	3,076	608	913	**1,753**
Infiltration of Runoff in Detention Basins	478	478	482	478	478	478	482	478	478	478	482	478	478	478	482	**479**
Recharge from Wastewater Discharge	6,978	7,380	7,797	8,214	8,629	9,056	9,474	5,238	7,812	3,650	6,104	6,072	6,289	5,994	7,997	**7,112**
Subsurface Inflow Subtotal	5,602	5,828	4,603	3,643	3,983	4,945	5,407	4,717	4,806	5,097	4,695	4,068	3,173	3,778	4,186	**4,569**
- Arlington Gap	4,654	4,880	3,652	2,695	3,035	3,997	4,456	3,769	3,858	4,149	3,745	3,120	2,225	2,830	3,235	3,620
- Temescal Wash (Temescal Canyon)	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
- Bedrock in Watershed	783	783	785	783	783	783	785	783	783	783	785	783	783	783	785	783
- Norco	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
Return Flows Subtotal	1,897	1,506	1,545	1,575	1,780	1,790	902	2,262	2,207	2,716	2,749	2,455	2,712	2,760	2,760	**2,108**
TOTAL INFLOWS (AFY)	**14,956**	**15,844**	**15,549**	**26,605**	**14,871**	**18,035**	**16,264**	**12,696**	**19,057**	**11,940**	**14,030**	**14,788**	**15,728**	**13,618**	**16,338**	**16,021**
OUTFLOWS																
Groundwater Pumping	10,248	7,294	9,378	10,302	8,465	9,233	10,470	11,492	12,889	13,847	12,251	13,981	19,986	19,073	20,112	**12,601**
Subsurface Outflow to Santa Ana River	4,104	3,944	3,973	4,019	4,028	4,040	4,050	4,061	4,074	4,074	4,096	4,102	4,123	4,121	4,114	**4,062**
TOTAL OUTFLOWS (AFY)	**14,352**	**11,238**	**13,351**	**14,321**	**12,494**	**13,273**	**14,520**	**15,553**	**16,963**	**17,920**	**16,347**	**18,082**	**24,109**	**23,194**	**24,227**	**16,663**
Cumulative Change in Storage (AF)	**604**	**5,210**	**7,408**	**19,692**	**22,069**	**26,831**	**28,575**	**25,718**	**27,812**	**21,832**	**19,514**	**16,220**	**7,839**	**-1,737**	**-9,627**	



3.6.2.1. Inflows to Temescal Subbasin

Inflows to the Temescal Subbasins include the following:

- deep percolation from rainfall on the basin floor
- return flows from urban and agriculture irrigation
- infiltration of runoff from surrounding uplands
- stormwater infiltration at flood control basins
- discharge at wastewater recharge ponds
- subsurface inflow from adjacent subbasins.

Each inflow component is estimated on an annual basis over the Study Period from 1990 through 2004. Methodology, assumptions, and results are discussed below.

Deep Percolation from Precipitation

Deep percolation from precipitation is the amount of precipitation (rainfall) that falls on the floor of the groundwater basin and infiltrates through the soil to the underlying water table. The volume of deep percolation is influenced by factors including the amount and timing of precipitation, soil type, geology, topography, vegetation cover, and extent of impervious areas (e.g., pavement and buildings). In the Study Area, deep percolation is limited due to the large impervious area of urban development that covers the basin floor, especially over the productive Channel Aquifer. In this area, a large portion of rainfall is funneled to lined storm drains and prevented from recharging groundwater. Nonetheless, deep percolation represents a significant portion of the subbasin inflow in wet years. It contributes almost no inflow in dry years.

Deep percolation was calculated over the Study Area using two steps: a runoff analysis and a soil moisture balance. The runoff analysis used the SCS Curve Number method to estimate the amount of precipitation resulting in runoff based on land use type, soil type, and precipitation amount. The soil moisture balance examines the precipitation that does not result in runoff and determines the amount available for groundwater recharge.

To account for the factors that vary spatially, the Study Area was divided into unique elements. This was accomplished by overlaying spatial maps to create elements each with a single soil hydrologic classification, soil moisture capacity value, precipitation multiplier, and land use category. Because the land use changes over time, a set of elements was created for each year that a land use map was available (i.e., even years from 1984 - 2004). For each year without a land use map (odd years), it was assumed that the land use remained the same as the previous year. The elements created for 2004 are shown on Figure 34.

For each element, the runoff analysis and soil moisture balance were applied to estimate deep percolation. Elements within the groundwater basin are applicable to deep percolation, while elements in the contributing watershed were analyzed as part of the evaluations of infiltration of runoff and subsurface inflow, respectively, which are addressed in subsequent sections.

Runoff Analysis

The Curve Number runoff analysis was developed by the SCS (Soil Conservation Service, now the U. S. Natural Resources Conservation Service, NRCS). The method is described in the document *Technical Release 55* from the U.S. Department of Agriculture (USDA, 1986). Direct runoff is calculated as a relationship between *rainfall*, the potential maximum *initial abstractions* and the *retention* after runoff begins.

Rainfall was estimated for each element and each month using historical rainfall data from the Elsinore station and the PRISM isohyetal map (see Figure 6). For watershed areas with substantially higher rainfall than Elsinore, monthly rainfall amounts were estimated by applying a rainfall-elevation factor based primarily on the PRISM map. Land use also was considered. Information on land use types and the portion of impervious area by housing type (provided in the Riverside County Flood Control and Water Conservation District Hydrology Manual) were used to derive a weighted average percent impervious area, 56 percent, which was used for all urban types. All precipitation falling on these impervious areas was assumed to become runoff that was captured by storm water collection systems (and removed from the water balance).

Initial abstractions include water that is captured before runoff. This initial abstraction includes plant interception, initial infiltration, and surface storage associated with ground cover and can be expressed as a percentage of the maximum retention. For the purposes of this study, initial abstractions were assumed to be 20 percent of the maximum retention, the recommended default value from the NRCS.

The *potential maximum retention* is estimated using a coefficient, or curve number. The curve number is based on information on land use and soil hydrologic classification, obtained primarily from the Hydrology Manual. The manual provides maps showing soil hydrologic groups (e.g., Group A – high infiltration through Group D – very slow infiltration) and provides the curve numbers for specific land use types and soil hydrologic groups. For this analysis, curves representing moderate runoff potential were used to calculate direct runoff on a monthly basis. These runoff values then were subtracted from actual precipitation to derive the *effective precipitation.* The effective precipitation is assumed available to meet ET demands, to contribute to soil water capacity, and to provide deep percolation to groundwater.

Soil Moisture Balance

Once the effective precipitation was calculated in the Curve Number analysis, it was input to the soil moisture balance. The soil moisture balance accounts for soil moisture storage

and provides an estimate of ET; the remaining water is assumed to recharge the aquifer as deep percolation.

Soil moisture holding capacity values were derived using the Riverside County and Orange County soil surveys performed by the NRCS (2006). Soil moisture capacity for each soil type was derived from the weighted average of the moisture capacity over the entire rooting depth. The soil types then were divided into four categories based on soil moisture holding capacity: low, medium, high, and very high capacity. These categories were overlain with the soil hydrologic groups (A through D). Figure 35 shows the distribution of the resulting soil types; soils without soil moisture holding capacity data (unknown-UNK or not available-NA) are indicated.

The soil moisture balance was applied to each element to evaluate deep percolation. In brief, the soil moisture balance computes deep percolation on a monthly time step as the residual of the equation:

Effective precipitation - ET - soil moisture storage = deep percolation.

The rate of percolation was then applied to each area to calculate the total volume of recharge from deep percolation. This analysis resulted in a range of recharge estimates from less than one AFY of recharge in years of very low precipitation such as 1999 and 2002 to almost 10,000 AFY in 1993, the wettest year of the Study Period. These numbers were adjusted upward slightly (about 2 percent) in the groundwater model during model calibration as documented in Appendix C. Final recharge values for the purposes of the water balance are provided in the first row of inflows in Table 3-5.

As shown in the table, deep percolation of precipitation averages 1,753 AFY for the Temescal Subbasin, accounting for about 11 percent of the total average subbasin inflow and about 7 percent of average precipitation over the Study Period. During that time period, recharge from deep percolation ranged from 0 AFY to 12,694 AFY.

Return Flows

When land is irrigated, either for agricultural or urban landscape uses, most of the water is consumed through ET, but some water typically percolates to the underlying water table (depending on irrigation efficiency). Urban return flows may also include leakage from septic systems, municipal pipelines, or other urban uses. Figure 8 shows general land uses in the Study Area for 1984 and 2004. For the purposes of this analysis, any area that currently receives water from a municipality is considered part of the urban area.

Urban Return Flows

The analysis of urban return flows involved evaluation of 1) the amount of municipal water used outdoors and 2) the portion of outdoor water that percolates to groundwater. Urban outdoor water use generally involves landscape irrigation, with different customer types (e.g.,

single family homes, multiple family homes, commercial/industrial, and landscape irrigation) using a different portion of water outdoors. The distribution of customer types in Corona was obtained from the City's Urban Water Management Plan (AKM, December 2005) and the amount of water served to each customer type was totaled. Estimation of the portion of water used outdoors for different customer types was derived from online DWR data on indoor/outdoor use for the North Riverside Detailed Analysis Unit from 1998-2004. While the relative portions of indoor and outdoor water use varied significantly from year to year, representative apportionments of 40 percent water use indoors and 60 percent water use outdoors was selected for multiple family homes. The apportionments for commercial customers and single family homes were similar. Applying these apportionments to the customer types and total water use, the portion of the total water supply used outdoors was estimated at 62.7 percent.

The urban return flow is the portion of applied irrigation water that exceeds the ET demands of the landscaping. For the purposes of this analysis, it was assumed that landscape irrigation water is not typically allowed to run off. Assuming that the average irrigation system is 90 percent efficient, then 10 percent of the applied water results in return flows to groundwater. Thus for each year, 10 percent of the water used outdoors returns to the aquifer as percolation.

A similar calculation addresses additional urban areas served by the City of Norco and Home Gardens County Water District. Assuming that water use has a similar indoor/outdoor apportionment as in Corona, the same portion (62.7 percent) of total water supply used outdoors was assumed. Similarly, it was assumed that 10 percent of the outdoor use would contribute to return flows.

Using this methodology, urban return flows average 1,960 AFY related to the City water supply and an additional 86 AFY associated with other urban water suppliers.

Agricultural Return Flow

Estimation of agricultural return flows was based on the total amount of applied water and the consumed fraction, which represents the portion of applied irrigation that is consumed by the crop through ET. According to the DWR website, the average consumed fraction for citrus crops in the North Riverside DAU from 1998 to 2002 was approximately 74 percent. The remaining 26 percent, assuming no runoff, represents agricultural return flow.

Although agricultural areas are now mostly urbanized, some agricultural areas were persistent in early portion of the Study Period. However, these agricultural return flows are small and average about 61 AFY, or less than one percent of total inflows to the groundwater subbasin. Total return flows for both urban and agriculture for Temescal Subbasin average about 2,108 AFY, about 13 percent of total inflows (Table 3-5).

Infiltration of Runoff

Although large amounts of natural runoff are generated in the Santa Ana Mountains west of the subbasin, most of this runoff is captured by the City's stormwater management system and is unavailable for infiltration into the groundwater basin. Two large flood control (detention) basins, the Oak Avenue Basin and the Main Street Basin, have been constructed on two main drainageways along the mountain front. These basins are owned and operated by the Riverside County Flood Control and Water Conservation District (RCFCWCD). The locations of these basins are shown on Figure 7. The Oak Avenue and Main Street detention basins together cover 28 acres and hold 240 AF of water at full capacity (about 120 AFY each) (PBS&J, 2004). The basins are operated to only detain peak flows and only a small amount of runoff is estimated to infiltrate the basin floor. Almost all of the flow is diverted into lined canals that drain to a lined portion of Temescal Wash, which ultimately conveys the runoff out of the subbasin. The only other large drainageway that provides significant runoff to the subbasin is Bedford Wash in the south. Runoff on this drainage is also lost from the Temescal Subbasin as it flows into Temescal Wash.

A variety of methodologies were examined to estimate the potential annual recharge through the Oak Avenue and Main Street detention basins, resulting in a wide range of possible values from several hundred AF to several thousand AF. The evaluation considered the potential wetted area, potential infiltration rates, variations in annual runoff, and anecdotal information on the number of days that water is observed in the basins. It was determined from this review that reasonable ranges of potential infiltration varied considerably. However, since the basins are operated only to detain peak flows for a very short duration, it was determined that a conservative average of infiltration would be appropriate for the water balance. As such, an estimated infiltration volume of 480 AFY is used. This is equivalent to about 240 AFY for each basin and assumes that an amount equal to twice the total basin capacities infiltrates to groundwater each year. This is considered a conservative amount and represents only about five percent of the runoff that could potentially reach the detention basins. The 480 AFY is maintained for every year in the Study Period. (The slightly different amount of 478 to 482 shown on Table 3-5 reflects rounded values extracted from detailed groundwater model budget outputs).

Another area for potential infiltration of runoff exists on the eastern side of Temescal Subbasin where Temescal Wash enters the subbasin from Temescal Canyon (Figure 7). Here, surface water is allowed to infiltrate along a short segment of the subbasin before entering a lined culvert near Magnolia Avenue (lined portion shown on Figure 7). The area available for recharge has historically been characterized by high groundwater, apparently from surface water infiltration and fine-grained soils at the surface. As such, infiltration from the wash is thought to be small and has been calculated by applying Darcy's Law to the subsurface area of Temescal Wash. This method results in an estimate of about 113 AFY of recharge, on average. In the absence of data that would be needed to allow this number to vary within a reasonable range of

values, the average amount is applied to the water balance for each year of the Study Period as shown on Table 3-5.

Wastewater Recharge

Since the 1950s, the City has discharged treated wastewater into unlined ponds in northern Temescal Subbasin. The current locations of the percolation ponds are indicated on Figure 33 and a graph of wastewater discharge to the ponds is provided on Figure 21. The three ponds, referred to as Lincoln, Cota North, and Cota South, range in size from 2.95 acres to 6.81 acres, and together total 16.51 acres. Since 1984, effluent volumes have ranged between 3,649 AFY and 9,476 AFY (Figure 21).

A 2006 wastewater pond investigation documented high historical percolation rates, ranging up to 25 feet per day (AKM, 2006). During the time of the investigation, percolation had decreased to less than 1 foot per day due to the buildup of clogging particles and organic material on the bottom of the ponds. As recommended in the investigation report, removal of fines and other pond rehabilitation methods were implemented and the higher percolation rates were restored. The amount of evaporation from the ponds is estimated to be small, given the high percolation rates and observations by City staff (perhaps about 30 inches or 40 AFY) and was not incorporated into the recharge amounts. As such, recharge to Temescal Subbasin from the wastewater discharge ponds is estimated to range from about 3,650 AFY to 9,474 AFY and averages 7,112 AFY as shown in Table 3-5.

A portion of the wastewater from WWTP No. 1 is now treated to tertiary levels and used for park irrigation. This change in operation occurred late in the Study Period (2002) and adds only a small amount of additional return flows for 2003 and 2004. As such, it is considered to have a negligible effect on the water balance.

The City operates a third WWTP, located at the southeast corner of Temescal Subbasin. Wastewater is used for local irrigation, with a small percentage discharged to Temescal Wash. Any addition of wastewater does not affect the water balance as the recharge from Temescal Wash is limited by lined channels and has been estimated at 113 AFY as described above.

Subsurface Inflow

Subsurface inflow contributes to the Temescal Subbasin from adjoining basins. In addition, some inflow likely occurs along the entire circumference of the Study Area from adjacent bedrock. General areas where subsurface inflows and outflows occur are indicated conceptually by arrows on Figure 33 and described in more detail below.

Subsurface Inflow at Arlington Gap into Temescal Subbasin

Water level contour maps indicate that groundwater enters the Temescal Subbasin from the Riverside-Arlington Basin through a narrow arm of the alluvial basin referred to as the

Arlington Gap (Figure 33). To estimate the volume of subsurface inflow across Arlington Gap, a calculation applying Darcy's Law was conducted using the cross-sectional area of water-bearing sediments, estimated hydraulic conductivity values, and a measured hydraulic gradient of 0.0028 ft/ft across the subbasin boundary. This amount was used as a preliminary target for inflow at this boundary in the groundwater model. Inflow amounts estimated by the model are provided on Table 3-5 and average 3,620 AFY. The methodology of the initial Darcy's Law calculation is described below.

As shown on cross-section C-C' (Figure 14), the saturated aquifer thickness at Arlington Gap (as defined by DWR Well 193583) is about 400 feet and includes both the Channel Aquifer and underlying Tertiary-age sandstones. Applying a K value of 1,500 gpd/ft^2 (200 ft/day) to the Channel Aquifer and 100 gpd/ft^2 (13 ft/day) to the Sandstone Aquifer results in an estimated average annual subsurface inflow through Arlington Gap of 4,869 AFY, of which 95 percent is represented by groundwater flow through the Channel Aquifer. This volume is in close agreement with a previous estimate by DWR of 3,000 AFY (DWR, 1947).

This value was tested in the groundwater flow model. As described in Appendix C, the boundary condition at the Arlington Gap was simulated with a specified head tied to water level data in a production well operated by Home Gardens Water District and located near the gap. As shown on Table 3-5, groundwater modeling indicated that inflow at the gap averaged 3,620 AFY over the Study Period and ranged from about 4,880 AFY to 2,225 AFY. Inflow decreased over the last few years in the Study Period in response to declining water levels in the well.

Subsurface Inflow from Surrounding Bedrock

Although limited by permeability, the bedrock surrounding the groundwater subbasin is recharged by small amounts of local precipitation. This bedrock groundwater system is in direct hydraulic communication with the groundwater in the alluvial basin over a relatively large area in the subsurface. Assuming that bedrock recharge and subsurface inflow will vary with precipitation, a soil moisture balance was calculated on the watershed area and the resulting groundwater recharge was used to approximate subsurface inflow. This amount was adjusted upward during model calibration.

Using these methods, about 783 AFY on average is estimated to provide subsurface inflow to the Temescal Subbasin from adjacent bedrock areas (Table 3-5). Although the amount was assumed to vary somewhat with precipitation, the lag time for inflow is unknown. Therefore a simplifying assumption was made using the average amount of inflow for each year in the Study Period as shown on Table 3-5. This inflow is relatively small and represents less than one percent of total precipitation in the watershed.

Subsurface Inflow from Norco Area

Although most of the Norco area is included within the Temescal Subbasin boundaries as provided by DWR, there are significant unknowns associated with the area. Alluvial sediments appear to be thin and interrupted by bedrock highs. In addition, a groundwater divide is indicated by the data, with some groundwater flow indicated to the north toward the Santa Ana River and exiting the subbasin. The area that contributes groundwater flow to the Temescal Subbasin is uncertain. As such, the area was simulated in the groundwater model as providing a specified flow into the subbasin, derived from a simple calculation of subsurface inflow using Darcy's Law. That calculation indicated an inflow of approximately 52 AFY, an amount that was held constant as an annual subsurface inflow for Temescal Subbasin water balance (Table 3-5).

3.6.2.2. Outflows from Temescal Subbasin

Two outflows from the subbasin have been accounted for in the water balance. The largest of these is groundwater pumping, mostly from the City's production wells. The other outflow component is the amount of groundwater that rises to surface water and contributes to the Santa Ana River outflow at Prado Dam. The incorporation of these components in the water balance is described below.

Pumping

Water pumped from the subbasin supplies water for urban, agricultural, and industrial uses. During the Study Period (1990 -2004), municipal uses account for 94 percent of the production. Pumping totals from the DMS were input into the water balance and the groundwater model. The monthly distribution of pumping used in the groundwater model was determined from the time period when monthly data were available and average monthly percentages were applied to annual totals.

As shown on Table 3-5, pumping represents the primary outflow in the water balance. During the Study Period, production in Temescal Subbasin averaged 12,601 AFY and ranged from 7,294 AFY to more than 20,000 AFY. In general pumping has increased during the Study Period with a significant increase beginning in 2002 when pumping exceeded 19,000 AFY. From 1990 to 2002, pumping averaged 10,821 AFY. From 2002 through 2004, average pumping increased more than 80 percent to 19,724 AFY. Section 3.4 provides a more complete discussion of pumping in the Study Area.

Subsurface Outflow

Subsurface outflows from the Temescal Subbasin are interpreted to occur at two main locations: contribution to baseflow at the Santa Ana River and contribution to Temescal Creek baseflow near Bedford Canyon. Methodology was similar to the calculations for subsurface inflow previously described.

Subsurface Outflow from Temescal Subbasin at Santa Ana River

Groundwater level contours in the Study Area (Figures 26 and 27) indicate that groundwater flows out of the Temescal Subbasin in the Prado Management Area (flood control basin) of the Santa Ana River (northern portion of the Study Area). Groundwater rises and discharges from the valley via surface water flow at Prado Dam. However, to incorporate subsurface data and provide a more reliable estimate of this amount, the outflow calculation was initially estimated at a location judged to be just upgradient of groundwater discharge to surface water.

To estimate the annual volume of subsurface outflow from Temescal Subbasin, the same methodology and K values were applied as those used for the Channel Aquifer and Tertiary deposits in the Arlington Gap inflow calculation. A hydraulic gradient of 0.0009 ft/ft was measured across the northwestern boundary of Temescal Subbasin, and an average saturated thickness of 600 feet was assumed for the Tertiary deposits. Results of the calculation using Darcy's Law indicate that the estimated annual subsurface outflow from Temescal Subbasin is 4,352 AFY, of which 90 percent is represented by groundwater outflow through the Channel Aquifer. This volume is within the previously estimated range of 3,000 to 9,000 AFY made by USGS in a study of groundwater outflow to Prado Management Area (French, 1972).

In order to analyze the variability of this outflow, output from the calibrated groundwater model was reviewed. This boundary was simulated as a general head boundary based on elevation of the pool at Prado Dam. Details of this boundary condition are provided in Appendix C. The model output agrees closely with the estimates from the calculations described above. These amounts are provided as outflow from the basin and are listed in Table 3-5. As shown in the table, average outflow to surface water is estimated at 4,062 AFY and varies within a relatively narrow range from 3,944 AFY to 4,123 AFY.

Subsurface Outflow from Temescal Subbasin along Bedford Canyon

Subsurface outflow from Temescal Subbasin at the subbasin southeast corner is interpreted to occur in the alluvial sediments of Bedford Canyon. According to hydrographs in this area (e.g., Figure 25 with location on Figure 22), groundwater discharge to surface water occurs in this area as Temescal Wash enters Temescal Canyon. Runoff contributing to infiltration along Bedford Wash is not accounted for in the water balance and is assumed to exit the subbasin as either groundwater or surface water. Because this area does not impact the remaining portions of the water balance, inflows and outflows are not included for this area.

Total Outflows

As shown on Table 3-5, total outflows from Temescal Subbasin, including pumping and subsurface outflow, average 16,663 AFY, about 642 AFY larger than average inflows. Outflows were generally less than inflows on an annual basis for most of the early years of the Study Period.

In recent years, outflows have exceeded inflows, especially in 2002-2004 when pumping amounts increased to about 20,000 AFY.

3.6.2.3. Change in Groundwater Storage in Temescal Subbasin

Groundwater in storage refers to the volume of groundwater in the saturated aquifers from the water table down to a level where groundwater extraction is limited by factors such as deteriorating water quality, insufficient permeability, or excessive lift costs. The amount of groundwater in storage changes from year to year with climatic variation and basin operation (i.e. pumping). The water balance provides a regional assessment of the change in storage by estimating how much water is entering and leaving the groundwater basin on an average basis and serve as an initial guide to the average amount of groundwater that can be extracted without significant depletion of groundwater. The balance is only an initial indication; changes in groundwater storage from pumping are controlled by pumping locations, boundary conditions, and the ability of pumping to capture inflows and outflows in the basin.

The change in groundwater storage predicted by the water balance is the subtraction of outflows from inflows. Although this calculation can be made annually, the change in storage over the Study Period is more representative of groundwater basin response to variable hydrologic conditions over time. The cumulative change in storage over the Study Period is also tabulated on Table 3-5 and represented by the graph at the bottom of the table.

For the Temescal Subbasin, the change in groundwater storage over the Study Period is estimated at -9,627 AF, an average deficit of about -642 AFY. The graph on Table 3-5 tracks the cumulative change in groundwater storage for each year of the Study Period (blue line on the graph on Table 3-5). The change in storage became negative only in the last two years of the Study Period, a time when average inflows were a little less than average (especially in 2003), but outflows increased more than 40 percent from average outflows due to increased pumping.

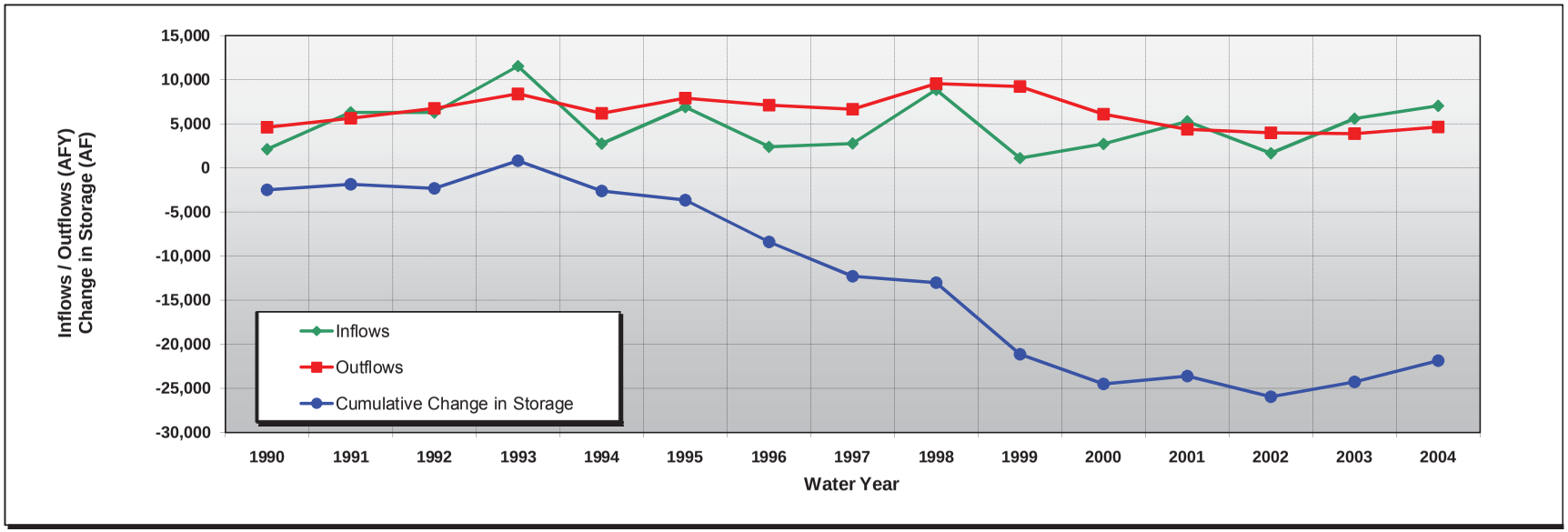
The deficit in cumulative change in storage is judged reasonable given that water levels have generally declined from 1990 to 2004. However, given that the pumping is primarily in the Channel Aquifer in the northern portion of the subbasin (Figures 16 and 18), the decline in water levels has not likely occurred on a basin-wide basis. Hydrographs in the Channel Aquifer indicate a water level decline of about 10 feet over the Study Period (e.g., Figure 23). The Channel Aquifer extends over about 3,000 acres and has an estimated specific yield of about 20 percent. Using these data and assuming an aquifer-wide water level decline, the change in storage is estimated at about -6,000 AFY. This amount is reasonably close to the average estimated change in storage in the water balance of -9,627 AFY (Table 3-5).

3.6.3. Coldwater Subbasin Water Balance

The water balance for the Coldwater Subbasin was initially conducted through an independent evaluation of the different components of inflow and outflow from the subbasin. The resultant change in storage was checked for reasonableness by estimating the change in storage indicated by water level fluctuations over the Study Period. The methodology for each of these steps is summarized below. Table 3-6 summarizes the water balance.

Table 3-6
Water Balance Summary for Coldwater Subbasin

Water Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Ave.
INFLOWS																
Deep Percolation from Precipitation	69	434	548	1,424	111	623	55	96	891	29	138	435	49	375	544	**388**
Subsurface Inflow from Watersheds	4	13	28	576	1	24	1	3	42	0	3	27	1	11	14	**50**
Return Flows																
- Agriculture	33	42	45	46	49	50	53	21	47	54	3	12	0	0	0	**30**
- Urban	127	159	169	149	135	121	165	166	200	162	160	143	121	118	160	**150**
- Industrial	226	183	149	112	95	98	124	132	143	210	42	129	158	189	324	**154**
Infiltration from Runoff	1,554	5,362	5,245	9,130	2,252	5,870	1,888	2,242	7,429	555	2,273	4,435	1,227	4,788	5,890	**4,009**
Glen Ivy Hot Springs Discharge	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
TOTAL INFLOWS (AFY)	**2,102**	**6,283**	**6,273**	**11,525**	**2,733**	**6,876**	**2,376**	**2,751**	**8,843**	**1,099**	**2,709**	**5,270**	**1,645**	**5,571**	**7,023**	**4,872**
OUTFLOWS																
Pumping	4,600	5,630	6,758	8,100	6,066	7,746	7,073	6,646	9,461	9,231	6,082	4,377	3,984	3,877	4,635	**6,284**
Subsurface Outflow to Bedford Subbasin	0	0	0	280	110	160	50	0	90	0	0	0	0	0	0	**46**
TOTAL OUTFLOWS (AFY)	**4,600**	**5,630**	**6,758**	**8,380**	**6,176**	**7,906**	**7,123**	**6,646**	**9,551**	**9,231**	**6,082**	**4,377**	**3,984**	**3,877**	**4,635**	**6,330**
Cumulative Change in Storage (AF)	**-2,498**	**-1,845**	**-2,329**	**816**	**-2,627**	**-3,657**	**-8,404**	**-12,299**	**-13,007**	**-21,140**	**-24,513**	**-23,619**	**-25,958**	**-24,264**	**-21,876**	



3.6.3.1. Inflows to Coldwater Subbasin

Deep Percolation from Rainfall

Deep percolation was calculated over the Study Area using two steps: a runoff analysis and a soil moisture balance, using the same methodology described for the Temescal Subbasin water balance. As shown in Table 3-6, deep percolation of precipitation is estimated to average 388 AFY for the Coldwater Subbasin, or about 8 percent of the total inflows. The amount is variable from year to year and is most significant during wet years (e.g., 1,424 AFY in 1993). The amounts are slightly higher than would be anticipated for average rainfall due to the open pits, permeable surface soils, and relatively un-vegetated industrial area of gravel mining in the southern portion of the subbasin.

Infiltration of Runoff

For Coldwater Subbasin, large amounts of runoff are generated in the Santa Ana Mountains adjacent to the basin and, unlike Temescal Subbasin, are not funneled into concrete lined culverts. The amount of water available for recharge varies annually with changes in rainfall and runoff amounts. Runoff was estimated from the contributing watershed using the same Curve Number methodology described in the Temescal Subbasin water balance.

Runoff into the Coldwater Subbasin is subject to ET, infiltration, or continued surface flow to the local drainageway of Temescal Wash. The contributing watershed to Coldwater Subbasin is comprised of about six individual watersheds. From south to north these are Mayhew Canyon, Coldwater Canyon, Anderson Canyon, Bixby Canyon, Brown Canyon, and smaller drainages south of Bedford Canyon. The northern subbasin is more developed and contains a stormwater control system. Therefore, it was assumed that runoff from the northern watersheds (i.e., Anderson, Bixby, Brown, and smaller drainages) do not significantly contribute to groundwater recharge. Runoff from Coldwater and Mayhew canyons, however, are diverted and managed for recharge and, as such, contribute significant amounts of inflow into the subbasin. Runoff from these two individual watersheds was based on the percentage of the entire contributing watershed area represented by Coldwater and Mayhew watersheds.

Runoff from Coldwater and Mayhew canyons is captured and diverted to gravel pits or spreading areas for groundwater recharge in the subbasin (MWH, 2004). The City has constructed berms and in-stream diversion structures along Coldwater Wash (assisted by Chandler Inc., the operator of the adjacent sand and gravel mining operation). Numerous berms capture streamflow and allow for infiltration into the permeable gravels of the streambed. EVMWD diverts varying amounts of surface water runoff along Mayhew Wash to gravel pits for enhanced groundwater recharge. Some portion of the diverted water may also provide irrigation to agriculture users in the subbasin, but the amount dedicated to such use is not documented (MWH, 2004).

Although most of the Coldwater and Mayhew runoff is conserved, wet years generate large amounts of water that bypass the recharge structures and flow to Temescal Wash (in some years causing flooding of local roads). For purposes of the water balance, in years with a total of more than 6,000 AFY of runoff it was assumed 85 percent of the runoff from Coldwater and Mayhew basins infiltrate to the groundwater system leaving about 5,000 AF over the study period that could not be captured. In years generating less than 6,000 AFY, 100 percent of the runoff was assumed to infiltrate, although some large storms may not be fully captured. In addition, the ET demands of the land cover were already taken into account in the runoff calculations. The total runoff resulting in groundwater recharge is estimated to average 4,009 AFY (Table 3-6). Runoff and recharge vary significantly from year to year with changes in precipitation.

Subsurface Inflow from Surrounding Bedrock

Subsurface inflows from bedrock were estimated for the Coldwater Subbasin using a similar methodology as the Temescal Subbasin water balance. Inflow is estimated to average only about 50 AFY (Table 3-6). This component represents the only subsurface inflow component applicable to Coldwater Subbasin.

Wastewater Recharge

Glen Ivy Springs operates a spa facility in the Coldwater Subbasin. The facility discharges approximately 90 AFY (per their NPDES permit) to a diversion channel that funnels discharge into Coldwater Wash (RWQCB, 2004). This flow is retained by the City's in-stream berms and is assumed to infiltrate to the groundwater. No other discharge of wastewater is known to exist in the Coldwater Subbasin.

Return Flows

Water supply available for return flows in the Coldwater Subbasin originates from several water sources. Total water supply includes groundwater pumping within the subbasin, imported water from LLWD (purchased from WMWD through Metropolitan), imported non-potable water by EVMWD from Corona Lake, and imported water from deep pumping by Glen Ivy Hot Springs (below the potable groundwater subbasin). A portion of the subbasin pumping is exported and not available for return flows within the subbasin. Groundwater pumping by the City of Corona is exported to the Temescal Subbasin. In addition, a portion of the EVMWD pumping provides water supply to the Butterfield Estates trailer park, just outside of the subbasin. The amount of exported pumping was not included in the return flow estimates for the subbasin.

Urban Return Flow

Urban return flows were estimated for the Coldwater Subbasin using the same methodology as used in the Temescal Subbasin. Land use data from DWR were used to identify changing urban areas during the Study Period. Urban water use was derived from total pumping plus imported water less basin exports. These exports include pumping by the City of Corona and

EVMWD, who provides water supply to Butterfield Estates located just outside of the subbasin boundary. Assuming that water use has a similar distribution as in the City of Corona, the same portion (62.7 percent) of total water supply used outdoors was assumed. Similarly, it was assumed that 10 percent of the outdoor use would contribute to return flows. As shown in Table 3-6, this methodology indicates that urban return flows in the Coldwater Subbasin average about 150 AFY.

Agriculture Return Flow

As documented in Table 3-6, agricultural return flows contribute only minor amounts of inflow to groundwater due to decreases in agriculture land use. Agriculture return flows in Coldwater Subbasin averages 30 AFY, but is thought to be higher prior to the beginning of the Study Period (before 2000).

Industrial Return Flow

Some industrial return flows are anticipated from sand and gravel mining use of groundwater. Groundwater is used to wash fines from the excavated sediments, and a portion of this water is returned to the gravel pits. Gravel mining operations are active in Coldwater Subbasin during the entire Study Period; however, pumping totals are small relative to pumping amounts by the City and EVMWD. Evaporation from the gravel pits and other losses associated with the mining operation are estimated to be small compared to the amount of water allowed to infiltrate back to the groundwater system. It was assumed 90 percent of industrial pumping becomes return flows.

Total Inflows

Total inflows for the Coldwater Subbasin are much lower than inflows into the Temescal Subbasin due to the smaller areal extent and relatively closed nature of the subbasin. Accounting for all of the inflows discussed above, total inflows are estimated to range from 1,099 AFY to 11,525 AFY and average 4,872 AFY over the 2,176 acres in the subbasin (Table 3-6).

3.6.3.2. Outflows from Coldwater Subbasin

Outflows from the subbasin include groundwater pumping and subsurface outflow to the Bedford Subbasin under certain conditions. Pumping represents the primary outflow in the water balance (Table 3-6). During the Study Period, production in Coldwater Subbasin averaged 6,284 AFY (Table 3-6). Section 3.4 provides a more complete discussion of pumping in the Study Area. Assumptions regarding the outflow to Bedford Subbasin are described below.

Subsurface Outflow from Coldwater Subbasin to Bedford Subbasin

The North Glen Ivy fault forms the subbasin boundary between Coldwater and Bedford subbasins. Details of where and under what conditions groundwater moves across the fault are not well understood. However, it is likely that when groundwater outflow occurs, it does so in the

central portion of the subbasin, based on natural surface water drainageways, topography, and the incised nature of shallow sediments and bedrock in the area. Estimates of subsurface outflow across the fault have been made by MWH (2004), which were interpreted to occur only in times of relatively high water levels. Those estimates were determined to be reasonable for this water balance and are incorporated for years in which outflow is estimated to occur (Table 3-6). These outflows are estimated to range between 50 AFY and 280 AFY and average only 46 AFY over the Study Period (Table 3-6). Declining water levels have resulted in a relatively closed basin over the last few years and it is assumed that during this time, subsurface outflow does not occur.

As shown on Table 3-6, total outflows from the Coldwater Subbasin are estimated to average 6,330 AFY over the Study Period. This amount exceeds inflows by an average of 1,458 AFY.

3.6.3.3. Change in Groundwater Storage in Coldwater Subbasin

The change in storage in the Coldwater Subbasin indicates a larger deficit in storage (Table 3.6) than occurred in Temescal Subbasin over the Study Period. The water balance indicates a cumulative loss of groundwater storage of about -21,876 AFY, an average deficit of about -1,629 AFY. To compare this deficit with declining water levels, a groundwater storage change was computed using water levels and subbasin hydrographs (e.g., Figure 24). These graphs indicate a decline in water levels of about 100 feet from 1990 to 2004, likely concentrated in the western subbasin where pumping occurs. Using a specific yield of 20 percent in the sediments where the decline has occurred and applying the deficit over approximately one-half of the subbasin, the change in storage over the Study Period is estimated at -21,760 AF. This estimate is consistent with the deficit predicted from the water balance. In addition, the graph on Table 3.6 showing the cumulative change in storage mimics the shape of the water level hydrograph on Figure 24 for the Study Period. This agreement provides additional confirmation of the average water balance estimates.

3.6.4. Water Balance Discussion

The results of the water balances indicate a negative change in storage at average pumping conditions in both Temescal and Coldwater subbasins over the Study Period. This indicates that more water is being withdrawn from the subbasins than will be naturally replenished over time, a condition referred to as overdraft. The water balances also provide a preliminary assessment for the operational range of the subbasins. Assuming no other significant changes in the water balance, average pumping totals of about 12,000 AFY in Temescal Subbasin indicate no significant loss of groundwater storage. For Coldwater Subbasin, average pumping totals around 4,500 AFY also indicate no significant loss of groundwater storage. These estimates are simplistic and do not take into account other changes in the water balance resulting from pumping decreases (such as potential increases in subsurface outflow or reduced return flows). Nonetheless, they provide a preliminary estimate for guiding management scenarios.

Although the Study Period is conservative, containing slightly below-average precipitation and ending with drought conditions, neither the Temescal or the Coldwater subbasin appears to be sustainable at the average pumping amounts unless additional recharge (natural or enhanced) can be captured. With an expected increase in demand associated with City build out, management strategies will be necessary to use the groundwater resource in a sustainable manner. An evaluation of current and future water demand as well as additional sources of water supply are provided in the following section.

4. City of Corona Water Demand and Supply

In order to manage the groundwater resource and provide for planned growth associated with build out, the City has examined current and future demand as well as water supply from other sources. Demand increases are categorized by water use type through 2030. The City is also taking measures for water conservation and demand management. Collectively, these data are summarized in previous City evaluations presented in their Water Master Plan (AKM, April 2005) and their Urban Water Management Plan (AKM, December 2005) and have been updated for this GWMP.

4.1. Current and Future Demand

The City has a wide array of water users, classified by sectors: residential single-family, residential multi-family, commercial, industrial, institutional/governmental, landscape, and agricultural. Total current water demand is 45,600 AFY (not including water transfers wheeled to the City of Norco and Western Municipal Water District in Calendar Year 2007). This represents a 15 percent increase from 2000 usage of 39,634 AFY.

Ultimately the City anticipates a total demand of 51,631 AFY by the year 2020 (projected City build out). In addition to use demand, the City must also account for spent filter backwash (from the Lester and Sierra del Oro water treatment plants) and brine reject (from the Temescal Desalter), which is currently 2,300 AFY. This amount is expected to increase to 2,954 AFY by 2020. A brief summary of the categories of water users and expected changes in the future are described below and summarized on Table 4-1.

Residential – Single-Family

In the City of Corona, a single family residential customer averages 3.5 persons per connection. Corona is a suburban community with approximately 30 percent of its acreage comprised of residential use. Total system consumption for this sector was 22,863 AF in 2000. Current consumption levels are at 28,000 AFY and are expected to ultimately increase 16 percent by year 2020 to 32,471 AFY. At build out, the single family residential water use will represent 63 percent of the total demand.

Residential – Multi-Family

Multi-family residential customers average 3.35 persons per household. Like the single-family residential sector, the multi-family sector is expected to experience significant growth over the next 15 years, but total demand is significantly less than for the single family sector. Currently the multi-family residential sector is using 4,000 AFY from 1,600 connections and is expected to increase to a total sector usage of 9,048 AFY with 3,601 connections by 2020.

Commercial

The City has a large mix of commercial customers that are categorized as general commercial, office professional, and downtown commercial. General commercial accommodates many commercial uses that service the community such as department stores, banks, supermarkets, and retail stores. Office professional includes general business, finance, insurance, real estate, and medical offices. Downtown commercial is intended to create a pedestrian-oriented street environment with such uses as retail shops, offices, services, cultural facilities, entertainment, and civic and public uses. Current commercial water use has grown about 18 percent to 1,700 AFY since the year 2000 and will ultimately grow to 1,980 AFY by 2020.

Industrial Sector

Corona has a large industrial base that is centered on high-tech and manufacturing. The industrial sector has increased water usage by 19 percent from 2000 to present and accounts for 3,200 AFY. This usage is expected to grow to 3,679 AFY by 2020.

Institutional/Governmental

The City has a stable institutional and government sector, primarily local government, schools, visitor services, and a public hospital. This sector will keep pace with the growth of the city.

Landscape

Landscape water use would be expected to increase with the growth of the city, fueled mainly by residential development. But increased efficiency and landscape conversions occurring at existing parks, golf courses, and cemeteries should help offset new demand and result in decreased water use in the future. Additional information on the City's water conservation and demand management efforts are described in Section 6.1.9 (management strategy 25).

Agriculture

Agricultural water demand has declined over the past 20 years, but is projected to remain fairly constant over the next 20 years. The City's General Plan reflects local citizen interest in space, quality of life, environmental values, and the long-term maintenance of a diverse economic base. It is projected that these objectives will be met with urban uses and open space rather than with agricultural land.

Table 4-1
City Current and Future Demand (AFY)

Year	Water Use Sectors	Single Family	Multi-Family	Comm.	Ind.	Special Acct.	Instit./ Gov.	Land-scape	Ag.	Total
2000	No. of accounts	33,616	1,355	277	515	3	9	583	35	36,393
	Deliveries AFY	22,863	3,405	1,443	2,679	666	82	3,230	480	39,634*
2005	No. of accounts	38,164	1,538	315	584	3	11	662	40	41,317
	Deliveries AFY	25,956	3,866	1,638	3,042	756	93	3,668	545	45,000*
2010	No. of accounts	42,593	3,213	339	631	3	10	485	34	47,308
	Deliveries AFY	28,968	8,072	1,766	3,282	740	79	2,686	468	46,062
2015	No. of accounts	44,140	3,329	352	654	3	10	502	35	49,026
	Deliveries AFY	30,020	8,366	1,831	3,401	767	82	2,783	485	47,735
2020	No. of accounts	47,743	3,601	380	707	4	11	543	38	53,028
	Deliveries AFY	32,471	9,048	1,980	3,679	830	89	3,010	524	51,631
2025	No. of accounts	47,743	3,601	380	707	4	11	543	38	53,028
	Deliveries AFY	32,471	9,048	1,980	3,679	830	89	3,010	524	51,631
2030	No. of accounts	47,743	3,601	380	707	4	11	543	38	53,028
	Deliveries AFY	32,471	9,048	1,980	3,679	830	89	3,010	524	51,631

*Total deliveries include sales/transfers to the City of Norco and WMWD.

4.2. Water Conservation and Demand Management

The City recognizes the importance of continuing current efforts for conserving water and decreasing demand. As such, they became a signatory to the California Urban Water Conservation Council (CUWCC) MOU in 1996 and are committed to implementing the 14 Best Management Practices (BMPs) in the MOU. The City has retained a Water Conservation Coordinator to lead these efforts.

The City and the Water Conservation Coordinator have developed and implemented an extensive water conservation education system, including a dedicated education center at the City's treatment plant. Materials and information on water conservation have been prepared and presented in schools (K-12) across the City. Last month alone, the Coordinator interacted with about 500 children in connection with numerous education programs, a total representative of a typical month. These programs not only provide basic information to younger children (typical of many programs), but also specifically develop material to target grades 6 through 12. It is more difficult and time-consuming to prepare materials for the older grade levels because much more detail is required. However, targeting the older children provides a higher level of education and potentially more benefits in promoting good stewardship of their water resource.

The City also sponsors numerous events that are focused on water. In May, the City held their third annual Water Festival, an event that attracts about 1,500 attendees. The City has also developed a Water Wise landscape award that is publicized to encourage residential responsibility. In addition to their own events and programs, the City participates in water conservation programs developed by Metropolitan and WMWD.

Since the single-family and multi-family residential sectors represent the largest growth in demand over the next 15 years, the City of Corona has implemented a water use efficiency program to offset increasing water demands. The program strives to increase water use efficiency by supporting water use surveys for residential and public facilities, ultra low flush toilet replacement, and educational/informational programs. Increased efficiency and landscape conversions occurring at existing parks, and golf courses should help offset new demand and result in decreased future water use for landscape irrigation.

4.3. Supply

The City water system contains potable water from two sources: local groundwater and imported water. The groundwater source includes the three groundwater subbasins described in this GWMP. The source of the imported water is the Colorado River and State Water Project water supplied by Metropolitan and purchased through WMWD. The supply obtained from each groundwater well and imported water sources from 1990 through 2007 is summarized in Table 4-2 and discussed in the following sections.

Table 4-2
Water Production and Purchases (AFY)

Source of Supply	Well #	1990	1995	2000	2002	2004	2007
Coldwater Basin	1	1,062	1,685		0	0	0
	2	0	1,191		0	0	0
	3	1,024	1,391	506	0	380	1,083
	20	0	0	0	0	0	430
	21	_	_	3,493	2,579	2,400	2,004
	Subtotal	*2,086*	*4,267*	*3,999*	*2,579*	*2,780*	*3,517*
Temescal Subbasin (including Well 4 in Bedford Subbasin)	4	253	173	0	0	0	0
	6	535	588	436	27	0	0
	7	531	654	876	12	0	0
	7A	0	0		15	1,202	1,149
	8 and 8A	1,164	1,737	1,654	1,517	2,081	1,812
	9 and 9A	650	467	554	14	2,480	1,443
	11	316	408	354	123	501	553
	12A	134	0	0	614	575	477
	13	886	0	0	0	231	699
	14	75	310	534	674	645	635
	15	761	1,150	1,633	870	1,480	1,122
	17A	1,059	1,349	959	954	454	1,701
	19	_	_	2,123	2,184	1,497	1,696
	22	0	0	0	4,465	2,885	2,343
	23	_	_	_	_	_	0
	24	0	0	0	679	200	394

Source of Supply	Well #	1990	1995	2000	2002	2004	2007
	25	0	0	0	3,686	2,386	1,334
	26	0	0	0	1,383	996	934
	27	0	0	0	0	253	184
	28	0	0	0	0	1,369	2,324
	Subtotal	*6,111*	*6,663*	*9,123*	*17,217*	*19,235*	*18,800*
Metropolitan Raw Water	WR – 19	11,574	6,373	13,920	12,384	11,452	15,638
	WR – 29	451	463	0	0	0	0
	WR – 33	5,471	4,661	6,258	3,924	3,039	3,919
	WR – 24	_	3,797	6,334	7,593	7,451	4,957
Metropolitan Treated Water	Lee Lake	_	_	_	_	98	43
	Subtotal	*17,496*	*15,294*	*26,512*	*23,901*	*22,040*	*24,557*
Total		**25,693**	**26,224**	**39,634**	**43,697**	**44,055**	**46,874**

4.3.1. Groundwater Basins

The City relies on the underlying groundwater for an increasing percentage of its total water supply. The City currently maintains and operates 21 production wells for its municipal potable water supply: 18 wells in the Temescal Subbasin, 3 wells in the Coldwater Subbasin, and 1 former well in the Bedford Subbasin (recently abandoned).

As previously discussed, most of the City's production is from the Channel Aquifer in the Temescal Subbasin. Typical depths for the City's wells in the Temescal Subbasin range from about 200 to 500 feet deep with screens as shallow as about 100 feet below ground surface. The combined capacity of the 18 Temescal Subbasin wells is approximately 23,405 gpm (about 38,000 AFY). Seven of these wells have been installed in the past five years (Wells 22, 23, 24, 25, 26, 27, and 28) to replace older wells and provide additional supply to the Temescal Basin Desalter for the improvement of water quality in the region.

The City pumps about 3,500 AFY from the Coldwater Subbasin from three active wells. The City also acquired the rights to the surface flows of Coldwater Canyon in 1964 when it purchased the assets of the Corona City Water Company (CCWC). To meet regulatory

requirements, runoff from the canyon is recharged through in-stream percolation ponds along Coldwater Wash. The City of Corona and EVMWD pump most of the groundwater extracted from the Coldwater Basin.

The City does not currently produce groundwater from the Bedford Subbasin, but has done so in the past at Well 4 located near WWTP 3. Although this well has been recently abandoned, the City has plans to re-drill in the Bedford Subbasin for future water supply.

The three subbasins from which the City extracts groundwater are not adjudicated. However, under a stipulated judgment entitled *Orange County Water District vs. City of Chino, et al*. (1968), the City, with other purveyors upstream of Prado Dam, have the right to use all surface and groundwater supplies originating above Prado Dam without interference from water purveyors downstream of Prado Dam, provided that the average adjusted base flow at Prado Dam is at least 42,000 AFY. WMWD is one member of a watermaster panel that administers provisions of this judgment. To ensure provisions of the judgment, the City is required to provide a base flow of 1,625 AFY (adjusted for water quality) from the City's WWTP.

The City of Corona has increased the production of local water relative to imported water. In 2000 the groundwater production accounted for 33 percent of the total supply. Last year in 2007 groundwater accounted for 50 percent of total water supply (not including water supplied to the City of Norco or WMWD), which is a 51 percent increase in local production since 2000. Looking forward, Corona would like to maintain an approximate 50 percent groundwater allocation for their water supply by year 2020. Based on the water balance provided in Section 3.6, current groundwater basin conditions in Temescal and Coldwater subbasins cannot support this level of production without significant enhanced recharge.

4.3.2. Imported Water

The City's imported water is supplied by Metropolitan and purchased through WMWD, a member agency of Metropolitan. The imported supply is delivered to the City through two separate pipelines. The Lower Feeder Pipeline supplies raw imported water to the City's Lester and Sierra del Oro water treatment plants (WTPs) through metered turnouts (WR-19 and WR-33 respectively). The Mills Pipeline delivers treated imported water directly to the City through a metered turnout (WR -24).

Turnout WR-19 is located in Chase Drive, east of Lester Avenue. The flow from this turnout is typically delivered by gravity to the City's Lester WTP located on Rimpau Avenue. The Lester Raw Water Booster Pump Station provides additional pumping head when the pressure in the Lower Feeder is not sufficient to deliver flow to the plant by gravity. This treatment plant has a firm treatment capacity of 25 million gallons per day (MGD) with a peak capacity of 30 MGD. In addition, current delivery constraints limit the treatment plant's capacity to 30 MGD. The hydraulic grade line at the turnout depends on the operation and flow through

the Lower Feeder pipeline. Based on observed pressures at the turnout, the hydraulic grade is around 1,075 feet msl.

Turnout WR-33 is connected to the Lower Feeder near Montana Ranch Road. WR-33 delivers raw water to Sierra del Oro (SDO) WTP located on Wilderness Circle via the SDO Raw Booster Station located on Montana Ranch Road. The SDO WTP has a firm treatment capacity of 6 MGD (9.1 MGD Peak). The estimated operating hydraulic grade elevation at this turnout is 1,070 feet msl, based upon the observed inlet pressure of 56 pounds per square inch (psi) and turnout elevation of 940 feet msl.

Turnout WR-24 is connected to the Mill's Pipeline at Temescal Canyon Road and La Gloria Road. The turnout is at elevation 890 feet msl and provides water to the City at a minimum hydraulic grade elevation of 1,380 feet msl. Corona's maximum allotment for this turnout is approximately 6.5 MGD (10 cfs). WR-24 delivers potable water to Zones 3, 4 and 5. Turnout locations and capabilities are summarized in Table 4-3.

Table 4-3
Imported Water Service Connections

Service Connection	Location	Elevation (Ft, msl)	Approx. Hyd. Grade Elev. (Ft, msl)	Max. Capacity (MGD)	Service Zone(s)
WR-19 (Lester WTP Supply)	Chase Dr East of Lester	945	1,075	30	3
WR-33 (SDO WTP Supply)	1670 Montana Ranch Rd West of Green River Rd	940	1,070	9.1	3
WR-24 (Mills Pipeline)	Temescal Cyn Rd at La Gloria Rd	890	1,380	6.5	3, 4, 5

The City also purchases a small amount of water from LLWD through the Mill's Pipeline at the City's Lee Lake connection. This water serves City customers near Weirick Road west of Temescal Canyon Road in the Bedford Subbasin.

The total combined supply capability of imported water is approximately 45.6 MGD (about 31, 666 gpm), which exceeds the estimated ultimate peak hour demand of 33.8 MGD (23,440 gpm). Assuming total capacity and available water, imported water supply could be as high as about 47,000 AFY.

Recent developments have added some uncertainty regarding the reliability of imported water from the State Water Project (SWP). A U.S. District Court decision in May 2007 ruled that the existing 2005 biological opinion for Delta smelt, issued by the U.S. Fish and Wildlife Service (USFWS), did not comply with the federal Endangered Species Act. The biological opinion

guides pumping operations for the SWP to ensure no long-term jeopardy to the health and habitat of Delta smelt. The Court ordered certain interim "remedies" or actions to protect endangered fish species until a revised biological opinion is prepared by the USFWS. These remedies collectively amount to cuts in statewide water supply for about one year (Calendar Year 2008). The long-term effect of the court decision is not known, but with these cuts, the availability of SWP water may be impacted, especially during drought cycles. Even though the City relies less on SWP for its imported water supply, these changes may result in increased competition for other imported water supplies.

4.3.3. Recycled Water

The City's recycled water system will ultimately consist of four service zones, four reservoirs, four booster pump stations, four pressure reducing valves and one surge anticipator valve, a portion of which is currently under construction. The existing recycled water distribution system consists of approximately 180,183 feet of pipe ranging from 4-inches to 24-inches in size. Approximately 31,531 feet of pipe is expected to be added to the system in the future.

The City expects recycled water demand to increase in the future and can currently supply up to 4,200 gpm (about 6,780 AFY). In addition, the source is seen as a reliable supply for recharging the groundwater subbasins to increase yield. Future expansions at the City WWTPs will increase recycled water supply by an additional 7,630 gpm (about 12,310 AFY), bringing the total future capacity to 11,830 gpm (about 19,090 AFY). These expansions will allow for increased recycled water for both irrigation and enhanced groundwater recharge (through basins and/or wells).

5. Basin Management Objectives

The City recognizes the need for more active groundwater management to maintain and protect the resource for reliable water supply. Establishing basin management objectives (BMOs) can provide a clear direction for the implementation of management activities such as pumping distribution and enhanced groundwater recharge. BMOs outline the water level and water quality conditions that are acceptable in the basin, address conditions that need to be remedied, and identify changes in the groundwater basin that need to be avoided. In consideration of the state of the groundwater basin and the water supply goals of the City, the following BMOs are proposed.

5.1. Manage Groundwater Basin in a Sustainable Manner

The City wishes to use groundwater as a long-term reliable supply and recognizes the importance of sustainability. As such, the City supports the operation of the basin such that natural or enhanced recharge can replenish the groundwater extracted on an average basis over time. This management objective recognizes the current overdraft conditions in the subbasins and proposes to adopt management strategies to move toward more sustainable use.

The perennial yield of a groundwater basin is defined as the amount of water that can be extracted on an average basis over time without adverse impacts (Todd and Mays, 2004). Because the term *adverse impacts* is defined on a site-specific basis and may change over time, the perennial yield of a groundwater basin may also change over time. The term *sustainable yield* suggests that a net decline in groundwater storage over some period of time such as an average hydrologic cycle would be an adverse impact and the goal of sustainability is to eliminate such declines. The sustainable yield of a groundwater basin is difficult to define in the absence of reliable, long-term data on all aspects of the water budget. In addition, the sustainable yield is not a fixed amount and can be altered by changes in inflows or outflows to the basin. This GWMP provides preliminary estimates on sustainable yield, but the actual yield will be better defined in the future as changes in operation and improved monitoring concurrently occur.

5.2. Prevent Substantial Water Level Declines in Channel Aquifer

Given the unconfined nature, shallow occurrence, and relatively limited thickness of the Channel Aquifer, water level declines are especially problematic. As water levels drop, the aquifer is de-watered and well yields are adversely affected. Some water level declines can be tolerated during drought conditions if groundwater is sufficiently replenished when recharge is available. As a preliminary operational guideline, the aquifer should be operated to prevent water level declines below about 50 percent of the total aquifer thickness. Assuming an average thickness of about 200 feet, then water levels should be maintained at least 100 feet above the bottom of the aquifer. The bottom of the aquifer is estimated to occur between about 400 to 450

feet msl, so water levels should be maintained above 500 to 550 feet msl across the aquifer. This lower limit is consistent with the range of historical water levels in the area.

5.3. Protect Groundwater Quality in Unconfined Aquifers

The unconfined aquifers on which the City relies are subject to impact from the quality of water infiltrating from the surface. Given the urbanized setting over the Channel Aquifer, this area is especially sensitive to future impact. Once water quality has been compromised, the resource may be subject to loss of use or expensive water treatment processes.

5.4. Maintain Required Outflow at Prado Dam

The stipulated judgment in *Orange County Water District vs. City of Chino, et al.* (1968) requires the City to contribute a baseflow of 1,625 AFY (adjusted for water quality) to the Santa Ana River. Depending on water quality the amount may be as high as 2,240 AFY (Boyle, 2001). Current subbasin outflow is significantly more than required, but basin management activities may reduce the total amount. The City wants to ensure that the required outflow continues to be provided in compliance with the judgment.

5.5. Monitor Groundwater Levels, Quality, and Storage

In order to continue to analyze current groundwater conditions and track changes in the groundwater basin resulting from active management activities, the City would like to expand and improve their monitoring program. The monitoring program would improve the understanding of groundwater level fluctuations, potential impacts to groundwater quality, and changes in groundwater storage across the three subbasins of interest.

6. Basin Management Strategies

6.1. Identification of Management Strategies

The following groundwater management strategies have been identified as having potential for improving the management of the groundwater basins. The 24 strategies have been grouped into seven categories involving similar facilities or locations, and are numbered for easy reference. The eight categories of management strategies are listed below:

- New and Replacement Water Supply Wells and Wellhead Treatment
- Groundwater Treatment Process Improvements
- Groundwater Monitoring Program
- Enhanced Groundwater Recharge
- Expanded Use of Recycled Water
- Use of Imported Water
- Wastewater Pond Maintenance
- Coordination with Regulatory Agencies

Specific strategies are listed in Table 6-1 and described in the following text. The strategies are not listed in order of priority. In addition, some strategies overlap those in other categories. For example, injection wells for groundwater recharge are listed as both a strategy for enhanced recharge and a strategy for expanded use of recycled water.

Table 6-1 List of Management Strategies

	Management Strategies
1	New Water Wells
2	Replacement Water Wells
3	Rincon Groundwater Treatment Project
4	Wellhead Treatment for Wells Impacted with VOCs
5	El Sobrante Groundwater Treatment Project
6	Groundwater Treatment Program
7	Groundwater Blending Program
8	Improvement of Groundwater Quantity/Quality Monitoring Program
9	Coldwater Subbasin Enhanced Recharge Project
10	Recharge Basins within the Oak Avenue Detention Basin
11	Recharge Basins within the Main Street Detention Basin
12	Upgradient Injection Wells
13	Recycled Water Injection Wells
14	Recycled Water Zone 3 to Zone 2 Interconnect
15	Recycled Water Zone 4 to Zone 3 Interconnect
16	WWTP2 Upgrade to Tertiary
17	WWTP1A Upgrade to Tertiary
18	Lee Lake Water District Recharge to Bedford Subbasin
19	Use of Recycled Water as In-Lieu Pumping
20	Purchase of Metropolitan Water District In-Lieu Water
21	Pipeline to Convey Metropolitan Water District In-Lieu Water to Border Avenue Recycled Water Reservoir
22	Lincoln and Cota Street Percolation Ponds Maintenance Program
23	Coordinate with Riverside County on Water Quality and Well Construction
24	Coordinate with the Regional Water Quality Control Board on Water Quality
25	Continue and Expand Water Conservation and Demand Management

6.1.1. New and Replacement Water Supply Wells and Wellhead Treatment

Strategies under this category provide for re-distribution of pumping within the Temescal Subbasin aquifers, use of poorer-quality groundwater, capturing a larger percentage of groundwater discharge from the subbasin, and replacing older less-efficient wells. Facilities

associated with these strategies include new wells, wellhead treatment, conveyance to the distribution system, and conveyance to brine disposal lines.

1. New Water Wells

In order to more effectively distribute pumping throughout the aquifer, the City is currently planning for the construction of one new water production well every two to three years. These new wells will enhance the City's production of groundwater during drought periods when imported water is limited. Additional wells will also allow for more flexibility in the maintenance of water levels in the Channel Aquifer. Wells will be located to pump within permeable aquifer zones while minimizing well interference. Wells will also be located to capture a portion of groundwater discharge that is currently exiting the groundwater basin, thereby increasing the basin yield.

2. Replacement Water Wells

The State Controller's Office lists the service life of water wells at 30 years. The City has eight water wells that have exceeded the 30-year service life. The City plans for one replacement water well about every three years.

3. Rincon Groundwater Treatment Project (wells plus treatment)

The Rincon project is in an area of historically high nitrate concentrations and the addition of wellhead treatment facilities will allow for expanded use of this poorer quality water. This project is scheduled for fiscal year of 2015-2016 at a projected cost of $15,000,000, reflecting the added costs of groundwater treatment. The proposed location is in the vicinity of Rincon Street and Alcoa. The project will yield 5,000 AFY to the current potable water system. The specific components of the project are three new wells, a raw water pipeline, a treatment process involving selective resins or best available technology (BAT) to reduce nitrate concentrations, a 6,500 sq. ft. building to house the process, a product pipeline, property acquisition, and brine disposal to the Santa Ana Regional Interceptor (SARI) pipeline.

4. Wellhead Treatment for Wells Impacted with Volatile Organic Compounds (VOCs)

Water quality in City Wells 7 and 17 appears to be threatened by groundwater plume(s) containing trichloroethene (TCE) and other VOCs migrating from an industrial area in eastern Temescal Subbasin. The City is evaluating the need to install a granular activated carbon (GAC) system or other groundwater treatment system to mitigate contamination at these production wells. Production here would also provide some containment of the continued migration, but additional data are necessary for a complete evaluation. More complete containment could be accomplished with new, properly-placed production wells in the area. This strategy is proposed as the El Sobrante Groundwater Treatment Project, described below.

5. El Sobrante Groundwater Treatment Project (wells plus treatment)

The El Sobrante project would target an area of impacted groundwater quality and, through proven treatment technologies, improve the quality for beneficial use. The project is currently scheduled for fiscal year of 2020-2021 at a projected cost of $20,000,000, reflecting the high cost of groundwater treatment. The proposed location is in the vicinity of Sixth Street and El Sobrante. The project will yield 5,000 AFY to the current potable water system. The specific components of the project are three new wells, a raw water pipeline, a GAC pre-treatment system to reduce TCE in the extracted groundwater, followed by a treatment process which will be selective resins or BAT to reduce nitrates in the groundwater pumped, a 6,500 sq. ft. building to house the process, a product pipeline, property acquisition, and brine disposal to the SARI pipeline.

6.1.2. Groundwater Treatment Process Improvements

Strategies for this category provide for increased treatment capacity to improve the quality of the water supply and the groundwater basin by reducing nitrates and salts in the ambient groundwater. Improving the quality of the water supply reduces the subsequent loading of these constituents in groundwater from wastewater return flows, thereby benefiting the groundwater basin.

6. Groundwater Treatment Program

The City currently operates the Temescal Desalter to reduce salts in the City's water supply. Expansion of the groundwater treatment program is needed to maintain long term water quality and usable supply. The amount of treated groundwater can be increased without additional facility expansion at this time.

7. Groundwater Blending Program

The City has an on-going nitrate blending program that is closely coordinated with the RWQCB and requirements of the City's salt management plan. Groundwater with elevated nitrate is blended with imported water or groundwater with lower nitrate levels. This allows groundwater extraction to occur in areas of high nitrate levels resulting from historical activities including agriculture.

6.1.3. Groundwater Monitoring Program

The goal of the monitoring program is to support the long-term sustainability and protection of the groundwater resource. The objectives of the monitoring program are to better understand groundwater conditions, monitor the impacts of groundwater use, identify changes to

groundwater quality, and evaluate the performance of management actions. The potential need for improved surface water monitoring and subsidence monitoring will also be evaluated.

8. Improvement of Groundwater Quantity/Quality Monitoring Program

The City desires to improve the current groundwater monitoring program to track water levels, groundwater quality, and groundwater storage throughout the subbasins and over time. Improvements involve the addition of dedicated monitoring wells that are not used for groundwater extraction. These wells provide a better representation of basin water levels and are not as influenced by near-well pumping depressions. The program involves the development of specific monitoring protocols including monitoring locations, frequency, measurements, sampling procedures, data management, and quality assurance/quality control measures. Current monitoring program and protocols are summarized in Appendix B with recommendations for future improvements.

6.1.4. Enhanced Groundwater Recharge

In order to increase basin yield and replenish extracted water, an increase in groundwater recharge is needed in all of the subbasins in this GWMP. Strategies for enhancing groundwater recharge involve the use of surface recharge basins, recharge wells, and in-lieu pumping when imported water is available. Sources of recharge water include stormwater, imported water and recycled water. Strategies that are more closely related to recycled water are repeated and expanded in the next section on recycled water.

9. Coldwater Subbasin Enhanced Recharge Project

The City may wish to implement an enhanced recharge project to enhance the quantity and quality of groundwater in the Coldwater Subbasin. Currently the City manages recharge in Coldwater Wash along a reach south of Glen Ivy Road. This enhanced recharge is accomplished through a series of in-stream berms that retain streamflow, allowing for increased percolation. Only high flows during wet years are not captured; these flows have been observed to contribute to local flooding of roads and may represent an opportunity for additional recharge water. The City may wish to work with Riverside County Flood Control District to investigate methods of capturing these additional flows.

In addition to Coldwater Wash, there may be additional drainages where natural recharge could be increased. It is our understanding that runoff from Mayhew Canyon to the south is being diverted and recharged by EVMWD, and additional opportunities for increasing recharge along that drainage may be limited. Some runoff along drainages in the northern subbasin (Anderson, Bixby, and Brown Canyons) may be available for enhanced recharge in the future, but additional analysis is required. These drainages are located in a relatively dense residential area and have

been modified for flood control. Enhanced recharge would likely involve diversions to a recharge area rather than in-stream berms.

10. Recharge Basins within the Oak Avenue Detention Basin

The Oak Avenue Detention Basin is a large stormwater basin located at the mountain front near Oak Avenue and Chase Drive. The basin is operated for flood control by RCFCWCD. According to a pilot study conducted by the City (PBSJ, 2004), a recharge basin constructed within the larger detention basin is capable of receiving and percolating about 2,500 AFY. If another similar recharge basin were constructed in the detention basin, recharge could be potentially increased to as much as 4,000 or 5,000 AFY. In addition to optimizing the recharge of stormwater, recycled water or imported water could be conveyed to the detention basin for recharge. The City has had discussions with RCFCWCD in the past about cooperating in a groundwater recharge project. This strategy would require stormwater monitoring and continued coordination with RCFCWCD to ensure compatibility in operation of the facility for both flood control and recharge. Facilities to convey recycled water are described in the recycled water strategies below.

11. Recharge Basins within the Main Street Detention Basin

Another flood control basin, the Main Street Detention Basin, could also be configured for additional groundwater recharge. The detention basin is located near Main Street and Upper Drive and functions to reduce peak flows into the lined channels of the City's stormwater management system. According to a pilot study conducted by the City (PBSJ, 2004), a recharge basin constructed within the larger detention basin is capable of receiving and percolating about 500 AFY. If two additional basins were constructed at the site, the quantity recharged could be tripled to about 1,500 AFY. Implementation of this strategy will require stormwater monitoring and may also involve potential cleanup work within the basin. Similar to the Oak Avenue basin, any evaluation for implementing a recharge strategy at the Main Street basin will require ongoing coordination with RCFCWCD.

12. Upgradient Injection Wells

Enhanced recharge through wells is an option for increasing yield to the groundwater basin. Although exact locations have not yet been determined, recharge would most likely be effective at the upgradient portion of the Channel Aquifer, near the Arlington Gap. Recharge wells would need to be located to minimize interference with inflow from the adjacent Riverside-Arlington Subbasin. Although the inflow has been observed to contain elevated nitrate concentrations, the area represents a major source of recharge water to the Channel Aquifer. Potable water, recycled water, or blended water could be injected into these wells. Specific components at each site would include a well, well head, down-comer pipes, flow metering, supply piping, flow control and pressure reducing valve, and air relief system.

6.1.5. Expanded Use of Recycled Water

The management strategies in this GWMP provide for the expanded treatment and use of recycled water. Given the potential restrictions on imported water and highly variable rainfall patterns in the valley, recycled water may be the most reliable source of water available for management strategies. Strategies within this category involve the expansion of recycled water use in the basin. Currently, recycled water is used for urban irrigation, but the demand is relatively small. These strategies would develop the infrastructure to expand recycled water use for irrigation, which would decrease reliance on the groundwater basin. The infrastructure would also allow the movement of recycled water to areas within the Temescal Subbasin for enhanced groundwater recharge, currently planned through injection wells.

In 2001, the City conducted a Recycled Water Master Plan (Boyle, 2001) to evaluate the potential to expand the direct use of recycled water for non-potable applications such as park irrigation. The study concluded that additional opportunities for recycled water use exist, primarily during the summer months. Current irrigation demand of recycled water is about 5,600 AFY. As this supply is expanded, additional recycled water could provide in-lieu pumping in the summer months and groundwater basin recharge in the winter months. The recycled water strategies that follow are built around this concept.

13. Recycled Water Injection Wells

Recycled water injection wells could be constructed in several areas of the City that meet regulatory requirements for residence time underground prior to extraction. The *Title 22, California Code of Regulations (Division 4, Chapter 3, Section 60320.010, California Department of Public Health)* states: “for a subsurface injection project, all the recycled water shall be retained underground for a minimum of twelve (12) months prior to extraction for use as a drinking water supply, and shall not be extracted within 2,000 feet of a recycled water injection well.” The required distance from extraction wells is currently under review and may be revised. This strategy would also need to meet other regulatory requirements including water quality objectives as provided in the DPH draft regulations (California DPH, 2007).

Specific components at each site include a well, well head, down-comer pipes, flow metering, piping and valves that are connected to the adjacent recycled water piping, and a flow control and pressure reducing valve.

14. Recycled Water Zone 3 to Zone 2 Interconnect

A pipeline that connects Zone 3 to Zone 2 would allow conveyance of recycled water to different water storage facilities in the City. Currently, Zone 3 is fed by WWTP3 and is not connected to any potential recharge sites such as the Oak Avenue and Main Street detention basins. Therefore, during wet periods the effluent from WWTP3 is currently unavailable for enhanced recharge to the groundwater basin.

15. Recycled Water Zone 4 to Zone 3 Interconnect

A pipeline that connects Zone 4 to Zone 3 would allow conveyance of recycled water to customers in Zone 4. This would provide more flexibility in using Zone 3 recycled water in Zone 4 rather than conveying Zone 1 or Zone 2 water to Zone 4.

16. WWTP2 Upgrade to Tertiary

The secondary effluent from Wastewater Treatment Plant 2 (WWTP2) is currently conveyed to the Lincoln and Cota percolation ponds. Upgrades could be constructed at WWTP2 that would provide tertiary treatment and disinfection of the secondary effluent and produce Title 22 recycled water. The recycled water from WWTP2 could be connected to the recycled water system distribution at Harrison Street—which is immediately north of WWTP2—or sent to the percolation ponds for recharge.

17. WWTP1A Upgrade to Tertiary

The secondary effluent from Wastewater Treatment Plant 1A (WWTP1A) is currently conveyed to the Lincoln and Cota percolation ponds. Upgrades could be constructed at WWTP1A that would route the flows through the WWTP1 tertiary filters and chlorine contact tank to produce Title 22 recycled water. The recycled water could then be stored in the on-site recycled water reservoir or sent to the percolation ponds for recharge.

18. Lee Lake Water District's (LLWD) Recharge to Bedford Subbasin

This recharge project includes discharging recycled water (tertiary treated and disinfected) produced by LLWD into surface recharge basins or injection wells (exact locations to be determined) in the Bedford Subbasin. This recycled water is currently being discharged to Temescal Wash and is not contributing to groundwater basin storage. Since the groundwater basin ultimately discharges to the wash, surface water flow on an average basis is not expected to be substantially decreased. The source of the recycled water is wastewater from local residential communities that are supplied with imported water of generally higher quality than ambient groundwater. The resulting recycled water typically has lower TDS values than the ambient groundwater. Therefore, the recharge of recycled water will likely have a beneficial water quality impact on the ambient TDS in the subbasin. In addition, both the City and LLWD may need to rely on local groundwater to increase water supply. Enhancing recharge is expected to increase the subbasin yield. A feasibility study of this project including impacts to water levels and water quality is included as Appendix D.

19. Use of Recycled Water as In-Lieu Pumping

The expanded use of recycled water as a substitute for groundwater under certain non-potable applications (such as park irrigation) would have major benefits for groundwater management. This use of recycled water would decrease pumping from the groundwater basin.

Currently, the City provides approximately 5,600 AFY of recycled water for irrigation. In 2001, the City conducted a survey to examine the potential for expanded recycled water use (Boyle, 2001). In that analysis, the engineers concluded that approximately 1,300 acres of parks, golf courses, and other landscape areas could be irrigated with recycled water. The City has a current capacity of about 6,780 AFY, with a current demand of about 5,600 AFY. As system improvements are made and additional recycled water is available, using recycled water to replace groundwater pumping is a viable management strategy. In addition, the sale of recycled water to customers for additional non-potable applications could provide revenue for continued investment in groundwater management strategies.

6.1.6. Use of Imported Water

Imported water has been and continues to be an important source of supply for the City. Water from the Colorado River and State Project Water is available from the Metropolitan Mills filtration plant and delivered to the City through three existing turnouts. These strategies involve the purchase of additional imported water when available for direct use to decrease groundwater basin pumping (in-lieu pumping). Alternatively, imported water may be used for enhanced recharge to the groundwater basin.

20. Purchase of Metropolitan Water District In-Lieu Water

In-lieu purchase water is excess raw water provided to Metropolitan customers at reduced rates. Use of this water will reduce the amount of groundwater pumped from the basin. When Metropolitan offers in-lieu water, the City should purchase it while concurrently reducing groundwater pumping as practicable. The in-lieu purchase water could be: 1) stored in the City's recycled water reservoir(s) for use; 2) stored in the City's recycled water reservoirs(s) and conveyed to spreading basins or injection wells for storage in the groundwater basin; or 3) treated at the City's water treatment plants and used as Title 22 drinking water.

21. Pipeline to Convey Metropolitan Water District (Metropolitan) In-Lieu Water to Border Avenue Recycled Water Reservoir

To convey the in-lieu purchase water to the City's recycled water facilities, a pipeline would need to be constructed from the City's WR-19 turnout (Metropolitan Lower Feeder connection) to the City's Border Avenue recycled water reservoir. In this area, available imported water could also be conveyed to recharge basins at the Oak Avenue Detention Basin. Recharge of imported water would require coordination with regulatory agencies such as the RWQCB and RCFCWCD.

6.1.7. Wastewater Pond Maintenance

This strategy provides for improved percolation of permitted amounts of wastewater into the groundwater basin. It is anticipated that amounts may decrease over time as treatment and use of recycled water is expanded.

22. Lincoln and Cota Street Percolation Ponds Maintenance Program

Regularly scheduled maintenance on the percolation ponds is critically important to optimize pond percolation and minimize losses to evaporation. This percolation provides groundwater recharge and contributes positively to the subbasin water balance. Even if most of this water ultimately leaves the subbasin as rising groundwater, it maintains head in the discharge area, decreasing gradients and the potential outflow of additional groundwater. Based on past monitoring of percolation rates in the ponds, they require maintenance approximately every 3 to 5 years. This consists of removing the fine soil particulates (filter cake) from the pond bottom and sides and hauling the filter cake offsite for approved disposal.

6.1.8. Coordination with Regulatory Agencies

The City maintains positive working relationships with local agencies, but currently has no centralized effort to coordinate with agencies on water quality issues for the protection and enhancement of the groundwater subbasins. The strategies offered below are a starting point for increased communication and action on specific groundwater issues.

23. Coordinate with Riverside County on Water Quality and Well Construction

The County of Riverside Department of Environmental Health (RDEH) conducts programs and services that are beneficial to the local groundwater subbasins (RDEH, 2008). Through the Water Engineering Program, the County handles well permitting for any well constructed in the County including, but not limited to, driven wells, monitoring wells, cathodic wells, extraction wells, agricultural wells, and community water supply wells. They are also responsible for the permitting, inspection, compliance, monitoring, and enforcement of state standards for small water systems in the County. These programs are consistent with and ensure well construction/destruction standards are implemented as developed by DWR. The City wishes to maintain a positive working relationship with the Water Engineering Program to track wells drilled within the subbasins and ensure proper well construction and destruction for the protection of the groundwater resource. Methods of coordination to access the well information at the County will be further explored through communication with Riverside DEH.

The Riverside DEH also conducts programs related to groundwater contamination. Their ongoing Local Oversight Program provides for oversight of the investigation and cleanup of soil and groundwater contamination from unauthorized releases from leaking underground storage tanks (LUSTs). This program is conducted under contract from the State Water Resources Control Board (SWRCB) and compiles regional information on assessment and cleanup efforts.

Information regarding UST cleanup sites and proposed corrective actions are available online and will be accessed periodically by the City to identify areas of concern. If such areas are identified, the caseworker at the County will be contacted for additional information and coordination.

24. Coordinate with the Regional Water Quality Control Board (RWQCB), Santa Ana Region on Water Quality Issues in the Basin

The City will work with the RWQCB to obtain information on groundwater contamination areas that may adversely impact water quality in the City's drinking water wells. This coordination will involve communication with the RWQCB on sites or areas of known or suspected groundwater impacts. This communication can also involve the periodic access of site cleanup lists on the RWQCB websites.

The City will also continue coordination with the RWQCB on monitoring industrial waste discharges to the sanitary sewer through the City's ongoing Industrial Waste Pre-treatment and Source Control Program. As a requirement of this program, quarterly and annual reports are provided to the RWQCB.

6.1.9. Water Conservation and Demand Management

As previously discussed, the City has committed to aggressive steps on water conservation and demand management. A full-time Water Conservation Coordinator has developed and implemented numerous educational programs (including an education center), water wise events and awards, rebate programs, data-based field tests to demonstrate actual water savings, installation of landscape irrigation controllers, and coordinated programs with Metropolitan and WMWD. Although these measures will continue on their established schedules, the City wishes to acknowledge and incorporate these activities into an overall GWMP strategy.

25. Continue and Expand Water Conservation and Demand Management Activities

Numerous programs have been implemented by the City's aggressive water conservation efforts. A rebate program for low-flow toilets and washing machines has been in place for several years. In addition to an extensive education program previously described (Section 4.2), the City is taking aggressive steps to reduce irrigation demand. The City has initiated a program of working directly with homeowners' associations and others on the installation of weather-based irrigation controls (WBIC) on landscape irrigation systems. Two test programs are planned to determine specific water savings for such devices and include a condominium neighborhood in the older part of Corona and a single-family residential neighborhood in an area of newer development. These two tests will provide monitoring data and information on potential water savings and demand reduction for application to other areas.

6.2. Evaluation of Management Strategies using AB3030 Checklist

Water Code Section 10753 provides a list of 12 examples of groundwater basin issues that may be considered in an AB3030 GWMP. These examples serve as a checklist to ensure that major groundwater basin issues are addressed. The issues are listed below, followed by an explanation of the relationship between each issue and the management strategies proposed in this GWMP.

6.2.1. Control of Saline Water Intrusion

The subbasins of interest are located in upland basins away from the coast and are not subject to the typical threat of coastal seawater intrusion. This issue can also include the potential influx of highly mineralized or brackish water from either natural or anthropogenic (human-influenced) sources. However, no highly mineralized influx has been identified to date. Although water entering the Temescal Subbasin through the Arlington Gap has been observed to have elevated nitrate and other minerals, the inflow contains similar water quality to ambient groundwater in the subbasin and is not a significant threat to water quality. In fact, this area has served as the main source of aquifer recharge to the basin.

6.2.2. Identification and Management of Wellhead Protection and Recharge Areas

Wellhead protection and recharge areas have been evaluated in the past and have been further assessed in this GWMP. In 2002, the City conducted an assessment of the vulnerability of their drinking water wells under the California Drinking Water Source Assessment Program (DWSAP). This program, developed by the California Department of Public Health (DPH) (formerly Department of Health Services), delineates the area around drinking water sources, such as wells, through which contaminants might reach the water supply. This assessment identified surface recharge areas in the vicinity of City wells. In addition, the analysis in this GWMP identifies the main areas of subbasin recharge for the aquifers tapped by City wells. These areas include the entire footprint of the unconfined Channel Aquifer, recharge areas along washes and alluvial fans, and areas of subsurface inflow such as Temescal Canyon and Arlington Gap.

Strategies to manage and protect the recharge zones involve coordination with regulatory agencies such as Riverside County DEH and the RWQCB. These agencies are responsible for evaluating impacts to water quality from industrial or commercial activities and leaking underground storage tanks (LUSTs). Strategies 23 and 24 provide for the coordinated management required for protection of water supply. Also, the City's expanded monitoring program (Strategy 8) will allow for better tracking of groundwater conditions in recharge areas.

6.2.3. Regulation of the Migration of Contaminated Groundwater

The RWQCB, Riverside DEH, and other regulatory agencies provide data and information on impacts to groundwater and potential offsite migration of contamination plumes. Strategies 23 and 24 allow for better coordination with regulatory agencies and identification of areas of contaminated groundwater. Strategies 4 and 5 (involving wellhead treatment of wells downgradient of contaminant sources) directly address one area where groundwater contaminated with certain VOCs has been migrating toward water supply wells.

6.2.4. Administration of a Well Abandonment and Well Destruction Program

Through their Water Engineering Program, Riverside DEH requires that a permit be obtained for the abandonment of any well in the County (Riverside DEH, 2008). Guidance for well abandonment procedures are consistent with the standards developed by DWR for drilling and destroying wells in California (DWR, 1991). In addition, the County provides a registry of approved well drillers who are familiar with County regulations and policies. The publication of such a list increases the likelihood that permits and proper well abandonment procedures will be followed. Strategy 23 involves increased coordination with the Riverside DEH Water Engineering Program and well abandonment procedures.

6.2.5. Mitigation of Overdraft Conditions

As indicated by the preliminary water balances for the Temescal and Coldwater subbasins, both areas have experienced overdraft conditions over the Study Period. From 1990 through 2004, Coldwater Subbasin experienced overdraft conditions with an estimated loss of about 20,000 AF of groundwater storage over the 15-year period. However, the water balance indicates that conditions were improving at the end of the Study Period because of decreased pumping rates in the subbasin. The City is working with other subbasin pumpers to control overdraft conditions through pumping limitations. Strategy 9 provides for an evaluation of enhanced recharge in Coldwater Subbasin.

The water balance in Temescal Subbasin indicates that overdraft conditions occurred in the last three years of the Study Period as average pumping increased from about 10,000 AFY to almost 20,000 AFY. Given the uncertainty associated with imported water amounts in the future, the City will need to rely on the groundwater subbasin for a substantial amount of its water supply. This indicates that control of overdraft conditions through pumping limitations alone may be unrealistic. As such, the City is including numerous strategies for managing groundwater while maintaining groundwater production.

Strategies 1 through 3 include new wells that will allow flexibility in pumping distribution and maintenance of water levels. Strategies 10, 11, 12, and 13 provide for enhanced recharge directly into the Temescal Subbasin. Strategies 9 and 18 provide for increased recharge

in Coldwater and Bedford subbasins. Strategies 14, 15, and 21 provide the infrastructure necessary for the conveyance of water to recharge facilities. Strategies 19 and 20 provide replacement water sources for a portion of the groundwater demand, potentially decreasing Temescal Subbasin production. Finally, Strategy 8 will allow for increased monitoring of groundwater levels and storage for the tracking of overdraft mitigation.

6.2.6. Replenishment of Groundwater Extracted by Water Producers

For this Study Area, the replenishment of groundwater extracted by pumpers in the basin is the same issue as the mitigation of overdraft conditions discussed above with a focus on Temescal Subbasin. As previously discussed, the replenishment of Coldwater Subbasin can likely be obtained with natural recharge over time if pumping reductions are in place. For Temescal Subbasin, enhanced recharge is more critical given the current and planned reliance on the subbasin for water supply. Strategies 10, 11, 12, and 13 are the most important strategies for replenishment with Strategies 14, 15, and 21 to provide the supporting infrastructure.

6.2.7. Monitoring of Groundwater Levels and Storage

Strategy 8 provides for the adoption of a monitoring program and protocols and a commitment for improved monitoring components in the future. The current monitoring program and protocols are described in Appendix B. Also included are recommendations for future improvements to the program.

6.2.8. Facilitating Conjunctive Use Operations

To provide for the efficient use of all water sources including groundwater, imported water, and recycled water, the City is interested in the construction and operation of several conjunctive use facilities. Strategies 9, 10, and 11 rely on existing detention basins or permeable off-stream sites for conjunctive use of surface water, imported water, and/or recycled water. In particular, Strategies 10 and 11 seem implementable with relatively minimal land acquisition and recharge basin construction costs. Strategies 12 and 13 involve the construction of injection wells that could use imported water or recycled water to replenish groundwater, especially during the winter months when excess water may be available. Collectively, these strategies provide for key conjunctive use facilities to be constructed and operated by the City.

6.2.9. Identification of Well Construction Policies

Since 1949, DWR has been given the responsibility for developing well standards for the purpose of water quality protection (DWR, 1991). Standards for the construction and destruction of water wells were first published in 1968 and updated in 1974 (DWR, 1981). Subsequent amendments to the Water Code required the development of minimum standards for monitoring and cathodic wells in addition to water wells. Bulletin 74-91 sets those standards as minimum requirements by local agencies. A permit filed in the form of a Well Completion Report/Driller's

Log is required by DWR for the drilling or destruction of wells in the State. A permit is also required by Riverside DEH to track wells in the County and ensure adherence to minimum construction standards. The City has not developed their own standards, but requires DWR standards and Riverside DEH standards.

6.2.10. Construction and Operation of Groundwater Contamination Cleanup, Recharge, Storage, Conservation, Water Recycling, and Extraction Projects

Strategies for groundwater management involve each of the components listed in this item with the exception of water conservation, which is being addressed separately by the City as summarized in previous sections of this document and described in the City's Urban Water Management Plan (AKM, December 2005). Strategies 4 and 5 provide for migration control of a VOC plume of contaminated groundwater and mitigation of water quality impacts to City wells. Strategies 9 through 13 and 18 describe recharge projects for increasing groundwater storage. Strategies 13 through 19 address the expanded and efficient use of recycled water. Strategies 1, 2, 3, and 5 provide for more flexibility in groundwater extraction through varying pumping distribution within the aquifer to manage levels and quality.

6.2.11. Development of Relationships with State and Federal Regulatory Agencies

Strategies 23 and 24 specifically address coordination with key regulatory agencies on groundwater management activities. Coordinated management focuses on water quality issues as regulated by the RWQCB and Riverside DEH and well construction/abandonment policies regulated by Riverside DEH and DWR.

6.2.12. Review of Land Use Plans and Coordination with Land Use Planning Agencies to Assess Activities which Create a Reasonable Risk of Groundwater Contamination

The City of Corona is close to build out with little opportunity for major changes to land use planning. Nonetheless, the Department of Water and Power can communicate closely with City planners on the vulnerability of the groundwater resource and protection measures for risk assessment. In the City's General Plan, adopted in March 2004, the City established a goal and related policies to manage urban runoff for protection of groundwater. Policies address the proper handling, storage, application, and disposal of pesticides, insecticides, and similar substances. Policies also address stormwater management and reuse and BMPs from construction.

6.3. Evaluation of Management Strategies

Several of the identified groundwater management strategies were evaluated with the groundwater flow model constructed as part of this GWMP. The evaluation and results are

discussed in the following sections. Details on model construction, calibration, and setup for application of the management strategies are provided in Appendix C. Figures C-11 through C-14 summarize changes in water levels in the target wells associated with the baseline evaluation and management strategies as described in the sections below.

6.3.1. Baseline Evaluation

To provide a baseline against which to measure groundwater management strategies, a baseline model run was developed that accounts for a total demand at build out of about 51,631 AFY. As previously discussed, the City has a tentative target for obtaining one-half of the demand from the groundwater subbasins, or a total pumping amount of 25,816 AFY. The Coldwater Subbasin appears capable of providing at least 3,500 AFY (equal to the City's 2007 pumping). Pumping in Bedford Subbasin could potentially provide another 600 AFY, leaving a demand of about 21,700 AFY from the Temescal Subbasin. Additional details of the baseline scenario are provided in Appendix C.

Modeling indicates that baseline pumping results in average water level declines of about 30 to 50 feet in the main portions of the Channel Aquifer over the simulation period. These declines would result in dewatering of more than 50 percent of the aquifer thickness in some wells, substantially decreasing well capacity.

The decline also represents a substantial loss of groundwater in storage in the unconfined aquifer. A summary of the average water budget components under baseline conditions is provided in Table 6-2.

Table 6-2
Baseline Evaluation Water Balance (AFY)

INFLOWS	Ave.
Deep Percolation from Precipitation	**1,689**
Infiltration of Runoff in Detention Basins	**479**
Recharge from Wastewater Discharge	**8,504**
Subsurface Inflow Subtotal	**5,163**
- Arlington Gap	4,182
- Temescal Wash (Temescal Canyon)	113
- Bedrock in Watershed	816
- Norco	52
Return Flows Subtotal	**2,542**
TOTAL INFLOWS (AFY)	**18,377**
OUTFLOWS	
Groundwater Pumping	**21,722**
Subsurface Outflow to Santa Ana River	**5,481**
TOTAL OUTFLOWS (AFY)	**27,203**
Change in Storage	**-8,826**

Values above represent average conditions over a 15-year model simulation period. The complete baseline simulation is summarized in Table C-3 in Appendix C. The groundwater basin water budget shown above indicates that under hydrologic conditions similar to the Study Period, an average decline in groundwater storage of about -8,826 AFY would be expected (subtract outflows of 27,203 AFY from inflows of 18,377 AFY). According to this analysis, pumping under the baseline scenario is unsustainable without additional management strategies to increase basin yield or reduce groundwater production.

6.3.2. Scenario 1 - Pumping Redistribution

To evaluate the impact of redistributing pumping within the Channel Aquifer, two new downgradient wells were simulated in this model run. The new wells were positioned to potentially intercept subbasin outflow to the Prado Management Area and were assigned a pumping amount of 2,500 AFY for each well. The baseline pumping total was maintained and pumping amounts were systematically decreased in current production wells to account for the added production in the new wells.

The water budget from this model run is summarized in Table 6-3. As shown in the table, the outflows are similar to the baseline simulation, but inflows have decreased (compare 18,377 AFY in Table 6-2 to 18,122 AFY in Table 6-3). As such, the average storage decline of -9,095 AFY is slightly worse than under baseline conditions due to the slight decrease in inflow from Arlington Gap. This occurred because decreased pumping in upgradient wells resulted in rising water levels and decreasing gradients across the gap. In addition, the new pumping was not sufficient to decrease basin outflow, which resulted in almost the same average outflow total as simulated under baseline conditions (compare outflows in Table 6-3 to Table 6-2). Annual results from the Scenario 1 simulation are provided in Appendix C in Table C-4.

Table 6-3
Scenario 1
Pumping Redistribution Water Balance (AFY)

INFLOWS	
Deep Percolation from Precipitation	**1,689**
Infiltration of Runoff in Detention Basins	**479**
Recharge from Wastewater Discharge	**8,504**
Subsurface Inflow Subtotal	**4,908**
- Arlington Gap	3,901
- Temescal Wash (Temescal Canyon)	113
- Bedrock in Watershed	842
- Norco	52
Return Flows Subtotal	**2,542**
TOTAL INFLOWS (AFY)	**18,122**
OUTFLOWS	
Groundwater Pumping	**21,742**
Subsurface Outflow to Santa Ana River	**5,475**
TOTAL OUTFLOWS (AFY)	**27,217**
Change in Storage (AFY)	**-9,095**

Although the decline in storage was greater, Scenario 1 was successful at increasing water levels in most target wells from baseline conditions (see Figures C-11 through C-14 in Appendix C). By the end of the 15-year simulation period, water levels had risen an average of about 10 feet in key wells. This is expected, given that most of the calibration targets are active pumping wells and any decrease in pumping will result in a rise in water levels. Nonetheless, this simulation suggests the water levels can be maintained on a short-term basis through redistributions in pumping.

Several additional model simulations were conducted with additional downgradient pumping wells to capture basin outflow to the Prado Management Area. Results of these runs are not included in the GWMP, but indicated that substantial increases in pumping just upgradient of the Prado Management Area were not capable of capturing large percentages of the outflow. It is not clear whether boundary conditions limit the model's ability to simulate the capture of outflow or whether most of the outflow is not occurring near the area of simulated wells. Additional analyses will be required to further evaluate the optimal location and number of wells for decreasing outflow and increasing basin yield.

6.3.3. Scenarios 2 and 3 - Enhanced Recharge at Detention Basins

As previously discussed, pilot testing conducted by the City at the Oak Avenue and Main Street detention basins noted high infiltration rates and indicated that up to about 6,500 AFY could be recharged with construction of spreading basins within each larger detention basin

(about 5,000 AFY in Oak Avenue Basin and about 1,500 AFY in Main Street Basin). The source of the recharge water would most likely be a combination of recycled water and stormwater. Imported water could also be used if available. Since current draft regulations regarding the recharge of recycled water call for dilution with another source, a combination of source waters will likely be needed. Actual implementation of this strategy would require coordination with regulatory agencies, including RCFCWCD, monitoring, and in-basin cleanup.

For simulation in the groundwater model, it is assumed that one-half of the recharge water is from water available only during the wet season. Recycled water is recharged year-round in the simulation. Recharge at the two basins was simulated separately for evaluation. Baseline pumping was used. Wastewater discharge to percolation ponds was slightly decreased reflecting the use of recycled water. Details of the simulations are provided in Appendix C.

The results of the model water budgets are summarized in Tables 6-4 and 6-5 for the Oak Avenue Detention Basin and Main Street Detention Basin recharge scenarios, respectively. Both scenarios show less groundwater storage declines than baseline scenarios because of the increase in inflows, equivalent to the amount of recharge assigned to each scenario. Because a larger volume of water was recharged at Oak Avenue, that scenario shows the most improvement. Declines in groundwater storage were -4,309 AFY and -6,562 AFY for Oak Avenue and Main Street basin recharge, respectively. This compares to the average decline in groundwater storage of -8,826 AFY under baseline conditions. Annual results for the two simulations are provided in Appendix C on Tables C-5 and C-6.

In general, water levels did not respond significantly to the smaller amount of recharge in the Main Street Detention Basin over a 15-year simulation period. Water levels rose about 16 feet on the alluvial fan in response to the larger recharge amounts in the Oak Avenue Detention Basin. In addition, water levels also rose several feet in the Channel Aquifer under this scenario. Water level hydrographs in target wells are provided in Appendix C.

Table 6-4
Scenario 2
Recharge at Oak Avenue Basin Water Balance (AFY)

INFLOWS	
Deep Percolation from Precipitation	**1,689**
Infiltration of Runoff in Detention Basins	**5,246**
- Oak Street	5,006
- Main Street	240
Recharge from Wastewater Discharge	**8,214**
Subsurface Inflow Subtotal	**5,199**
- Arlington Gap	4,192
- Temescal Wash (Temescal Canyon)	113
- Bedrock in Watershed	842
- Norco	52
Return Flows Subtotal	**2,542**
TOTAL INFLOWS (AFY)	**22,890**
OUTFLOWS	
Groundwater Pumping	**21,718**
Subsurface Outflow to Santa Ana River	**5,481**
TOTAL OUTFLOWS (AFY)	**27,199**
Change in Storage (AFY)	**-4,309**

Table 6-5
Scenario 3
Recharge at Main Street Basin Water Balance (AFY)

INFLOWS	
Deep Percolation from Precipitation	**1,689**
Infiltration of Runoff in Detention Basins	**1,743**
- Oak Street	240
- Main Street	1,502
Recharge from Wastewater Discharge	**9,507**
Subsurface Inflow Subtotal	**5,161**
- Arlington Gap	4,154
- Temescal Wash (Temescal Canyon)	113
- Bedrock in Watershed	842
- Norco	52
Return Flows Subtotal	**2,542**
TOTAL INFLOWS (AFY)	**20,642**
OUTFLOWS	
Groundwater Pumping	**21,722**
Subsurface Outflow to Santa Ana River	**5,481**
TOTAL OUTFLOWS (AFY)	**27,204**
Change in Storage (AFY)	**-6,562**

6.3.4. Scenarios 4a and 4b - Upgradient Injection Wells in Channel Aquifer

Currently, 5 MGD to 10 MGD could be dedicated to a recharge well project during the wet season (2,762 AF to 5,524 AF over six months). Assuming an injection well capacity of about 1,000 gpm, approximately four wells to seven wells would be needed for the recharge of recycled water. As such, two scenarios were evaluated in the groundwater model: four wells recharging 2,762 AFY and seven wells recharging 5,524 AFY (with recharge occurring over a six month period). Wastewater discharge is also decreased to reflect the treatment of additional wastewater for recycled water production. To provide benefits to downgradient wells, the preliminary location selected for the injection wells was the most upgradient position in the Channel Aquifer, near Arlington Gap. Additional details on the simulation of the injection wells are provided in Appendix C.

The results of the scenarios are summarized by the model water budgets presented in Tables 6-6 and 6-7. (Annual results are provided in Appendix C on Tables C-7 and C-8). In both cases, the average subbasin inflows are higher than estimated for baseline conditions, reflecting the increased recharge. As shown in the tables, total inflows are estimated at 20,987 AFY and 21,068 AFY for the injection well scenarios compared to average inflows of 18,377 AFY for the baseline scenario. However, the increase in inflows was not equivalent to the amount of recharge added because of decreases in other inflow totals including less subsurface inflow at Arlington Gap. The locations of the injection wells create water level rises near the gap and block a certain portion of the inflow. Additional evaluation is necessary to optimize the location of the injection wells. Nonetheless, the storage decline associated with these two scenarios is less than under baseline conditions. Water level hydrographs showing the change in water levels at the end of the 15-year simulation period for both injection well scenarios (Scenarios 4a and 4b) are provided in Figures C-11 through C-14 in Appendix C.

Table 6-6
Scenario 4a
Recharge near Arlington Gap (4 wells) Water Balance (AFY)

INFLOWS	
Deep Percolation from Precipitation	**1,689**
Infiltration of Runoff in Detention Basins	**479**
Recharge from Wastewater Discharge	**9,390**
Subsurface Inflow Subtotal	**4,125**
- Arlington Gap	3,131
- Temescal Wash (Temescal Canyon)	113
- Bedrock in Watershed	833
- Norco	48
Return Flows Subtotal	**2,542**
Recharge Wells at Arlington	**2,762**
TOTAL INFLOWS (AFY)	**20,987**
OUTFLOWS	
Groundwater Pumping	**21,717**
Subsurface Outflow to Santa Ana River	**5,481**
TOTAL OUTFLOWS (AFY)	**27,199**
Change in Storage (AFY)	**-6,212**

Table 6-7
Scenario 4b
Recharge near Arlington Gap (7 wells) Water Balance (AFY)

INFLOWS	
Deep Percolation from Precipitation	**1,689**
Infiltration of Runoff in Detention Basins	**479**
Recharge from Wastewater Discharge	**7,988**
Subsurface Inflow Subtotal	**2,846**
- Arlington Gap	1,839
- Temescal Wash (Temescal Canyon)	113
- Bedrock in Watershed	842
- Norco	52
Return Flows Subtotal	**2,542**
Recharge Wells	**5,524**
TOTAL INFLOWS (AFY)	**21,068**
OUTFLOWS	
Groundwater Pumping	**21,715**
Subsurface Outflow to Santa Ana River	**5,481**
TOTAL OUTFLOWS (AFY)	**27,195**
Change in Storage (AFY)	**-6,127**

In addition to improving changes in groundwater storage, these two recharge scenarios also benefit water levels throughout the Channel Aquifer. Water levels rose more than 25 feet in some upgradient areas near the injection wells. As expected, water levels rose more in upgradient wells, but even some downgradient wells recorded water level rises of about 8 feet over baseline conditions (Figures C-11 through C-14, Appendix C).

In summary, the management strategy of recharge wells improved water levels and water budgets, but decreased Arlington Gap inflow. Recharge wells offer the best potential for direct and immediate recharge to the Channel Aquifer, but additional evaluation will be necessary to determine optimal locations and number of wells.

6.3.5. Recycled Water Recharge

As described in the management strategies above, enhanced recharge will be needed for management of the groundwater subbasins. Given recent uncertainties in the reliability of SWP and other sources of imported water, recycled water may be the City's most reliable supplemental supply for groundwater recharge. To ensure that groundwater quality is not adversely impacted from the recharge of recycled water, a preliminary review of 2007 recycled water quality data was conducted. Prior to implementation, recycled water recharge projects will be further evaluated to ensure compliance with recharge regulations and permit requirements.

Water quality data from the 2007 monitoring program was compared against the primary and secondary MCLs for regulated compounds relevant in draft recycled water recharge regulations (California DPH, 2007). Because the City is not currently recharging recycled water, not all of the regulated constituents have been analyzed to date. In particular, radionuclides and an expanded list of organic chemicals will be analyzed as recycled water recharge is further evaluated. Additional unregulated constituents may also require analysis.

A review of the 2007 monitoring data demonstrates that all but one constituent (TDS) analyzed in the City's recycled water already meet relevant regulatory standards. The recycled water TDS concentration of 650 mg/L does not meet the secondary recommended MCL of 500 mg/L, but is significantly below the maximum permitted of 1,000 mg/L. Because the City's wastewater is a blend of groundwater and imported water (with lower TDS), the concentration of TDS in wastewater is generally lower than in groundwater, resulting in a benefit to the subbasin. DPH regulations allow recharge of TDS concentrations higher than 500 mg/L under certain conditions. Final permitted levels will be determined as the project moves forward.

Only one regulated organic compound, chloroform, has been detected in the City's recycled water. This chemical is typically formed as a disinfection byproduct after chlorination has been used to ensure extinction of microbial pathogens. The compound was detected at only a trace value and is more than two orders of magnitude below the MCL. Given the data reviewed to date, the recharge of recycled water is not anticipated to adversely impact groundwater quality.

6.4. Recommended Management Strategies

As indicated in the evaluations above, no single strategy will achieve BMOs. A combination of strategies will be required, especially those supporting enhanced recharge and in-lieu pumping. Without management strategies, the groundwater subbasins will not be sustainable at the pumping rates identified as being needed at build out. Management strategies will be conducted in concert with continued water conservation strategies to manage demand.

7. Implementation Plan

In development of an implementation plan for the management strategies identified, issues such as funding opportunities, budgeting, and need are considered. Several of these programs are ongoing and are required for continued operation of the water supply. In addition, several of the strategies rely on the implementation of other strategies. Information on the prioritization of projects and the implementation are provided below.

7.1. Prioritization of Strategies

Given the results of the water balance and the need for increased groundwater development, the highest priority for groundwater management are strategies that provide for enhanced recharge (or in-lieu pumping) in the groundwater basin. The best use for imported water at this time seems to be direct use, especially if the availability allows for an offset in pumping. The most reliable supply for recharge is likely to be recycled water. However, for the expanded use of recycled water, additional conveyance and infrastructure improvements are required, namely, Strategies 14 and 15 (Interconnect Recycled Water Zone 3 to Zone 2 and Interconnect Recycled Water Zone 4 to Zone 3).

7.2. Implementation Plan and Schedule

Capital improvement projects and corresponding implementation schedule are summarized in Table 7-1. These projects, designated C-1, C-2, etc., correspond directly to the strategies described in Chapter 6 (C denotes a capital improvement project). The remaining management strategies not listed in Table 7-1 include Strategy 19 (Use of Recycled Water as In-Lieu Pumping), 23 (Coordination with Riverside DEH), and 24 (Coordination with RWQCB). The coordination efforts will begin immediately and build on current relationships with the agencies. Strategy 25 (Water Conservation and Demand Management) is ongoing and will continue as a coordinated effort with the City's Water Conservation Coordinator. The use of recycled water as in-lieu pumping (Strategy 19) is also ongoing and will be expanded as additional markets are identified.

Table 7-1
Implementation Plan and Schedule

Project Number	Project Description	Annual Water Yield (AF)	Project Cost	Year
C-1	New Water Wells	1,935	$1,500,000/ well	On-going
C-2	Replacement Water Wells	1,935	$1,500,000/ well	On-going
C-3	Rincon Groundwater Treatment Project	5,600	$15,000,000	2015
C-4	Wellhead Treatment for Wells 6, 7, and 17	4,800	$10,000,000	2012
C-5	El Sobrante Groundwater Treatment Project	5,600	$20,000,000	2020
C-6	Groundwater Treatment Program	3,800	$3,000,000	2011
C-7	Groundwater Blending Program	1,800	$600,000	2010
C-8	Improvement of Groundwater Quantity/Quality Monitoring Program	0	$50,000	2010
C-9	Coldwater Subbasin Enhanced Recharge Project	2,000	$100,000	2011
C-10	Recharge Basins within Oak Avenue Detention Basin	5,000	$2,300,000	2010
C-11	Recharge Basins within Main Street Detention Basin	1,500	$690,000	2012
C-12	Upgradient Injection Wells	4,800	$5,000,000	2009
C-13	Recycled Water Injection Wells	4,500	$4,600,000	2011
C-14	Recycled Water Zone 3 to Zone 2 Interconnect	1,800	$4,800,000	2009
C-15	Recycled Water Zone 4 to Zone 3 Interconnect	3,000	$2,400,000	2009
C-16	WWTP2 Upgrade to Tertiary	3,300	$9,500,000	2010
C-17	WWTP1A Upgrade to Tertiary	1,100	$2,100,000	2012
C-18	Lee Lake Water District Recharge to Bedford Subbasin	80	$500,000	2010
C-20	Purchase of Metropolitan Water District In-Lieu Water	Unknown	Unknown	As Available
C-21	Pipeline to Convey Metropolitan Water District In-Lieu Water to Border Avenue Recycled Water Reservoir	Unknown	Unknown	As Available
C-22	Lincoln and Cota Street Percolation Ponds Maintenance Program	1,000	$100,000/ every 3-5 years	On-going

7.3. Annual Re-evaluation of Management Performance

The implementation of groundwater management strategies and the performance of management activities will be reviewed on an annual basis. A close assessment of the basin response to operational changes and pumping re-distribution among existing wells will provide additional information on management. Ongoing improvements to the monitoring network will also allow for a more detailed evaluation of groundwater levels, quality, and storage.

8. References

Albert A. Webb Associates, Final Programmatic Environmental Impact Report for the Western Municipal Water District, Riverside-Corona Feeder Project, prepared for Western Municipal Water District, SCH Number 2003031121, May 2005.

Albert A. Webb Associates, Draft Program Environmental Impact Report for the Western Municipal Water District Riverside-Corona Feeder Project, SCH number 2003031121, prepared for Western Municipal Water District, July 2004.

AKM Consulting Engineers, Technical Memorandum, To: Rudy Fandal, Department of Water and Power, City of Corona, From: Safa M. Kamangar, Evaluation of Cota South Pond, Cota North Pond and Lincoln Pond (Revision No. 1), October 11, 2006.

AKM Consulting Engineers, City of Corona Urban Water Management Plan, 2005 Update, Draft, December 21, 2005.

AKM Consulting Engineers, City of Corona Water Master Plan, prepared for the City of Corona, April 2005.

AKM Consulting Engineers, City of Corona Sewer Master Plan, prepared for the City of Corona, September 2005.

Bergamaschi, Brian A., Erica Kalve, Larry Guenther, Gregory O. Mendez, and Kenneth Belitz, An Assessment of Optical Properties of Dissolved Organic Material as Quantitative Source Indicators in the Santa Ana River Basin, Southern California, USGS Scientific Investigations Report SIR 2005-5152, prepared in cooperation with Orange County Water District, 2005.

Boyle Engineering Corporation (Boyle), City of Corona Recycled Water Master Plan and Market Study, in association with Parsons Engineering Science, Reiter-Lowry Consultants, The Recycling Group, June 2001.

Burton, Carmen A., John A. Izbicki, and Katherine S. Paybins, Water-Quality Trends in the Santa Ana River at MWD Crossing and Below Prado Dam, Riverside County, California, USGS Water-Resources Investigations Report 97-4173, prepared in cooperation with the Orange County Water District, 1998.

California Data Exchange Center (CDEC), http://cdec.water.ca.gov/, accessed July 2006.

California Department of Health Services Division of Drinking Water and Environmental Management (DHS DDWEM), http://www.dhs.ca.gov/ps/ddwem/, accessed July 2006.

California Department of Public Health (DPH), Groundwater Recharge Reuse Draft Regulation, January 4, 2007.

California Department of Toxic Substance Control (DTSC), http://www.dtsc.ca.gov/, accessed July 2006.

California Department of Water Resources Division of Planning and Local Assistance (DWR DPLA), http://www.landwateruse.water.ca.gov/annualdata/datalevels.cfm, accessed July 2006.

California Department of Water Resources (DWR) Land Use, http://www.landwateruse.water.ca.gov/basicdata/landuse/landuselevels.cfm, accessed July 2006.

California Department of Water Resources (DWR), Upper Santa Ana Valley Groundwater Basin, Temescal Subbasin, Groundwater Basin No. 8.2-09, Hydrologic Region South Coast, California's Groundwater Bulletin 118, last update February 27, 2004a.

California Department of Water Resources, Elsinore Groundwater Basin No. 8-4, Hydrologic Region South Coast, California's Groundwater Bulletin 118, last update February 27, 2004b.

California Department of Water Resources (DWR), Upper Santa Ana Valley Groundwater Basin, Riverside-Arlington Subbasin, Groundwater Basin No. 8.2-03, Hydrologic Region South Coast, California's Groundwater Bulletin 118, last update February 27, 2004c.

California Department of Water Resources (DWR), Status of Groundwater Management in California, December 2004.

California Department of Water Resources (DWR), California's Groundwater, Bulletin 118, Update 2003.

California Department of Water Resources (DWR), Groundwater Basins in California, electronic file in .pdf format, http://www.water.ca.gov, latest update June 27, 2003.

California Department of Water Resources (DWR), California Well Standards, Bulletin 74-90, Supplement to Bulletin 74-81, June 1991.

California Department of Water Resources (DWR), California Well Standards, Bulletin 74-81, December 1981.

California Department of Water Resources (DWR), Ground Water Basin Objectives for Upper Temescal Subarea, Memorandum Report, June 1980.

California Department of Water Resources (DWR), Ground Water Quality Study, Temescal Hydrologic Subarea, A Report to Santa Ana River Basin Regional Water Pollution Control Board (No. 8), Project Code No. 4110-024, February 1965.

California Department of Water Resources (DWR), Ground Water Quality Objectives, Temescal Valley, Project No. 58-8-1, A Report to Santa Ana Regional Water Pollution Control Board (No. 8), September 1959.

California Division of Water Resources (DWR), South Coastal Basin Investigation, Overdraft on Ground Water Basins, Bulletin No. 53, 1947.

California Irrigation Management Information System (CIMIS), http://wwwcimis.water.ca.gov/cimis/welcome.jsp, accessed July 2006.

California Regional Water Quality Control Board (RWQCB), Santa Ana Region, http://www.swrcb.ca.gov/rwqcb8/, accessed July 2006.

California Regional Water Quality Control Board (RWQCB), Santa Ana Region, Order No. R8-2004-0003, NPDES No. CA8000023, Water Discharge Requirements for the Glen Ivy Hot Springs, Inc., Temescal Canyon, Riverside County, March 17, 2004.

California Regional Water Quality Control Board (RWQCB), Santa Ana Region, Order No. R8-2002-0001, NPDES No. CA8000100, Water Discharge and Producer/User Recycling Requirements for the Lee Lake Water District Wastewater Reclamation Facility, Riverside County, September 6, 2002.

California Regional Water Quality Control Board (RWQCB), Santa Ana Region, Order No. 01-55, NPDES No. CA8000383, Water Discharge and Producer/User Reclamation Requirements for the City of Corona, Wastewater Treatment Plant No. 1, Riverside County, December 19, 2001.

California Regional Water Quality Control Board (RWQCB), Santa Ana Region, Order No. 01-79, NPDES No. CA8000395, Water Discharge and Producer/User Recycling Requirements for the City of Corona, Municipal Wastewater Treatment Plant No. 3, Riverside County, September 26, 2001.

California Regional Water Quality Control Board (RWQCB), Santa Ana Region, Order No. 98-3, Waste Discharge Requirements for City of Corona, Wastewater Treatment Plant No. 2, Riverside County, April 17, 1998a.

California Regional Water Quality Control Board (RWQCB), Santa Ana Region, Meeting minutes regarding Item 31a, Subject: Waste Discharge Requirements for the City of Corona, Wastewater Treatment Plant No. 2, Riverside County, Order No. 98-3, April 17, 1998b.

City of Corona, Consumer Confidence Reports, 1998 through 2005, http://www.coronautilities.org/3_4_WaterQuality/3-4-WaterQuality.htm, accessed July 2006.

Davies, S.N., and M.N. Bramlette, The Alberhill and Other Clay Deposits of Temescal Canyon, Riverside County, California, USGS Open-File Report 53-52, September 1942.

Elsinore Valley Municipal Water District, Groundwater Management Plan Adoption, PowerPoint public presentation, June 10, 2004.

Elsinore Valley Municipal Water District, EVMWD Director Divisions 5, division map, no date.

Fox/Roberts, Mark Roberts, Consulting Hydrogeologist, City of Corona DWP, Hydrogeologic Assessment and Well Siting Analysis for the City Desalter Facility, April 2004.

French, J. J., Ground-Water Outflow From Chino Basin, Upper Santa Ana Valley, Southern California, USGS Water-Supply Paper 1999-G, 1972.

Galloway, D.L., Jones, D.R., and Ingebritsen, S.E., Land Subsidence in the United States, USGS Circular 1182, 1999.

Kennedy/Jenks Consultants, Drinking Water Source Assessment and Protection Plan (DWSAP), City of Corona, December 2002.

Lee Lake Water District (LLWD), Unpublished water quality laboratory data sheets, Well 4, Bedford Subbasin, August 20, 2007.

McDonald, M.G., and Harbaugh, A.W., Techniques of Water-Resources Investigations of the United States Geological Survey, Chapter A1, A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model, Book 6, 1983.

Montgomery Watson Harza (MWH), Coldwater Basin Recharge Feasibility Study, Elsinore Valley Municipal Water District, January 2004.

Montgomery Watson Harza (MWH), Groundwater Monitoring Plan, Elsinore Basin Water Management Plan, Final Draft Report, Prepared for Elsinore Valley Municipal Water District, June 2003a.

Montgomery Watson Harza (MWH), Elsinore Valley Municipal Water District, Elsinore Basin Groundwater Management Plan, Final Draft Report, June 2003b.

Morton, D.M., Preliminary Geologic Map of the Santa Ana 30'x60' Quadrangle, Southern California, Version 2.0, USGS Open-file Report 99-172, 2 sheets, 2004.

Norris, Robert M. and Webb, Robert W., Geology of California, Second Edition, John Wiley & Sons, 1990.

Oregon Climate Service (OCS), PRISM Group, Oregon State University, California Average Monthly or Annual Precipitation 1961-1990, http://www.ocs.orst.edu/prism/prism_new.html, updated January 8, 2007.

Page, L.R., and T.P. Thayer, The Temescal Tin District, Riverside County, California, USGS WRIR, December 1945.

PBS&J and Ron Barto, Ground Water Consultant, Surface Disposal Pilot Project for the City of Corona, July 2004.

Piper, A.M., A Graphic Procedure in the Geochemical Interpretation of Water Analyses, American Geophysical Union Transactions, v. 25, p. 914-923, 1944.

Riverside County, Jim Gillis, http://www.rivcoeh.org/water-eg.htm, accessed July 2006.

Riverside County, Department of Environmental Health (DEH), http://www.rivcoeh.org/oencms/rivcoeh/ProgServices/ERM Program.htm, accessed various times between July 2006 and April 2008.

Riverside County Waste Management Department, County of Riverside, Delineation Report for the Evaluation of Groundwater Flow and Contaminant Transport at the Corona Sanitary Landfill, September 1999.

Santa Ana Watershed Data Management System (SAW DMS), http://www.sawpa.net/Sawdms_portal/site/1/home.aspx, accessed July 2006.

Santa Ana Watershed Project Authority (SAWPA), http://www.sawpa.org/index.asp, accessed June 2006 and July 2006.

State Water Resources Control Board (SWRCB), Geotracker online database, http://geotracker.swrcb.ca.gov/, date accessed July 2006.

Todd, David K. and Mays, Larry W., Groundwater Hydrology, 3rd edition, John Wiley and Sons, 2004.

U.S. Department of Agriculture (USDA), Technical Release 55, 1986.

U.S. Department of Conservation, Division of Land Protection Farmland Monitoring and Mapping Program, http://www.consrv.ca.gov/dlrp/fmmp/index.htm, accessed July 2006.

U. S. Geological Survey (USGS), Preliminary Digital Geologic Map of the Santa Ana 30' x 60' Quadrangle, Southern California, Version 2.0, USGS Open File Report 99-172, Southern California Areal Mapping Project, compiled by D.M. Morton, digital preparation by Kelly R. Bovard and Rachel M. Alvarez, prepared in cooperation with the California Geological Survey, 2004.

U. S. Geological Survey (USGS), National Water Information System (USGS NWIS), http://waterdata.usgs.gov/nwis/sw, accessed July 2006.

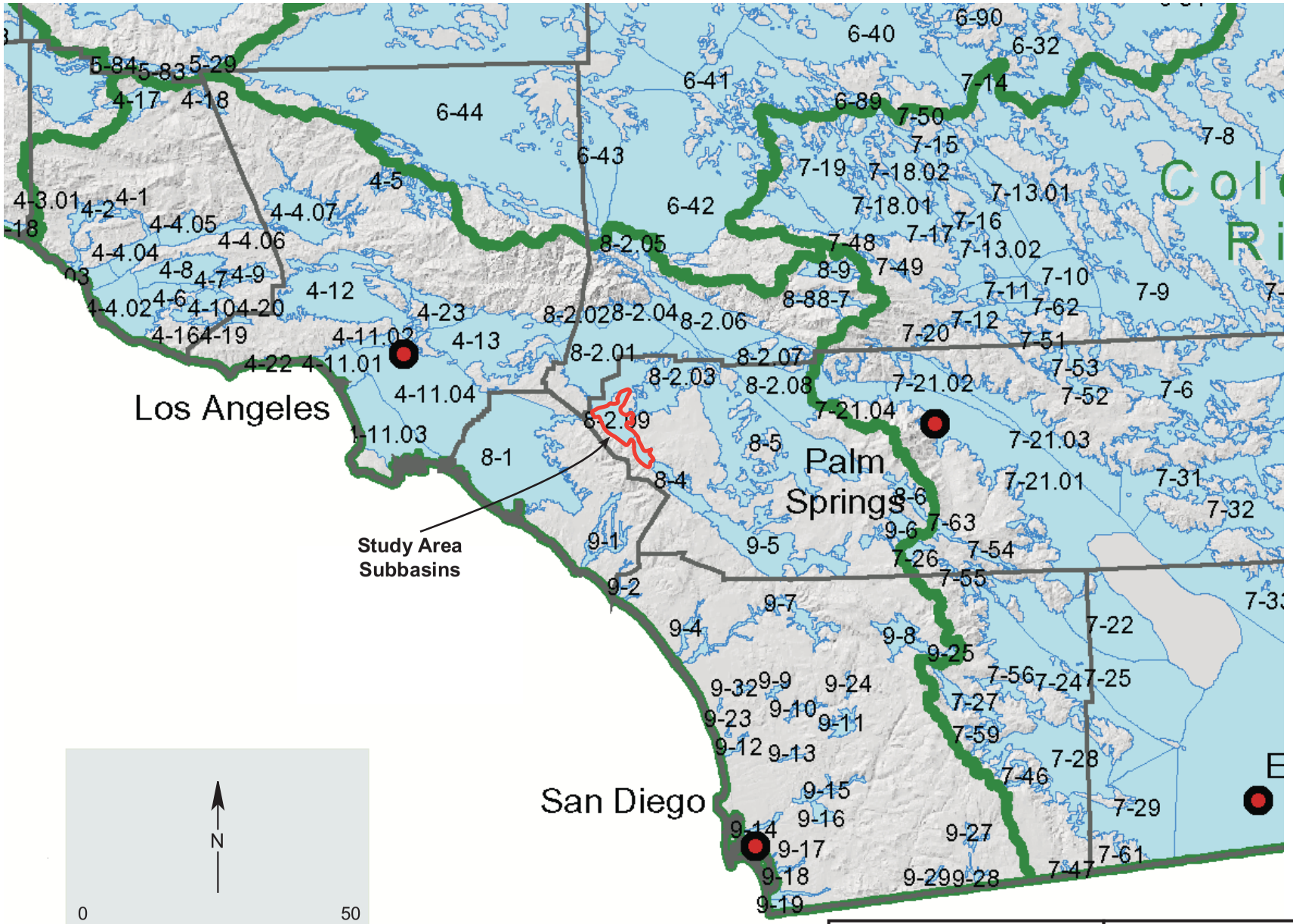
U.S. Natural Resource Conservation Service (NRCS) Soil Map, http://soildatamart.nrcs.usda.gov/, accessed July 2006.

Western Regional Climate Center (WRCC), Pan Evaporation Data for Riverside Citrus Exp St Station, http://www.wrcc.dri.edu/htmlfiles/westevap.final.html, accessed May 2007.

Wildermuth Environmental (WE), Chino Basin Maximum Benefit Monitoring Program Annual Report, Prepared for Chino Basin Watermaster and Inland Empire Utilities Agency, April 15, 2006.

Wildermuth Environmental (WE), Chino Basin, Optimum Basin Management Program, State of the Basin Report – 2004, July 2005.

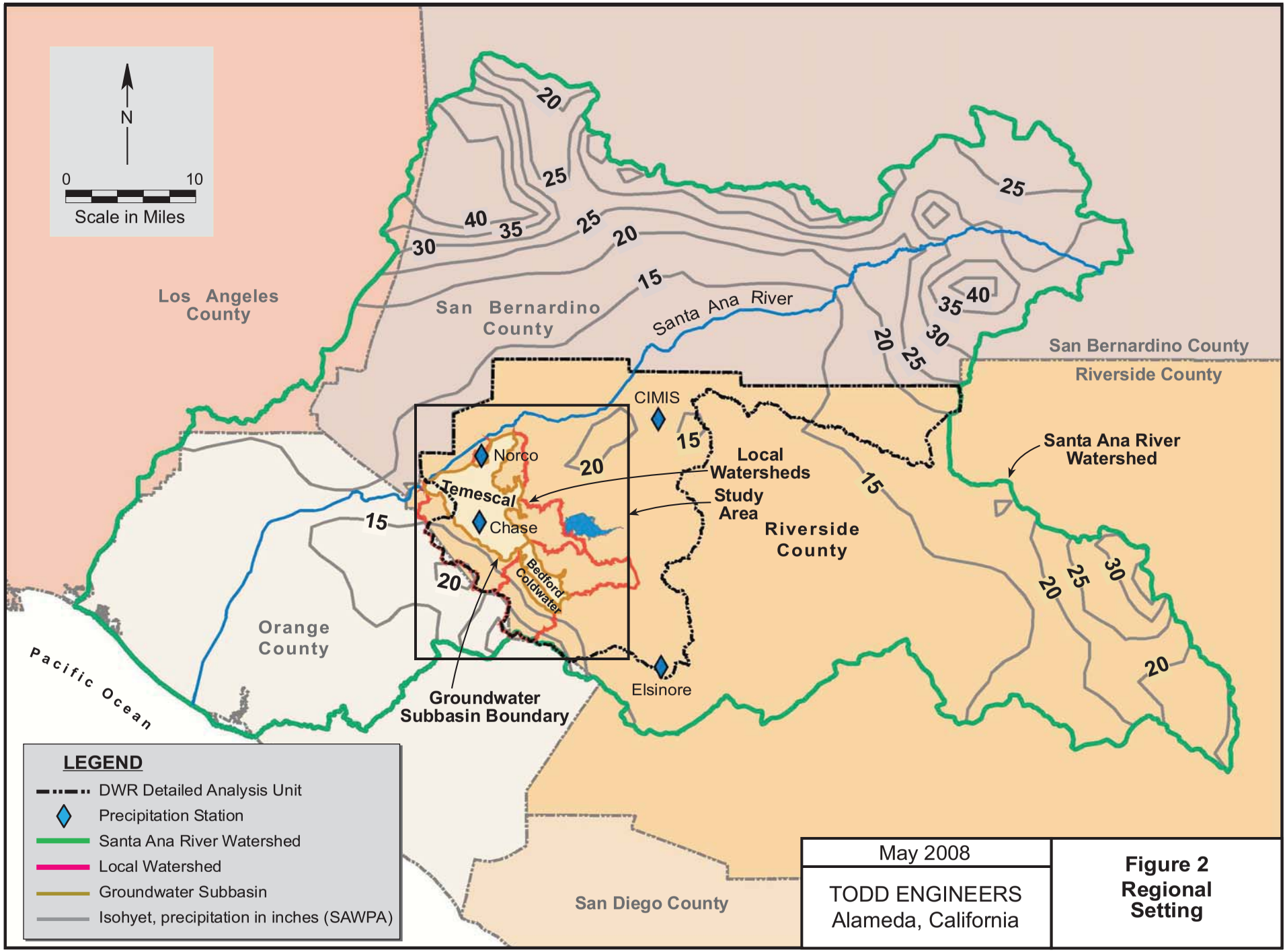
Figures



May 2008

TODD ENGINEERS
Alameda, California

Figure 1
DWR Groundwater Basins

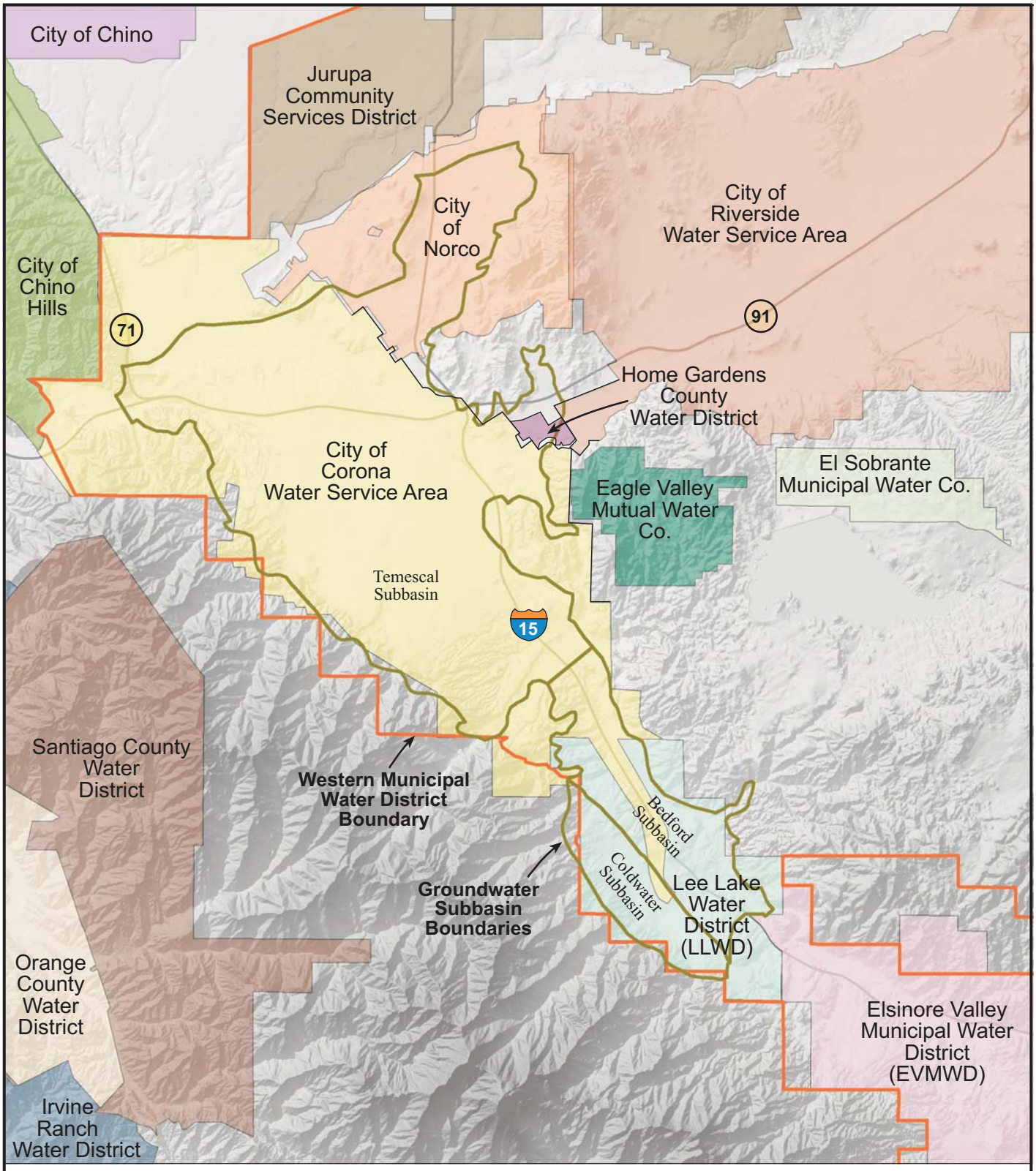

N
0
10
Scale in Miles
Los Angeles County
San Bernardino County
Santa Ana River
San Bernardino County
Riverside County
CIMIS
Norco
Temescal
Chase
Local Watersheds Study Area
Santa Ana River Watershed
Riverside County
Bedford Coldwater
Orange County
Pacific Ocean
Groundwater Subbasin Boundary
Elsinore
San Diego County
LEGEND
DWR Detailed Analysis Unit
Precipitation Station
Santa Ana River Watershed
Local Watershed
Groundwater Subbasin
Isohyet, precipitation in inches (SAWPA)
May 2008
TODD ENGINEERS
Alameda, California
Figure 2
Regional Setting



May 2008

TODD ENGINEERS
Alameda, California

Figure 3
Study Area

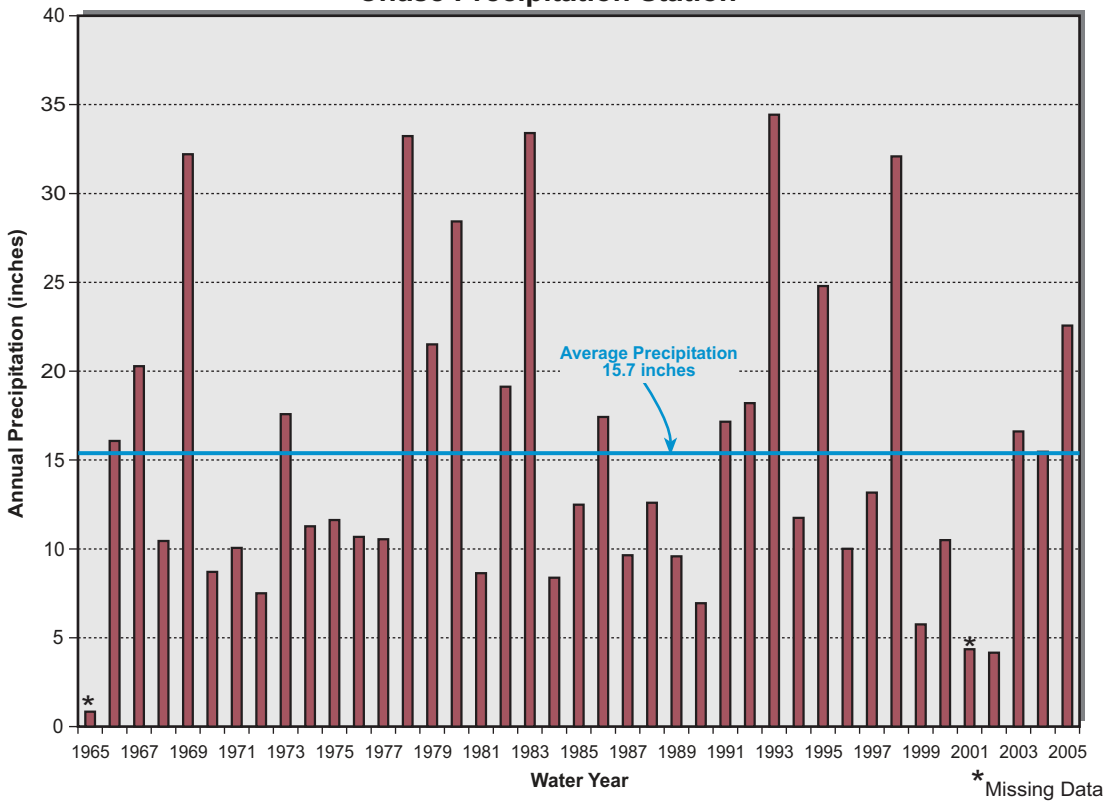


May 2008

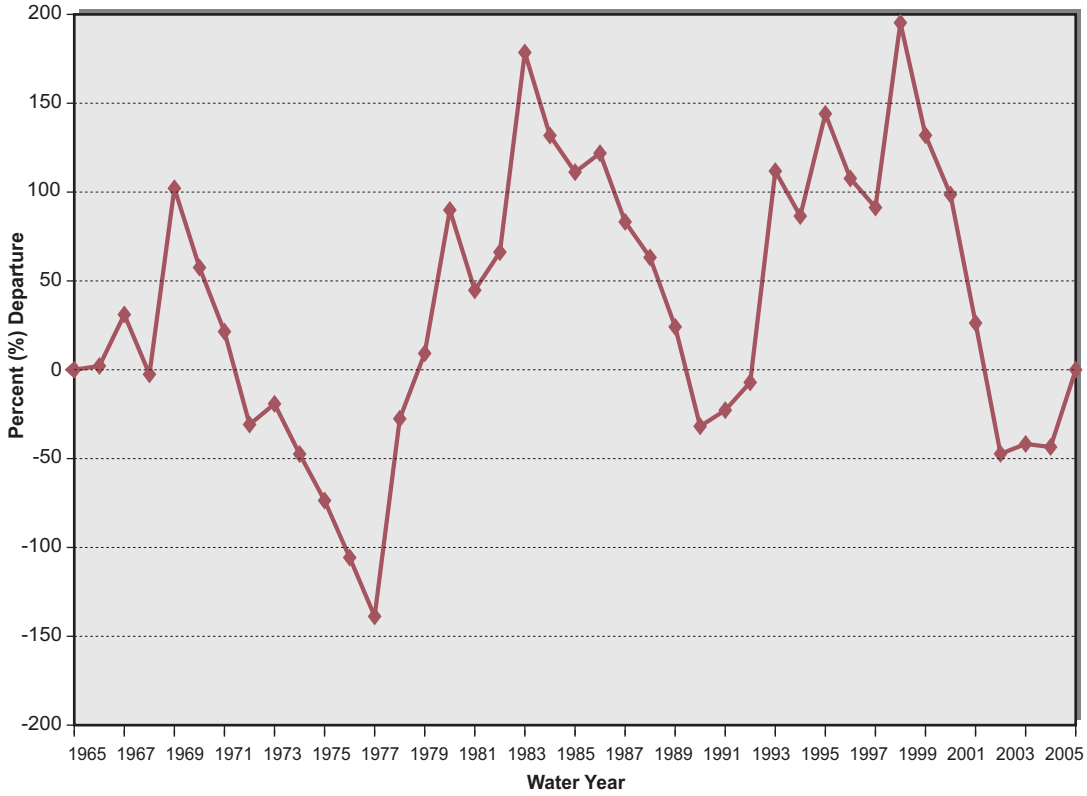
TODD ENGINEERS
Alameda, California

Figure 4
Water Agencies

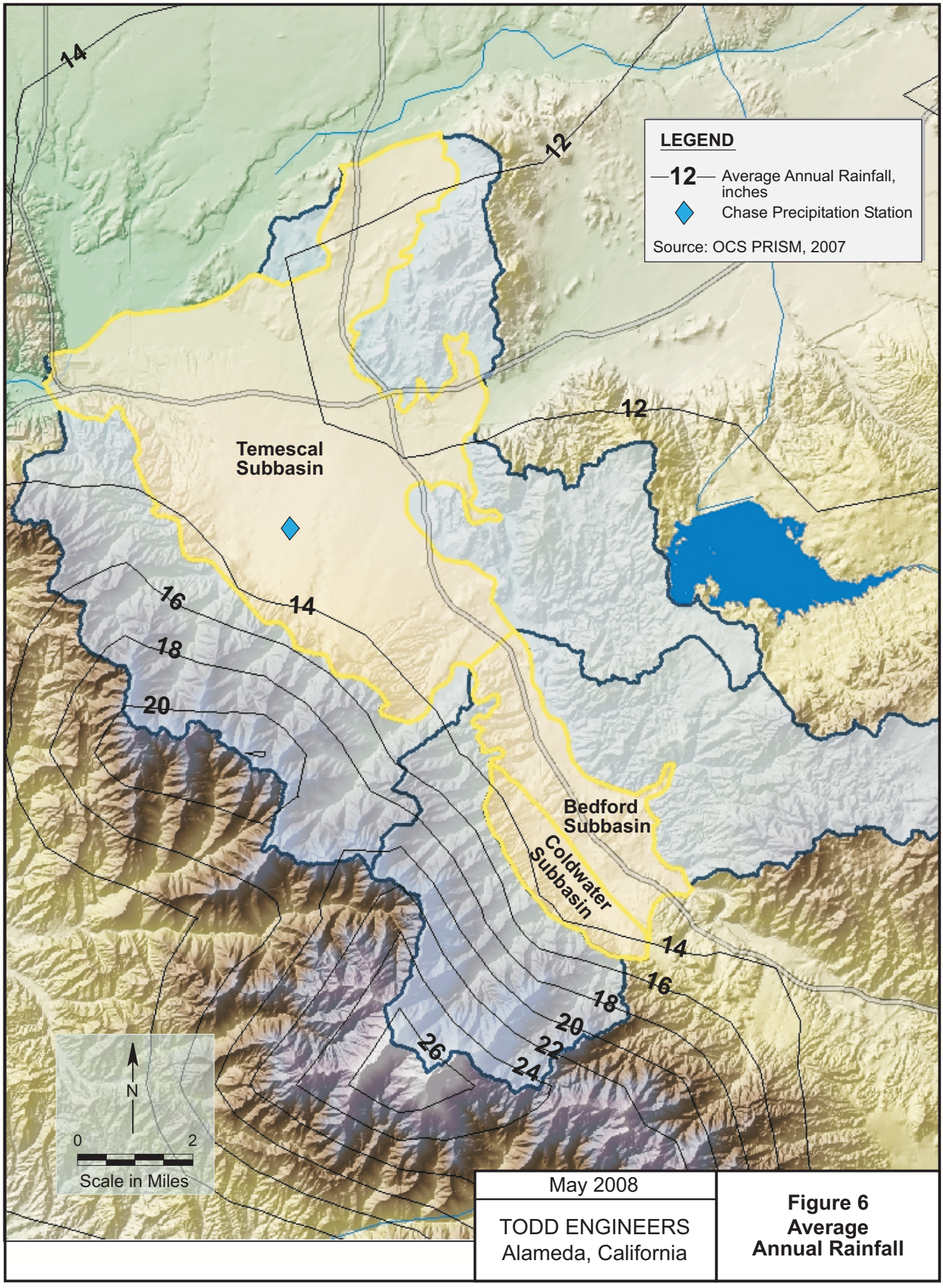
Average Annual Rainfall
Chase Precipitation Station



Cumulative Departure Curve from Average Rainfall



May 2008	**Figure 5**
TODD ENGINEERS Alameda, California	**Precipitation and Cumulative Departure Curve**



May 2008

TODD ENGINEERS
Alameda, California

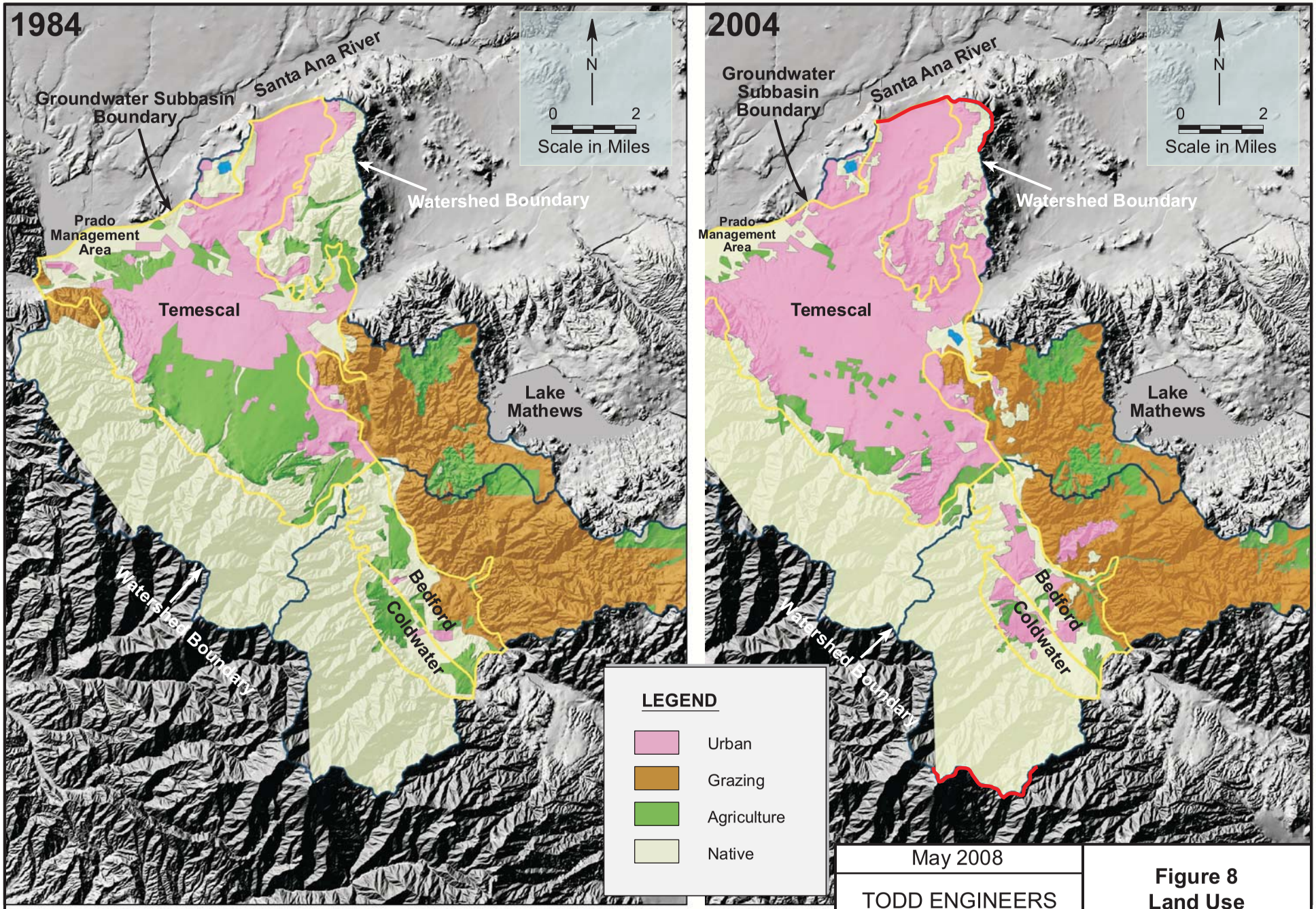
Figure 6
Average Annual Rainfall



May 2008

TODD ENGINEERS
Alameda, California

Figure 7
Stream Gage Locations

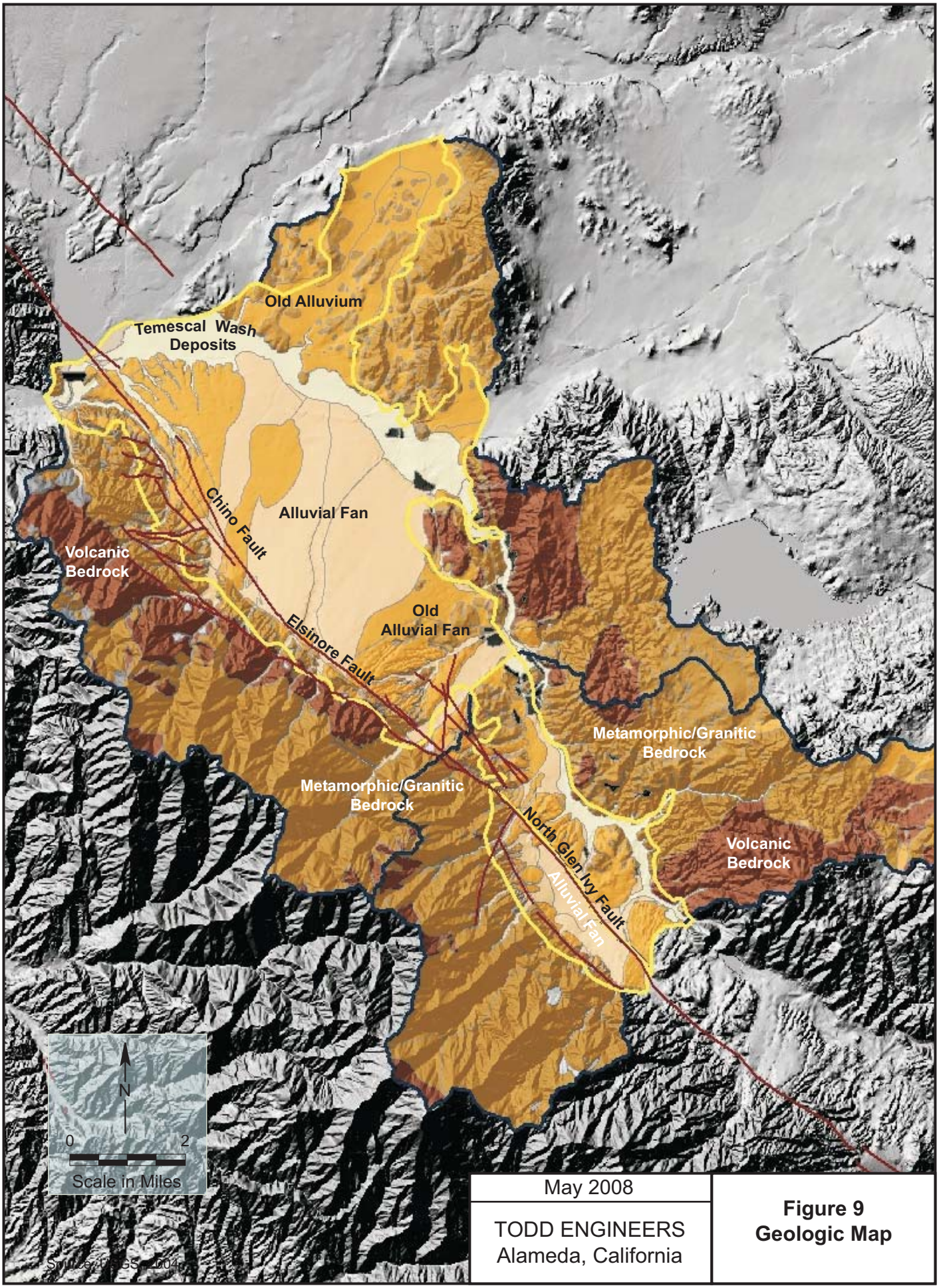


Source: DWR, July 2006.

May 2008

TODD ENGINEERS
Alameda, California

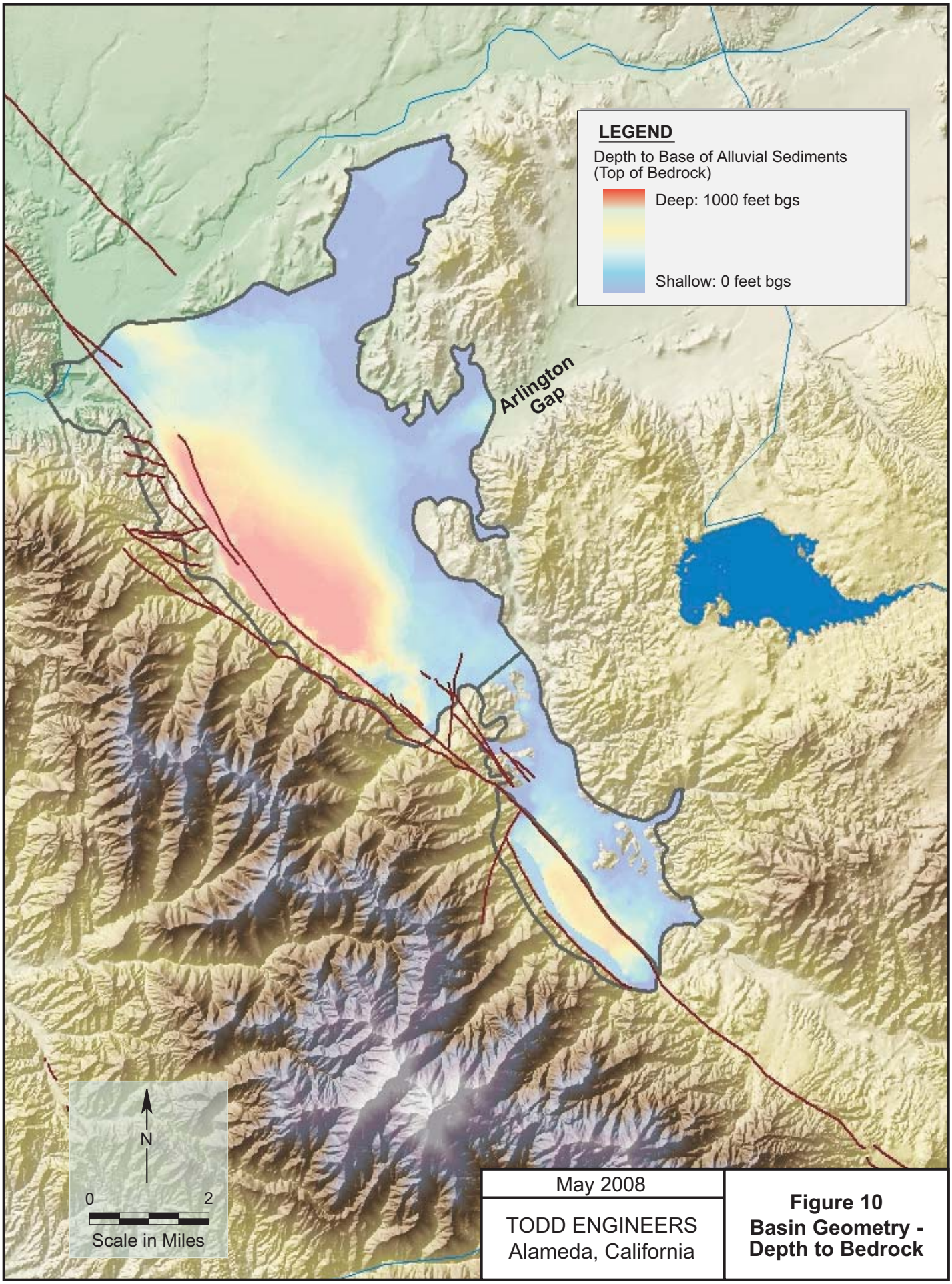
Figure 8
Land Use
1984 and 2004



May 2008

TODD ENGINEERS
Alameda, California

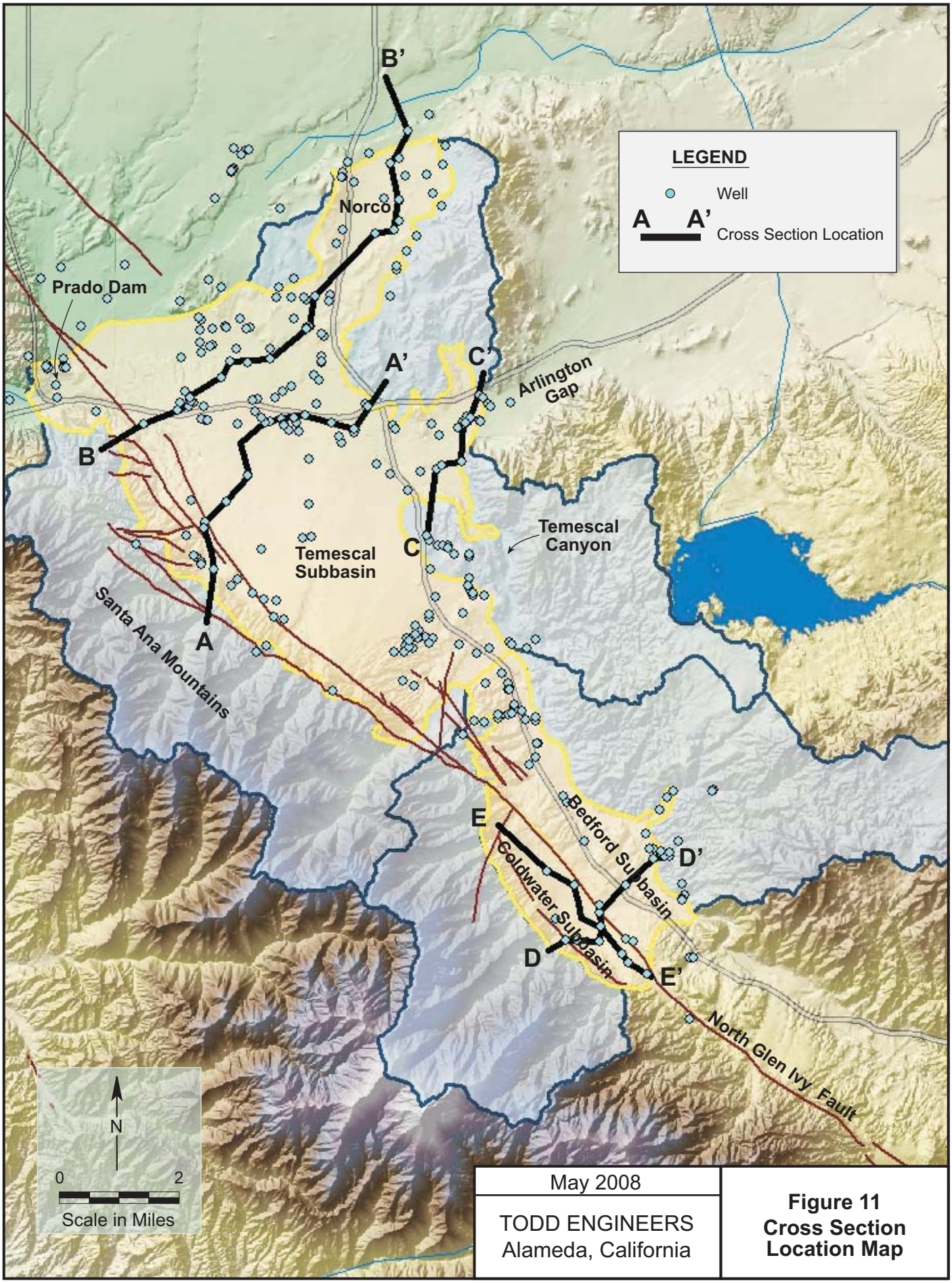
Figure 9
Geologic Map



May 2008

TODD ENGINEERS
Alameda, California

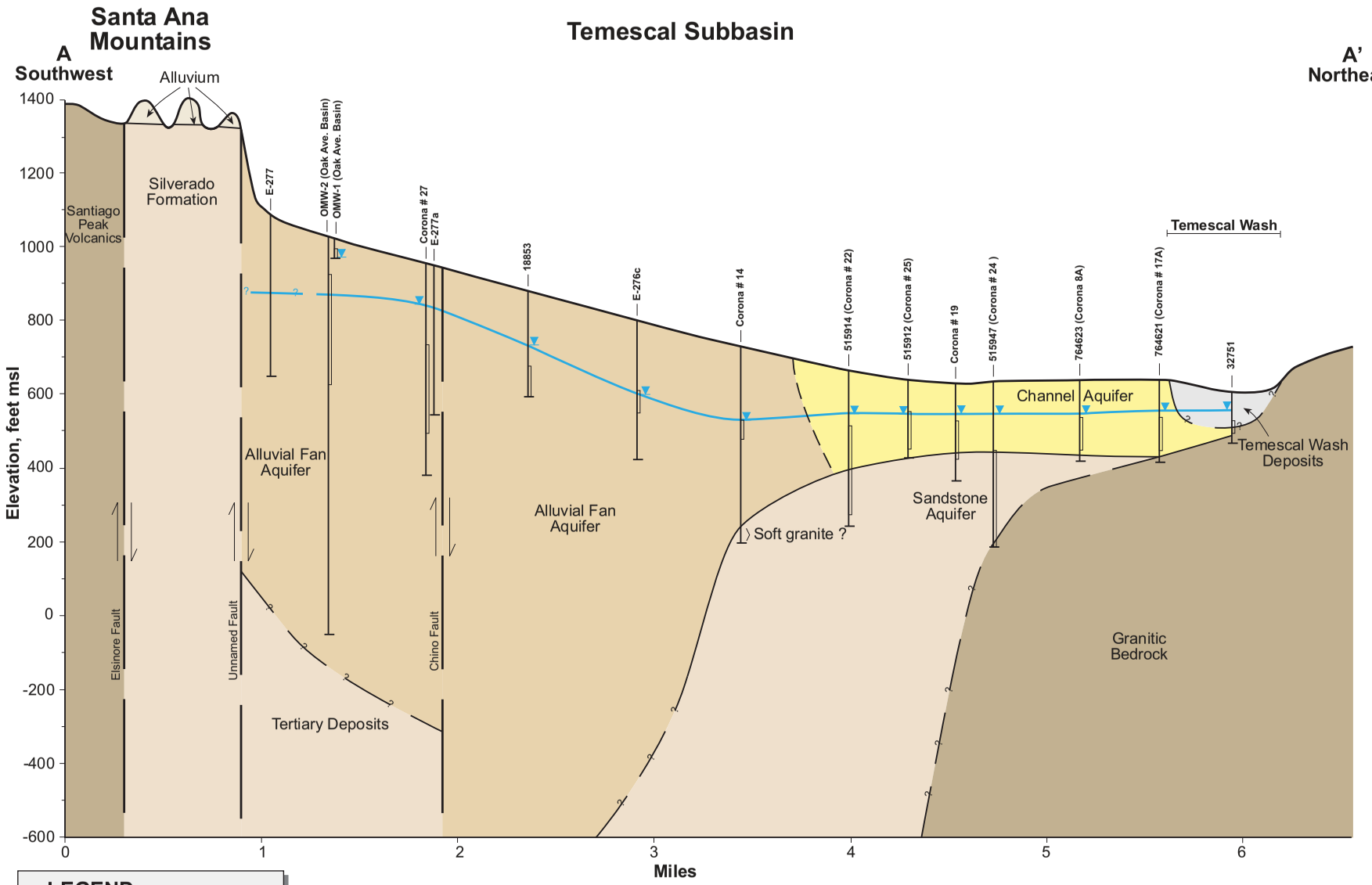
Figure 10
Basin Geometry - Depth to Bedrock



May 2008

TODD ENGINEERS
Alameda, California

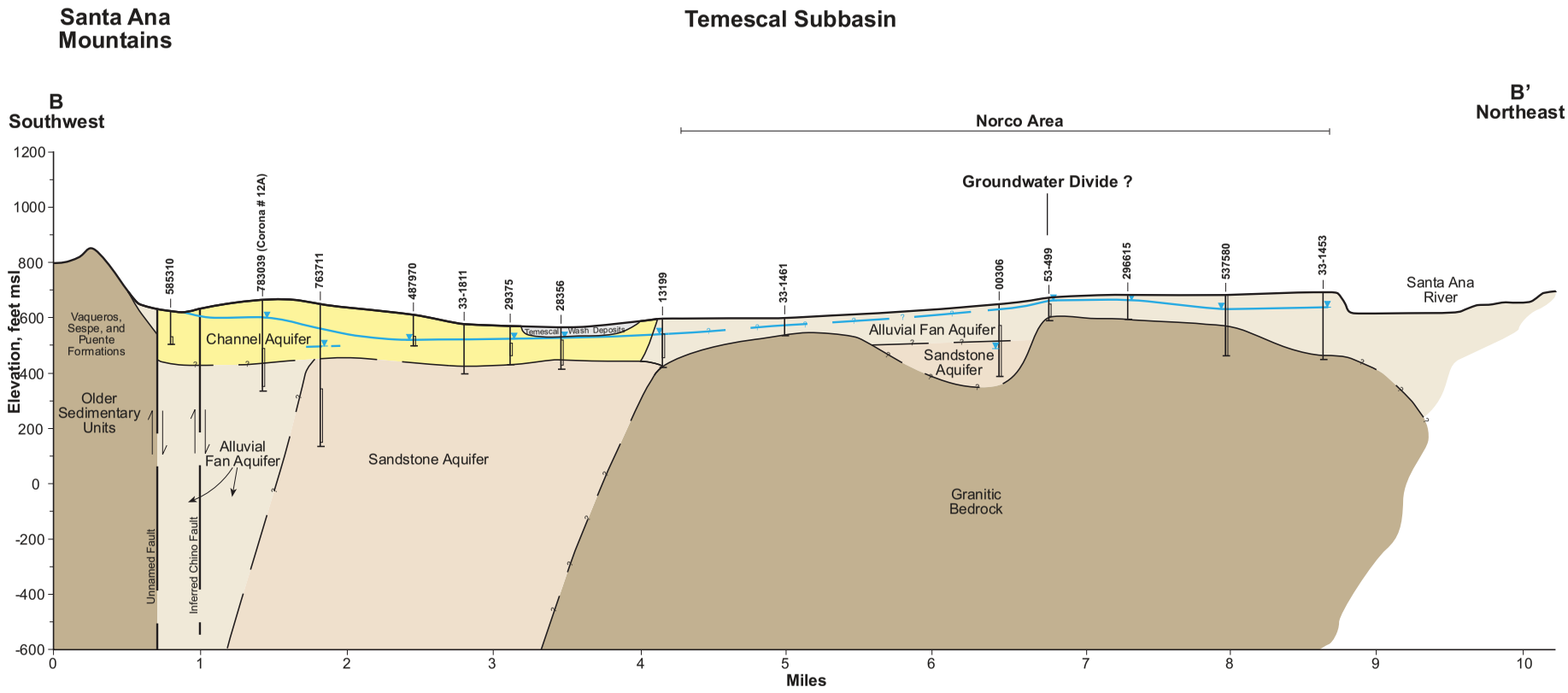
Figure 11
Cross Section Location Map



May 2008

TODD ENGINEERS
Alameda, California

Figure 12
Cross Section
A - A'



LEGEND

13199 — DWR Well Number

Water Level / Well Screen

Bottom of Well

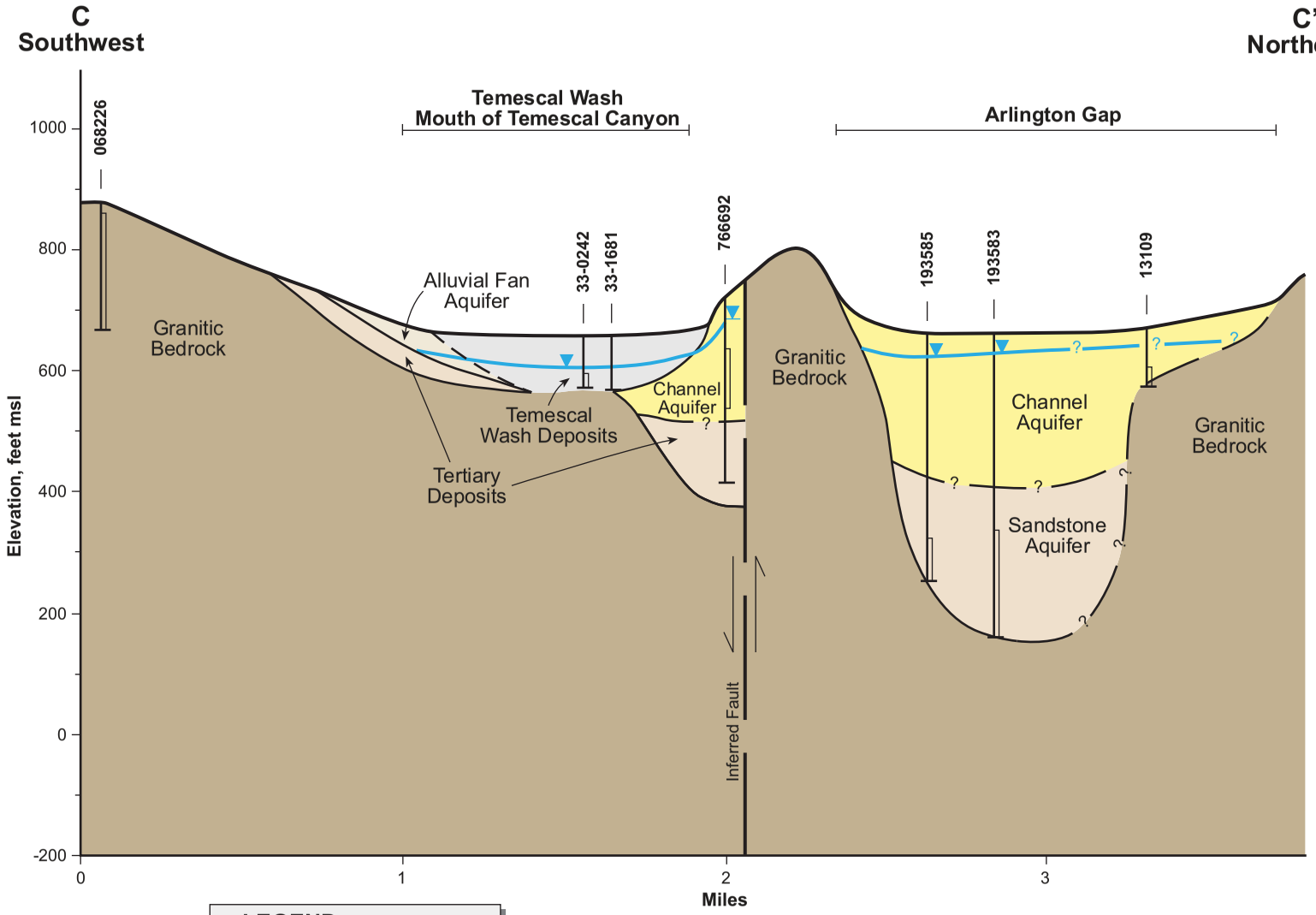
Groundwater Elevation (dashed where estimated)

May 2008

TODD ENGINEERS
Alameda, California

Figure 13
Cross Section
B - B'

Temescal Subbasin



LEGEND

13109 — DWR Well Number

Water Level
Well Screen

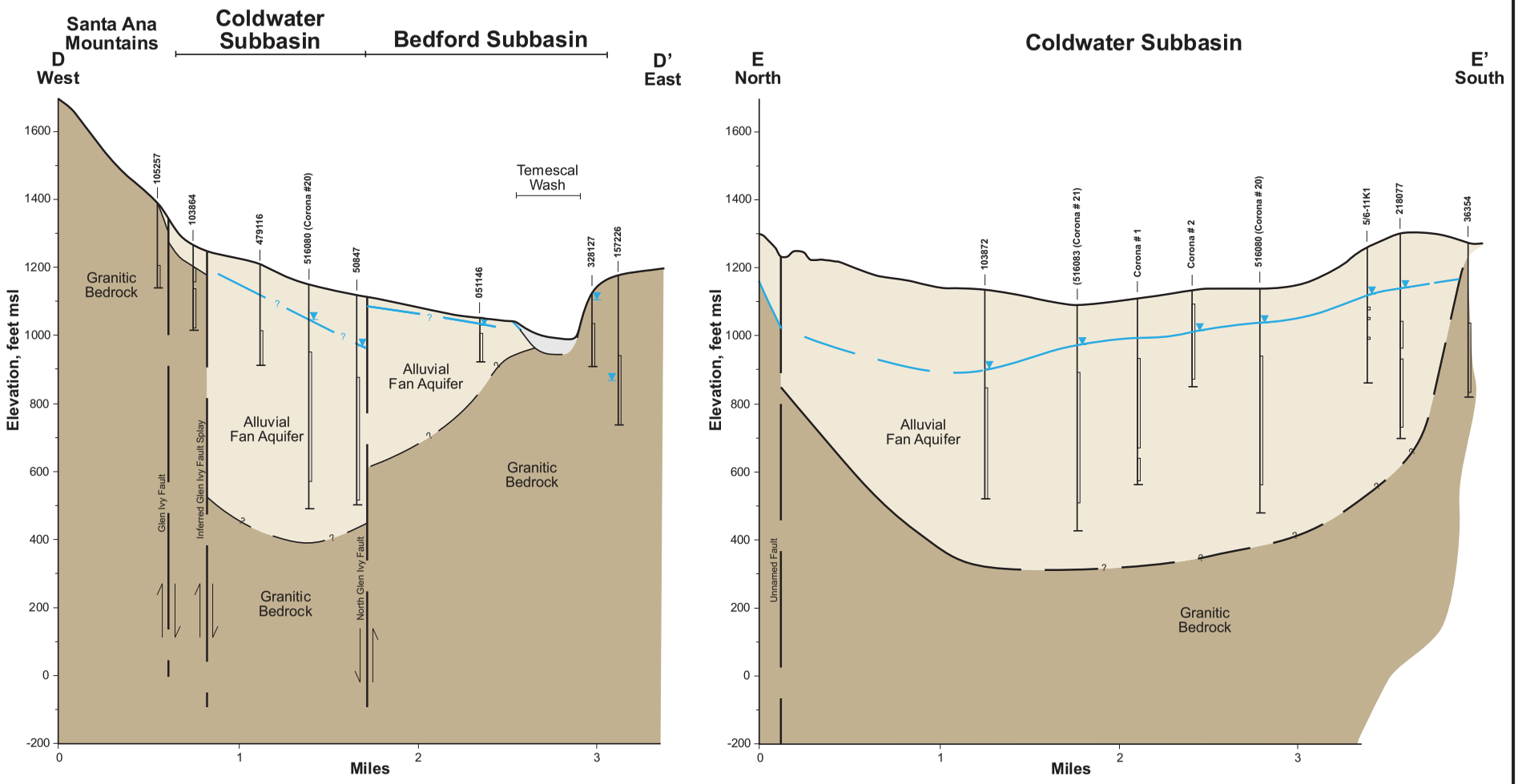
Bottom of Well

Groundwater Elevation
(dashed where estimated)

May 2008

TODD ENGINEERS
Alameda, California

Figure 14
Cross Section
C - C'



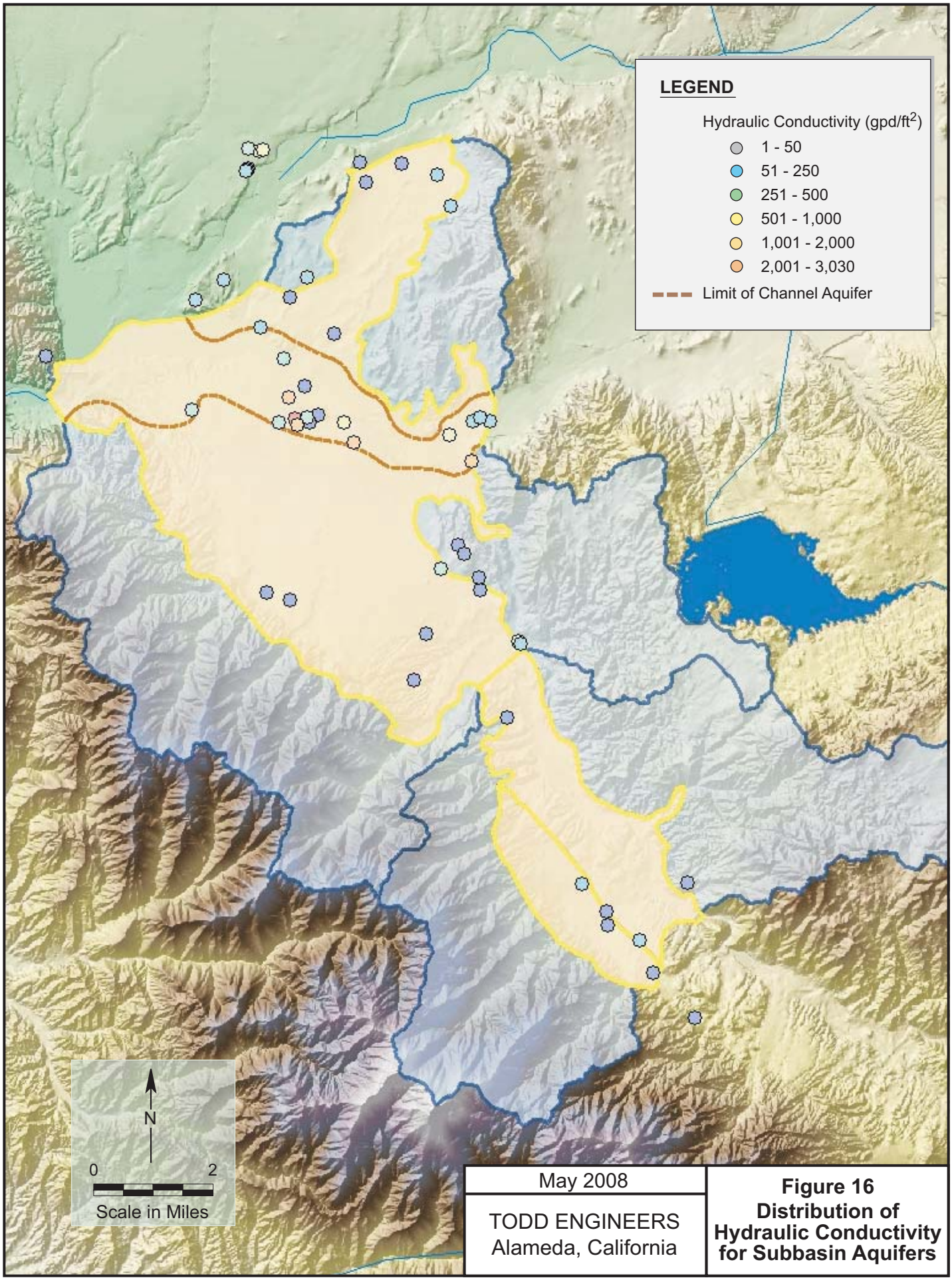
LEGEND

- 50847 — DWR Well Number
- Water Level / Well Screen
- Bottom of Well
- Groundwater Elevation (dashed where estimated)

May 2008

TODD ENGINEERS
Alameda, California

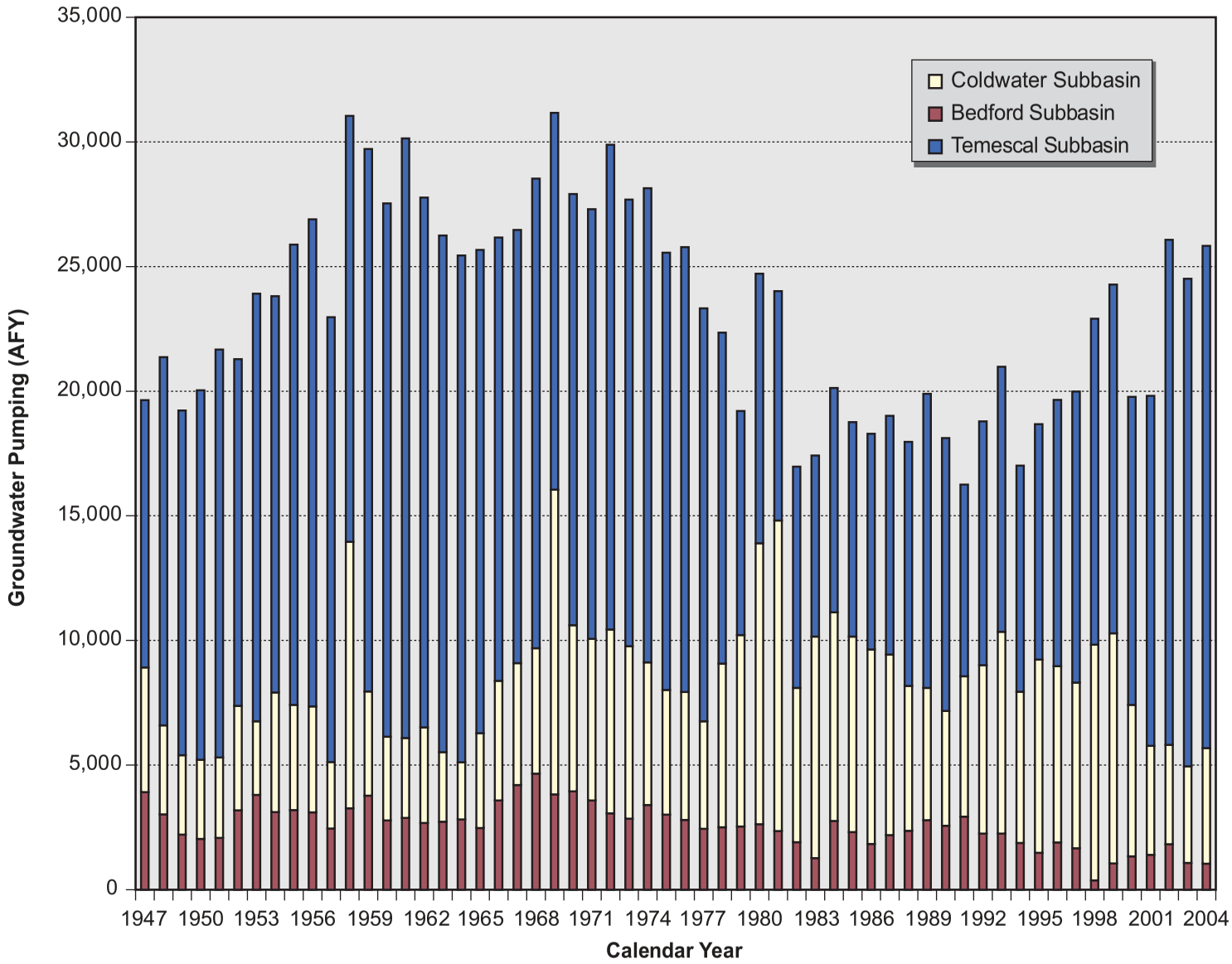
Figure 15
Cross Sections D - D' and E - E'



May 2008

TODD ENGINEERS
Alameda, California

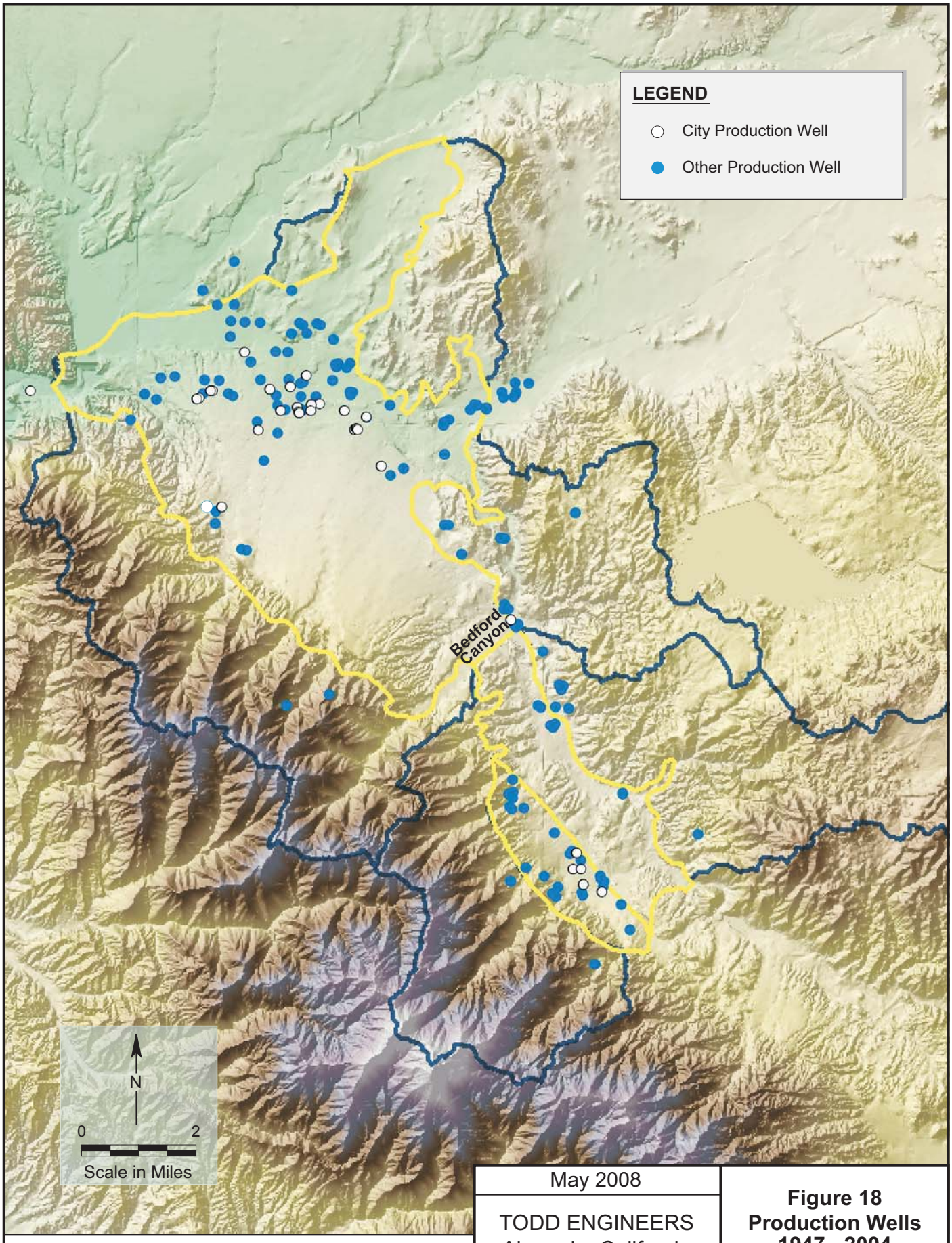
Figure 16
Distribution of Hydraulic Conductivity for Subbasin Aquifers



May 2008

TODD ENGINEERS
Alameda, California

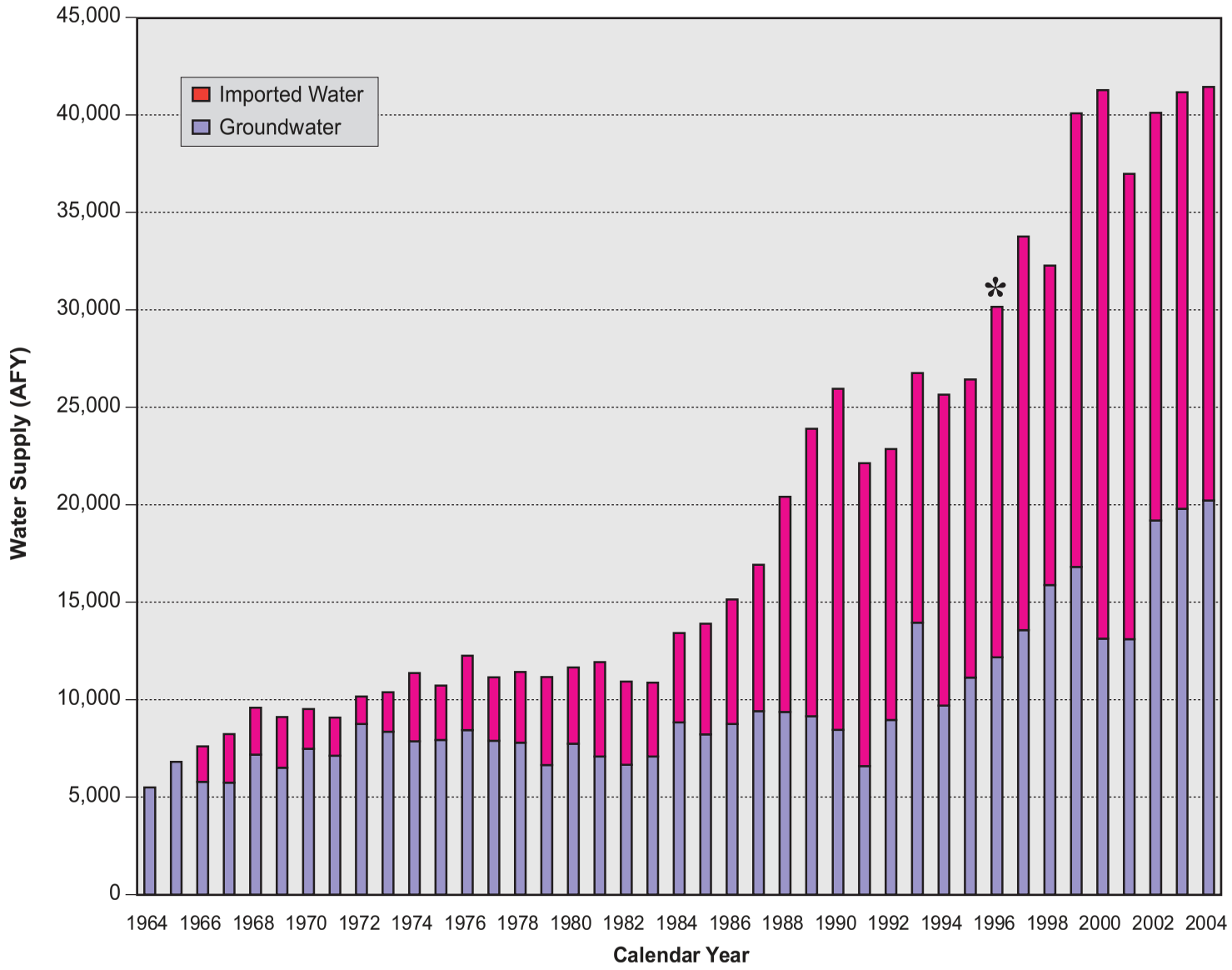
Figure 17
Study Area Groundwater Pumping



May 2008

TODD ENGINEERS
Alameda, California

Figure 18
Production Wells
1947 - 2004

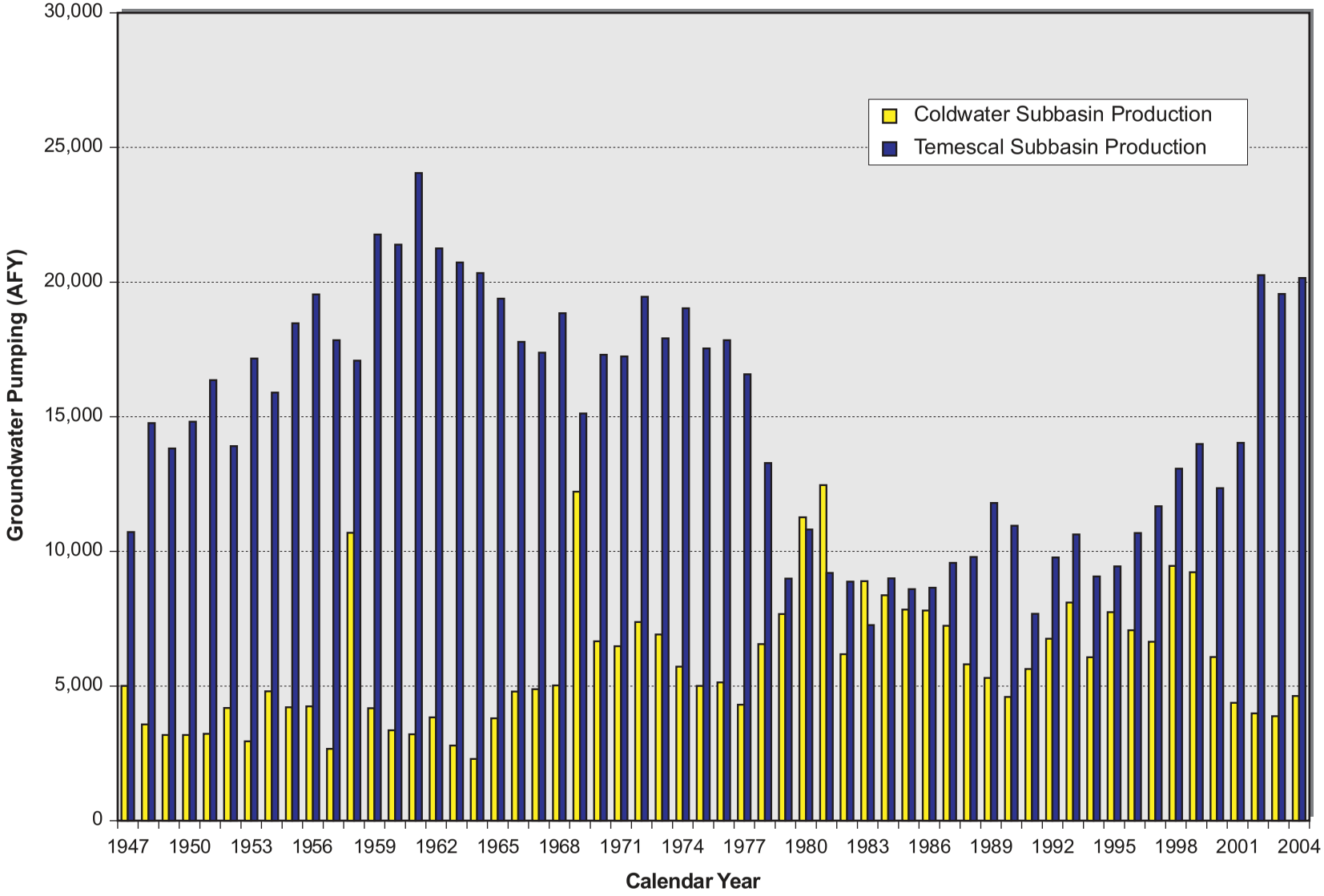


* Includes estimates for missing data between July 1996 and December 1996.

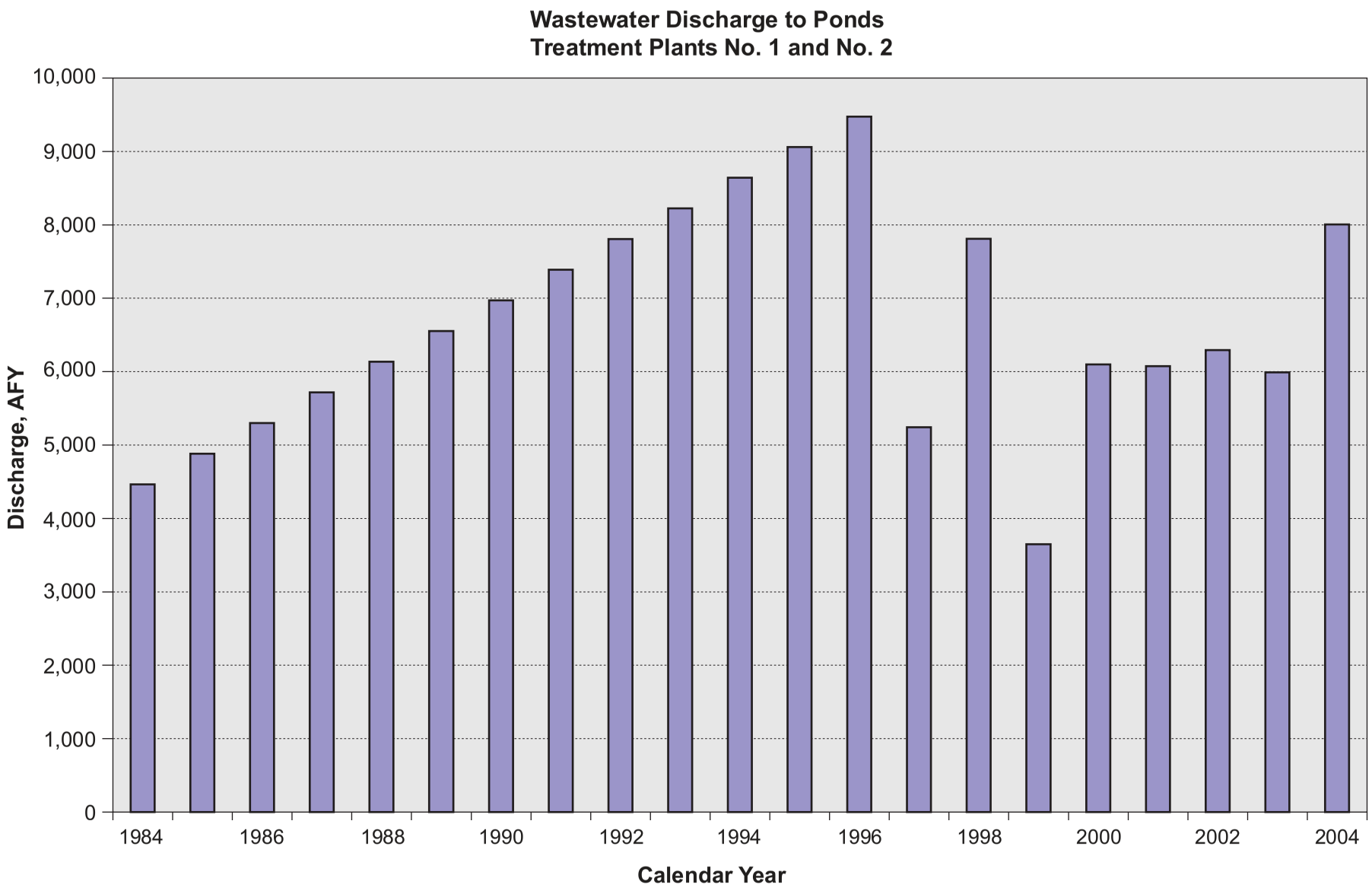
May 2008

TODD ENGINEERS
Alameda, California

Figure 19
City of Corona
Water Supply



May 2008	**Figure 20**
TODD ENGINEERS Alameda, California	**Pumping in Temescal and Coldwater Subbasins**



Note: Prior to 1997, all effluent was discharged to percolation ponds.
After 1997, effluent was discharged to ponds and Temescal Wash.
Effluent discharge 1984 - 1996 estimated based on population.

May 2008

TODD ENGINEERS
Alameda, California

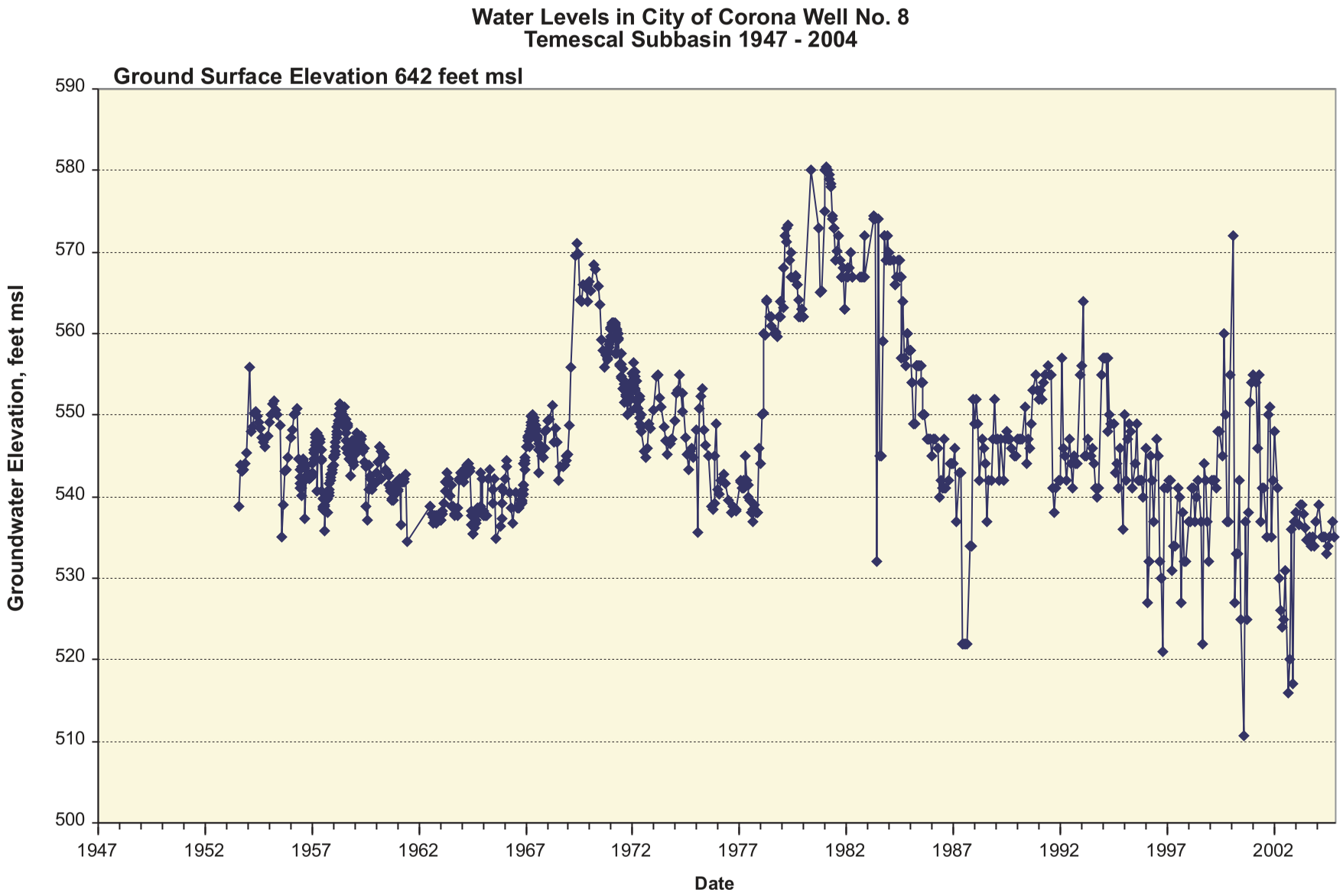
Figure 21
Wastewater Discharge to Ponds



May 2008

TODD ENGINEERS
Alameda, California

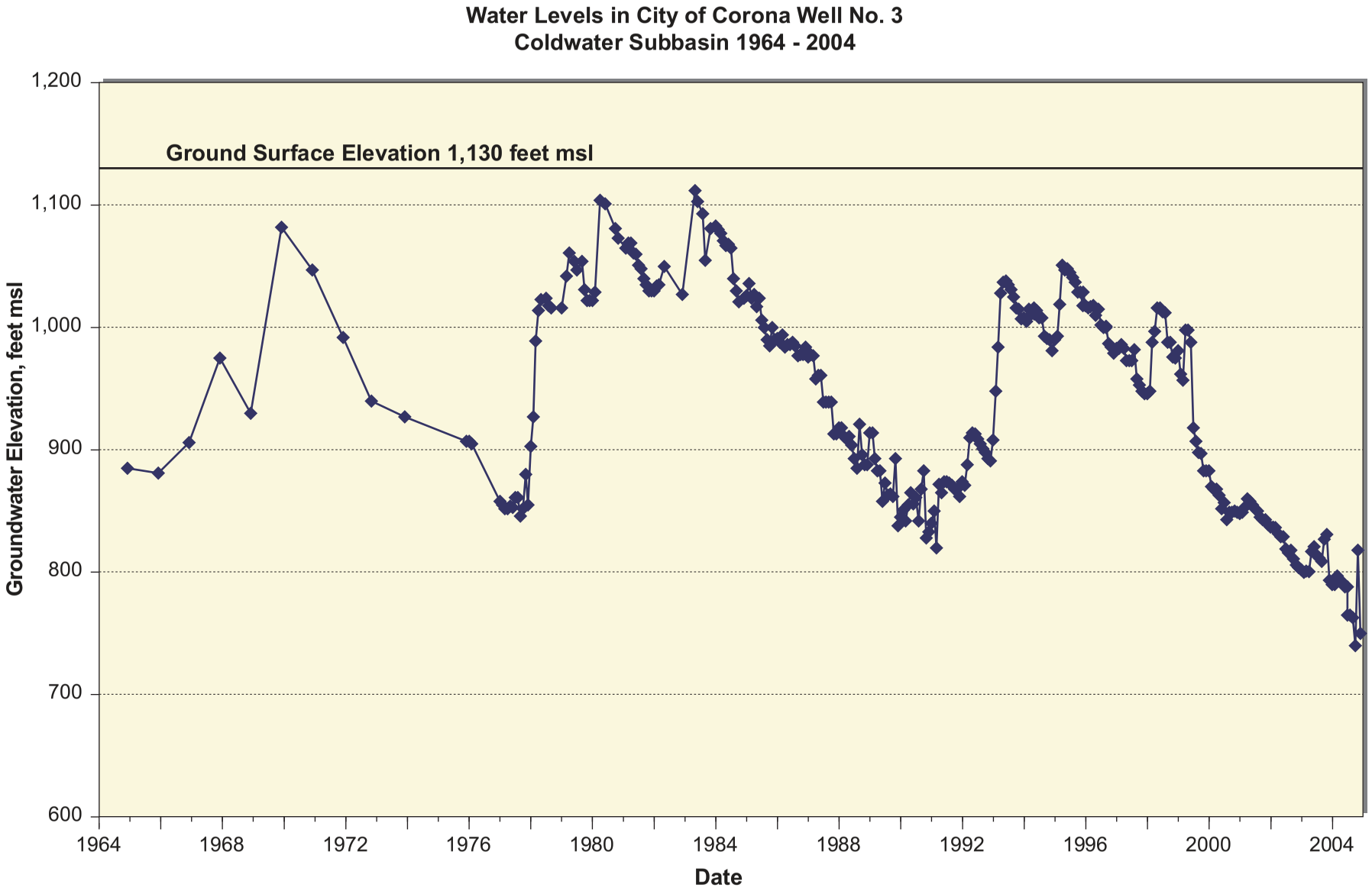
Figure 22
Location of Key Hydrographs



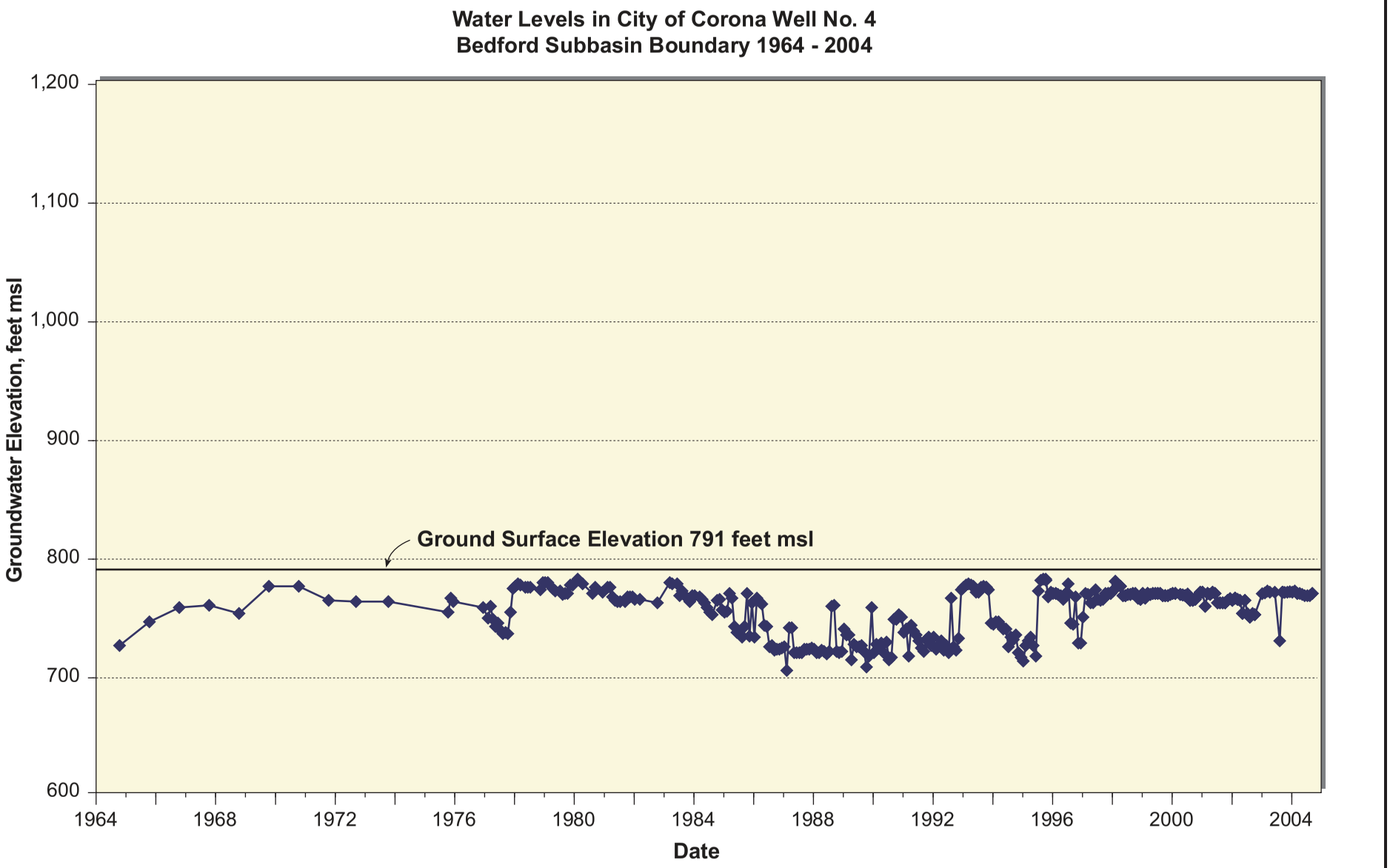
May 2008

TODD ENGINEERS
Alameda, California

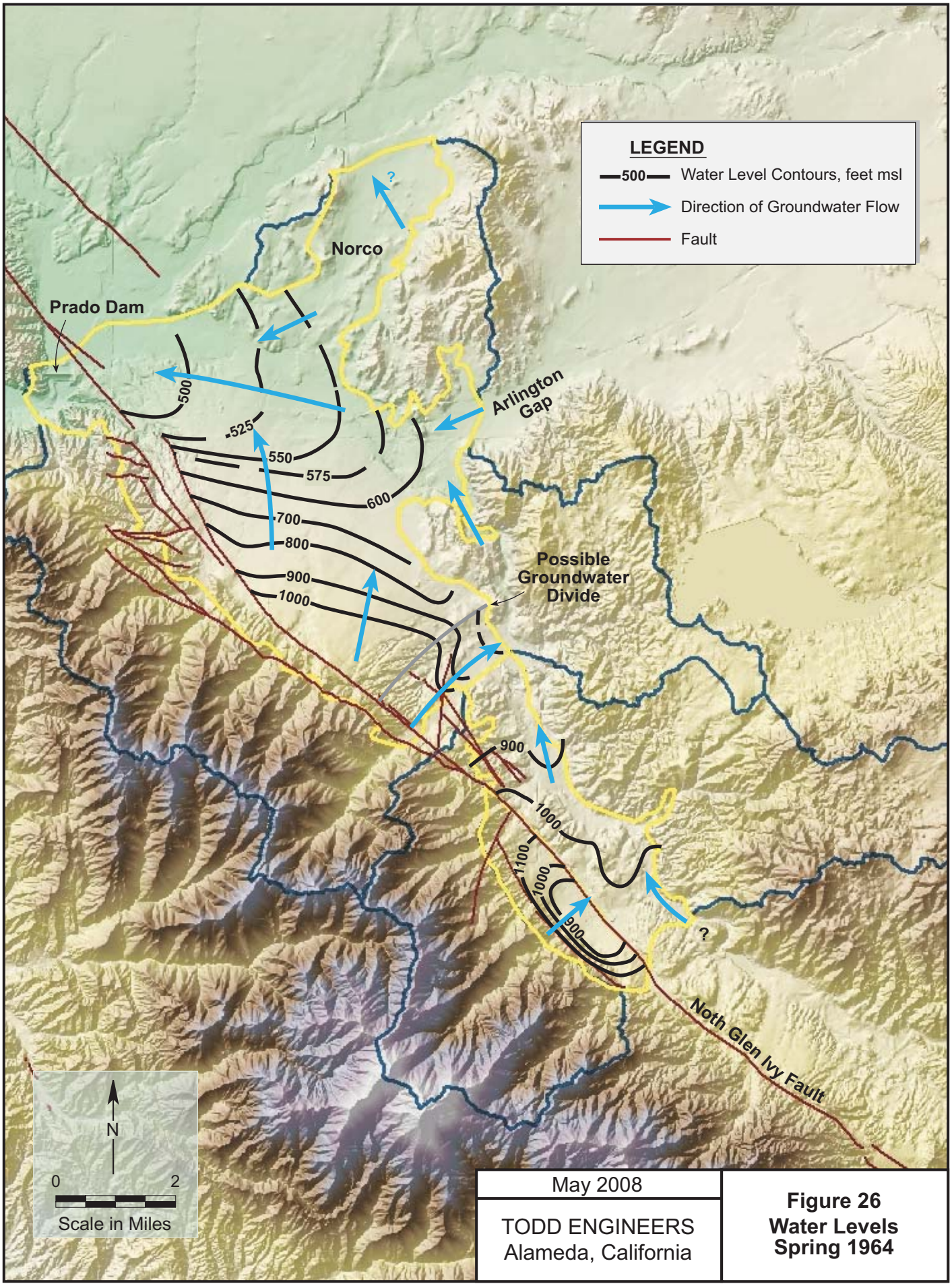
Figure 23
Temescal Subbasin Hydrograph



May 2008	**Figure 24**
TODD ENGINEERS Alameda, California	**Coldwater Subbasin Hydrograph**



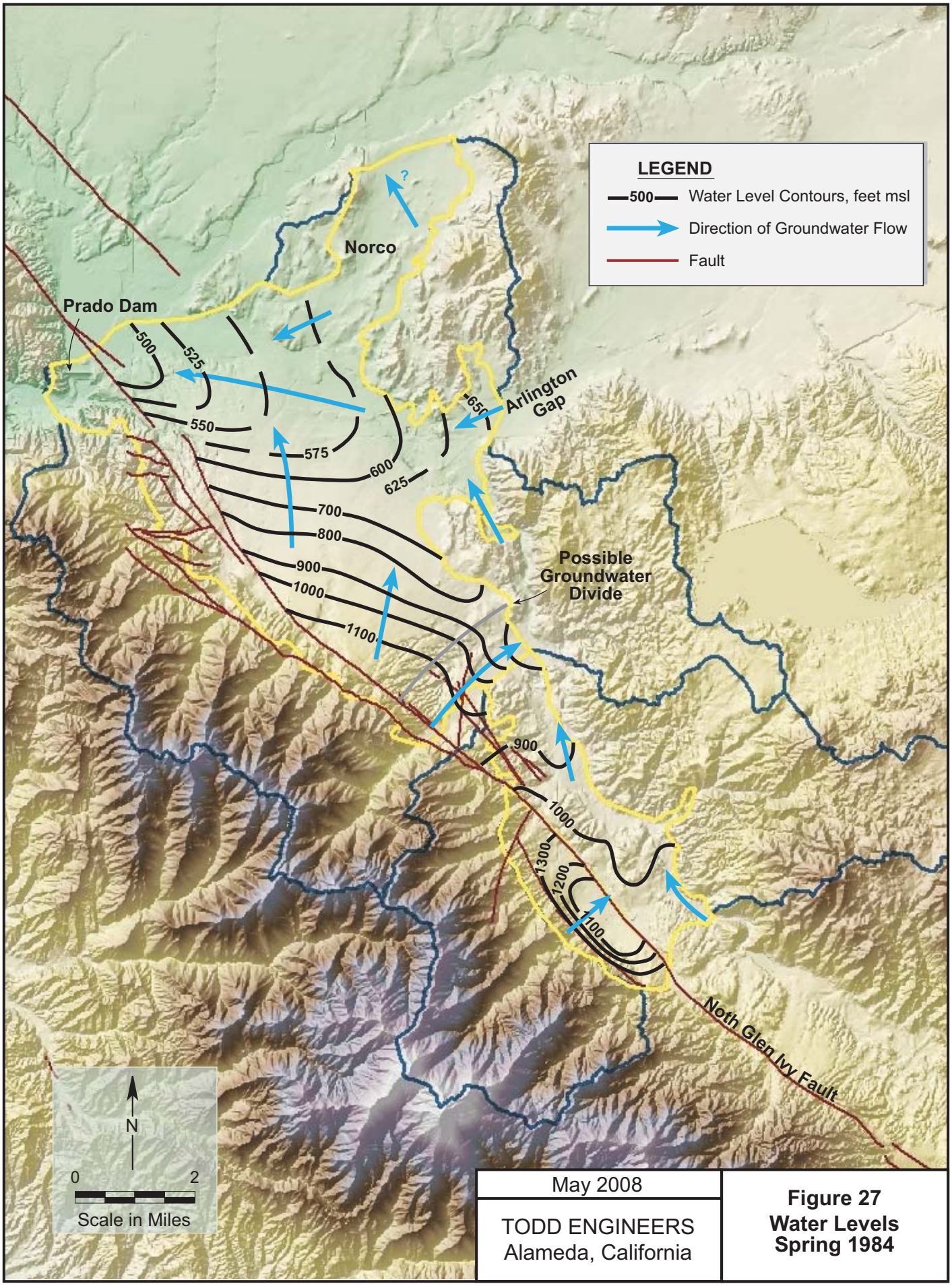
May 2008	**Figure 25**
TODD ENGINEERS Alameda, California	**Bedford Canyon Hydrograph**



May 2008

TODD ENGINEERS
Alameda, California

Figure 26
Water Levels
Spring 1964

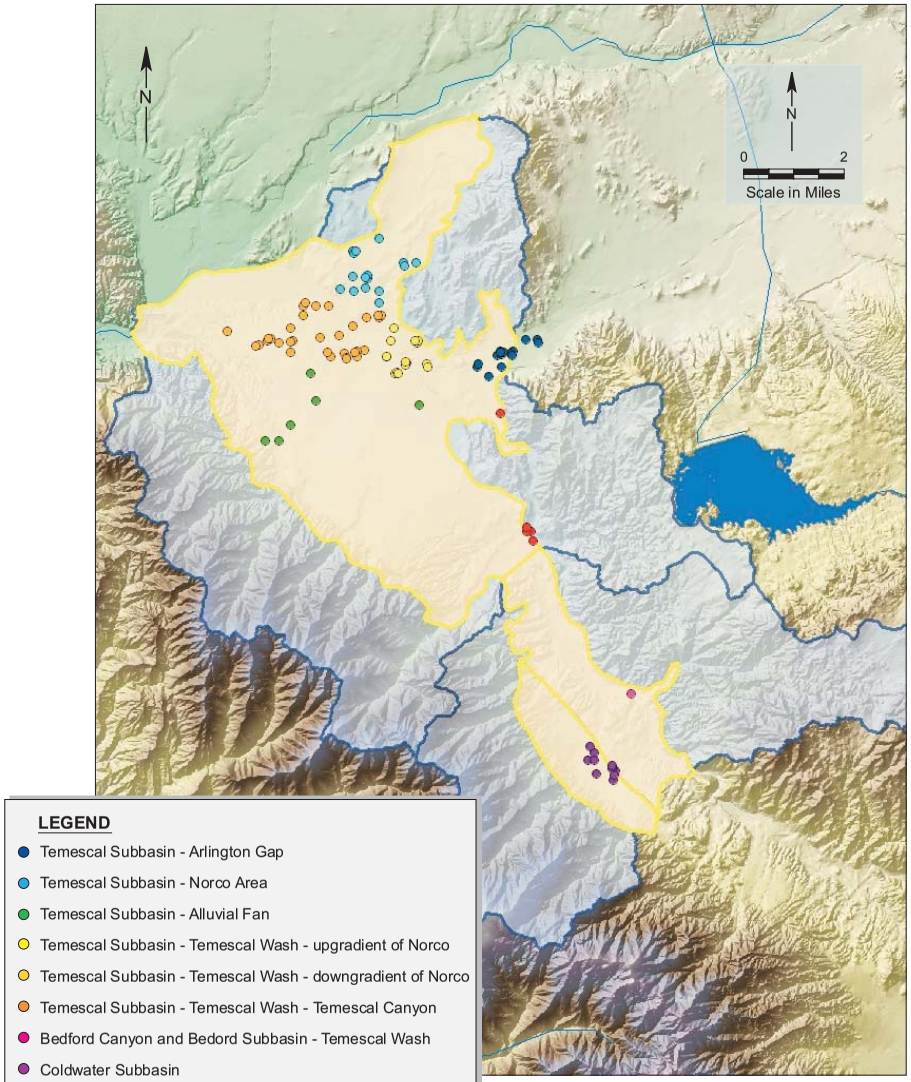


May 2008

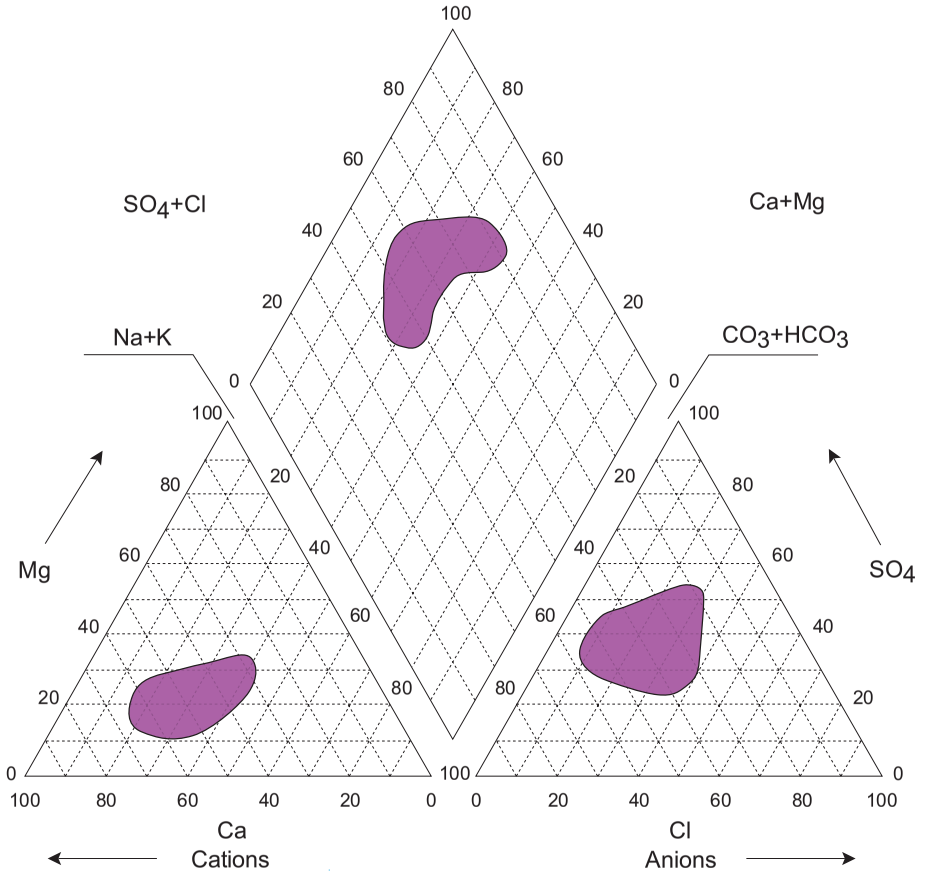
TODD ENGINEERS
Alameda, California

Figure 27
Water Levels
Spring 1984

Water Quality Data Sets by Area

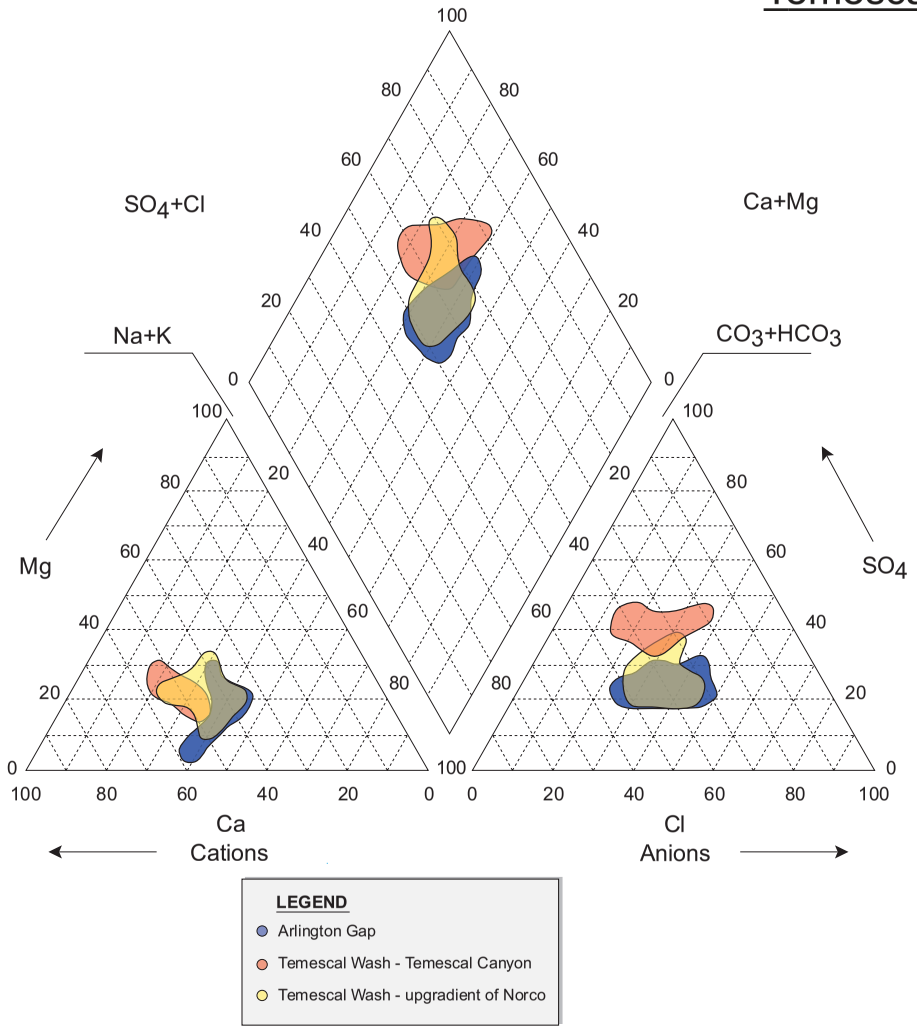


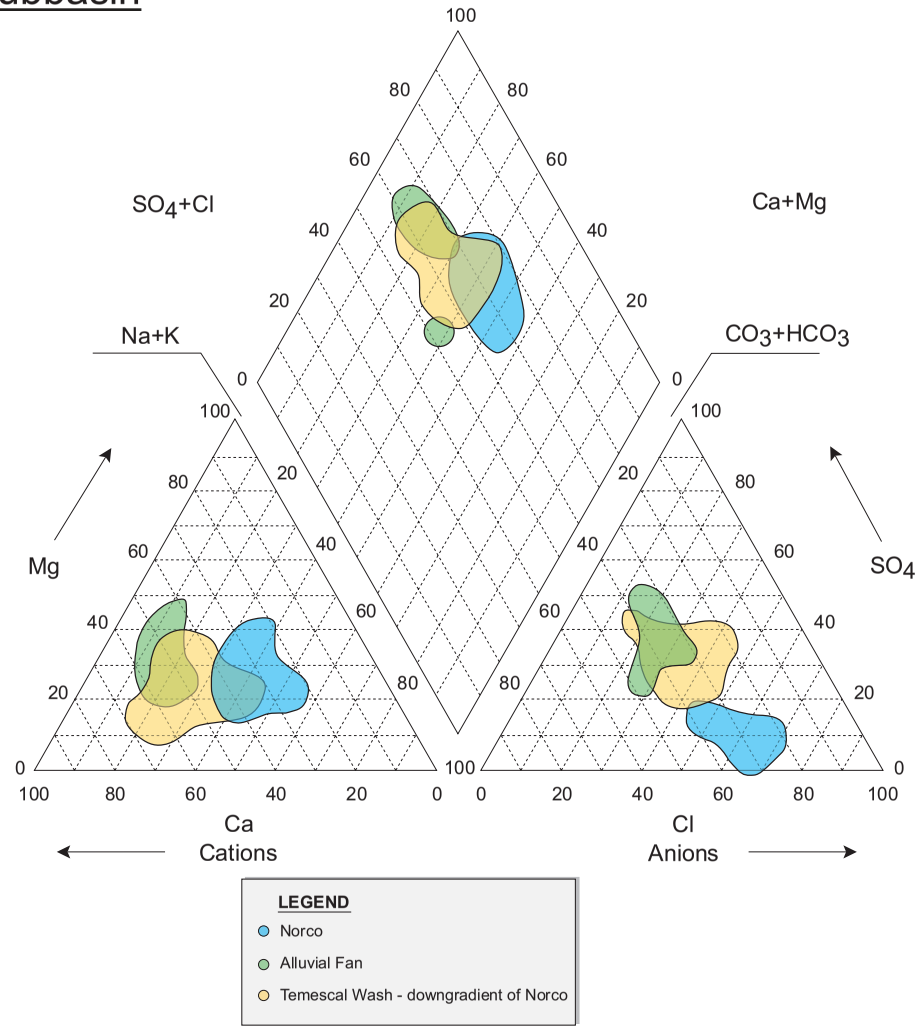
Coldwater Subbasin



May 2008	**Figure 28**
TODD ENGINEERS Alameda, California	**Water Quality Analysis and Coldwater Subbasin Water Chemistry**

Temescal Subbasin



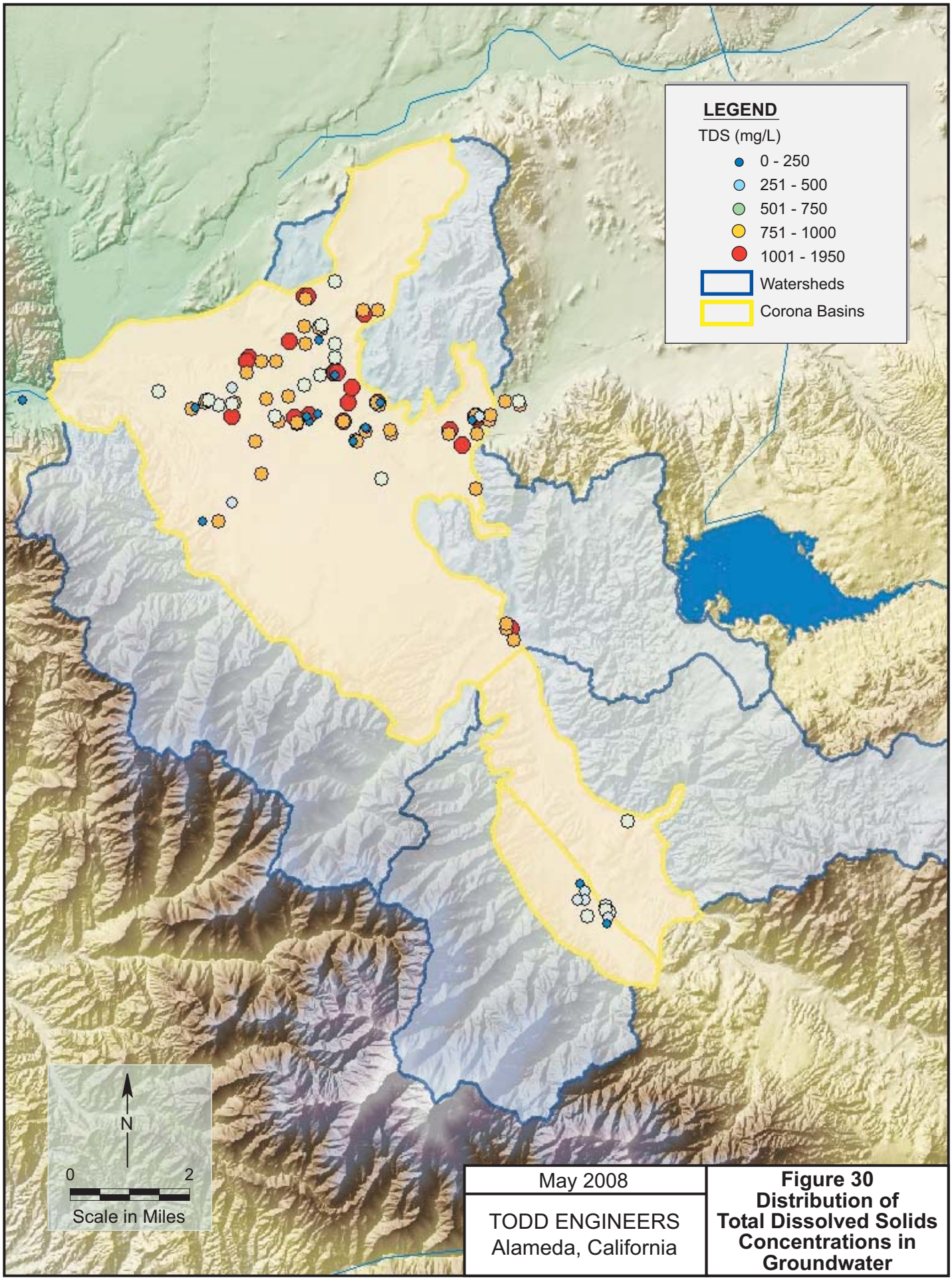


Colors correspond to map locations on Figure 28.

May 2008

TODD ENGINEERS
Alameda, California

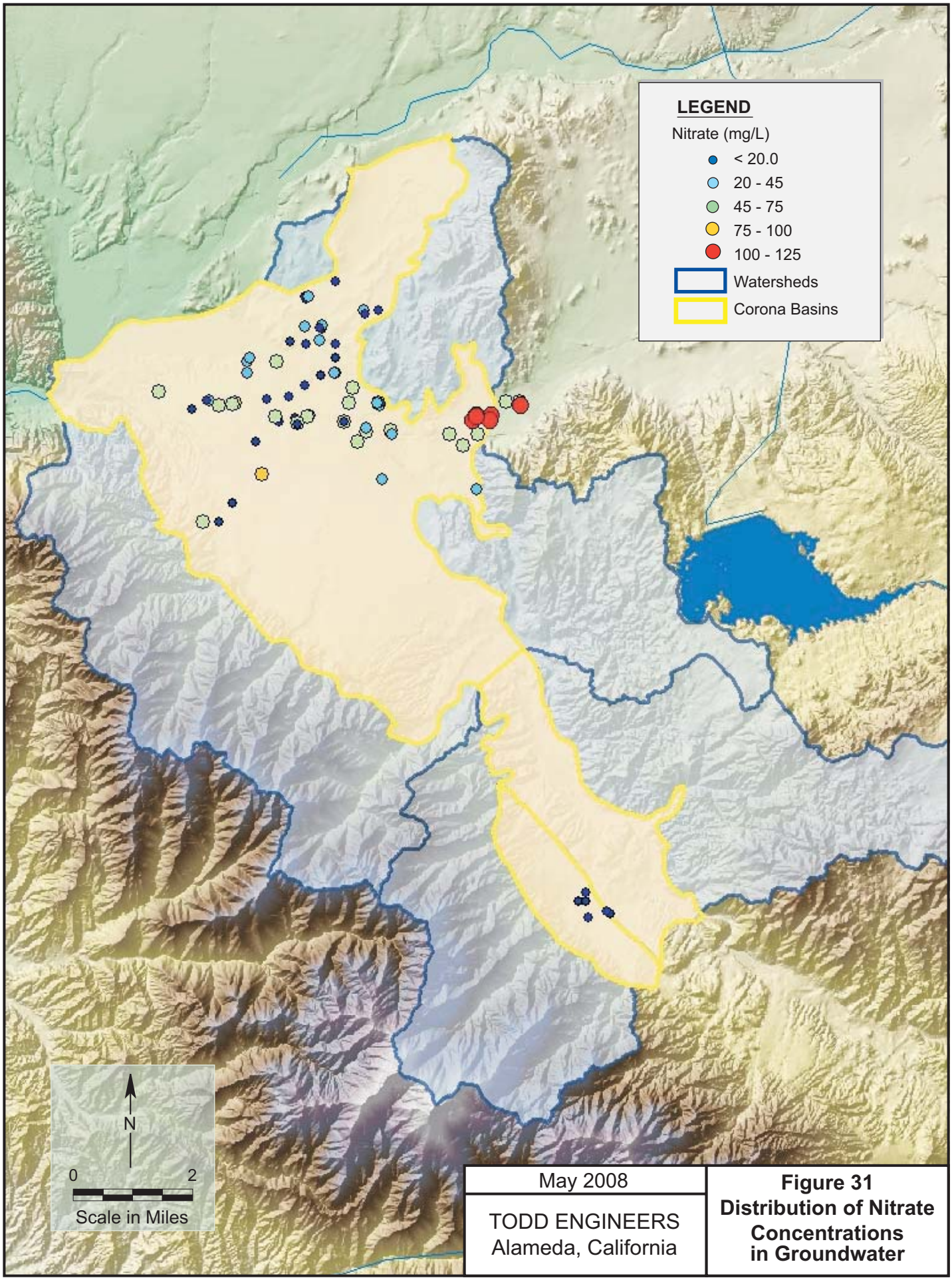
Figure 29
Variability of Water Chemistry Among Aquifers - Temescal Subbasin



May 2008

TODD ENGINEERS
Alameda, California

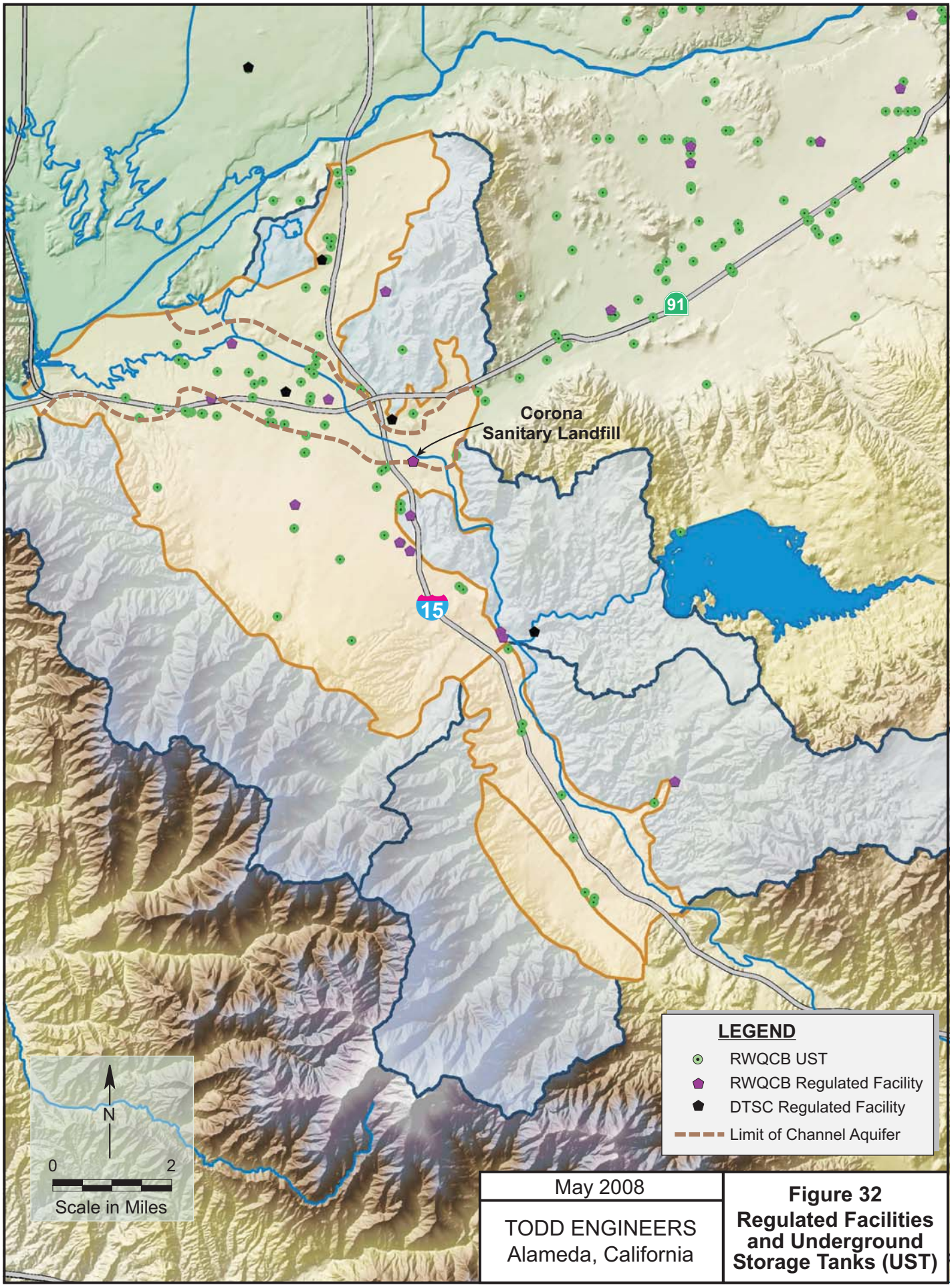
Figure 30
Distribution of Total Dissolved Solids Concentrations in Groundwater



May 2008

TODD ENGINEERS
Alameda, California

Figure 31
Distribution of Nitrate Concentrations in Groundwater



May 2008

TODD ENGINEERS
Alameda, California

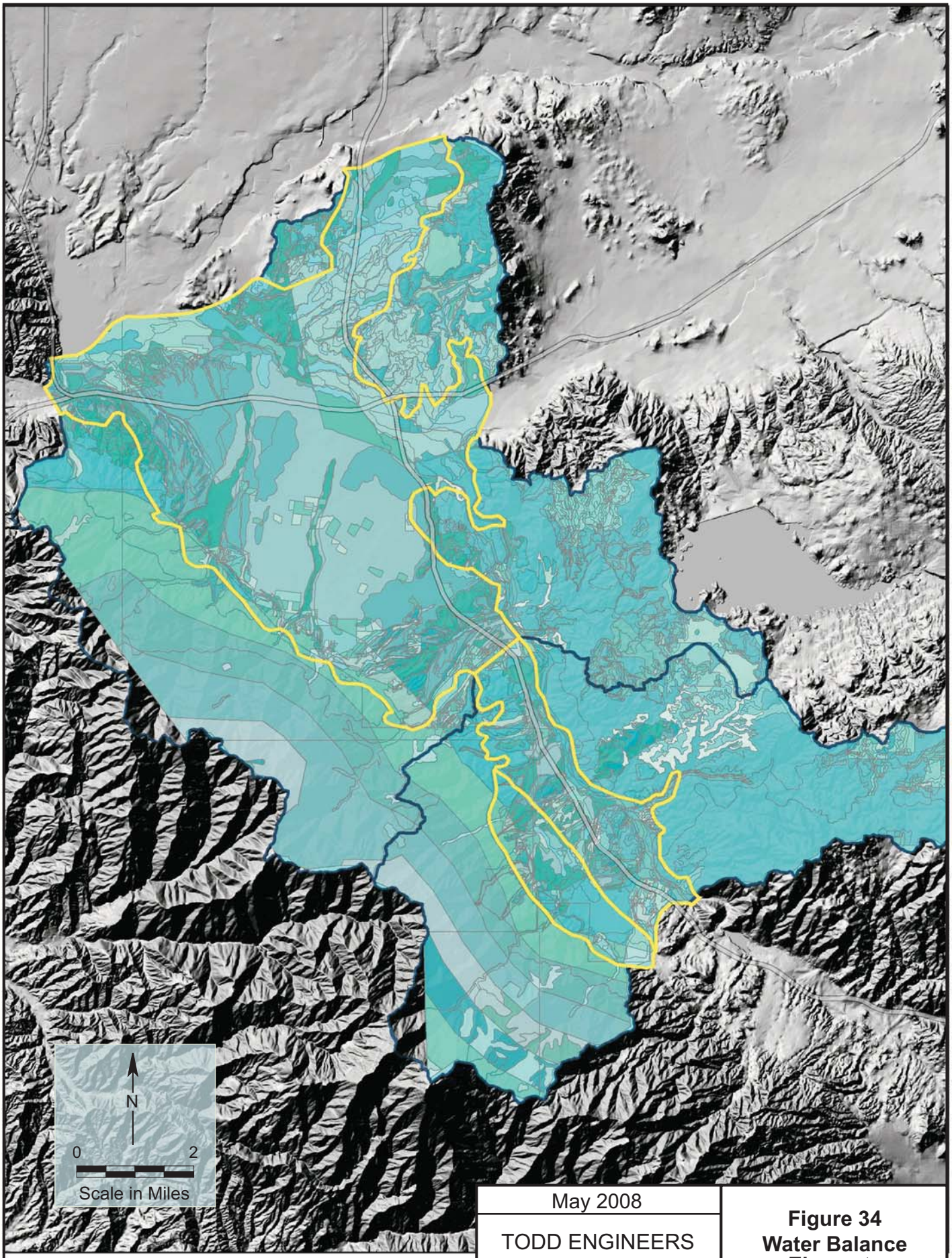
Figure 32
Regulated Facilities and Underground Storage Tanks (UST)



May 2008

TODD ENGINEERS
Alameda, California

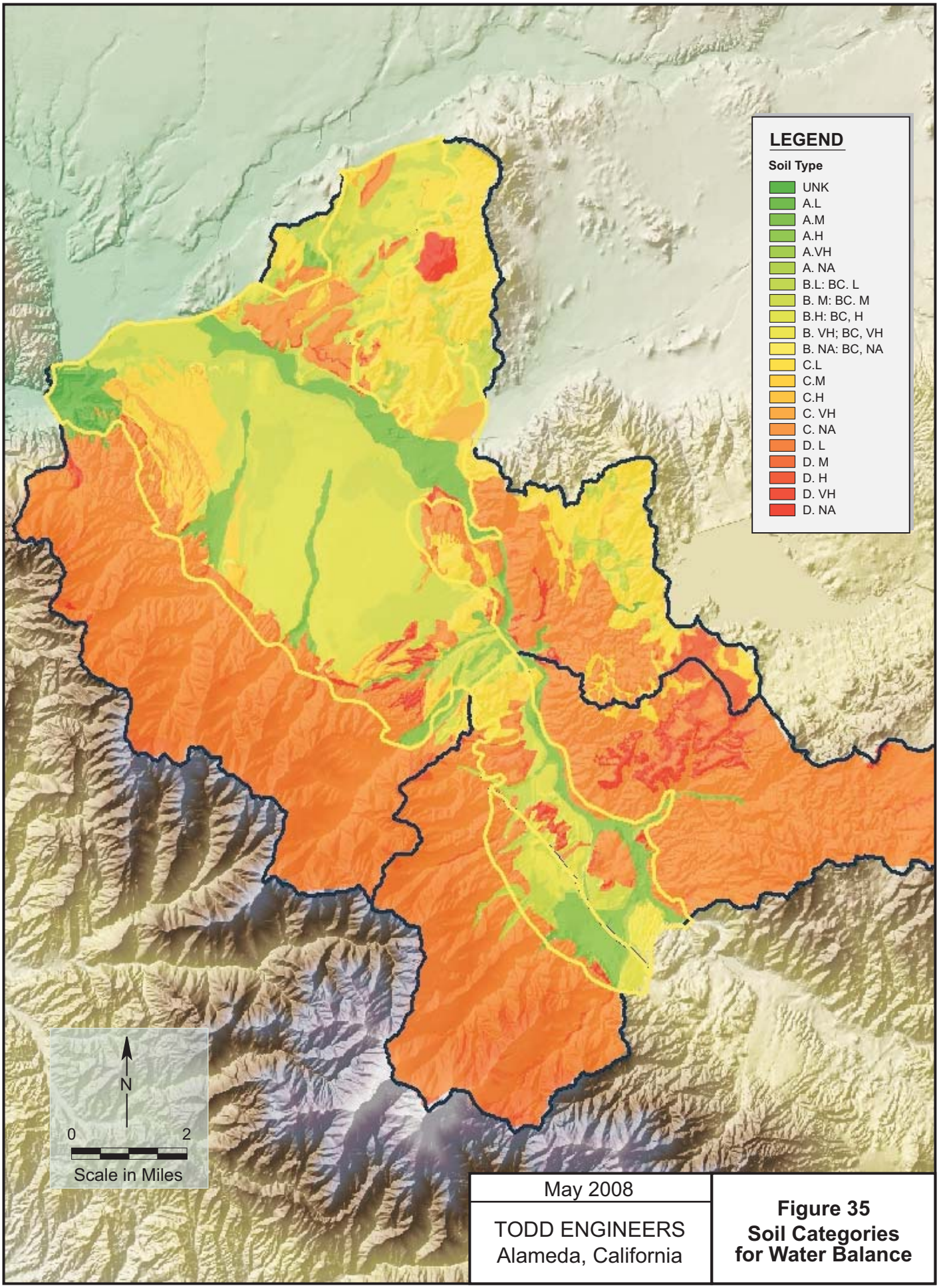
Figure 33
Water Balance Units



May 2008

TODD ENGINEERS
Alameda, California

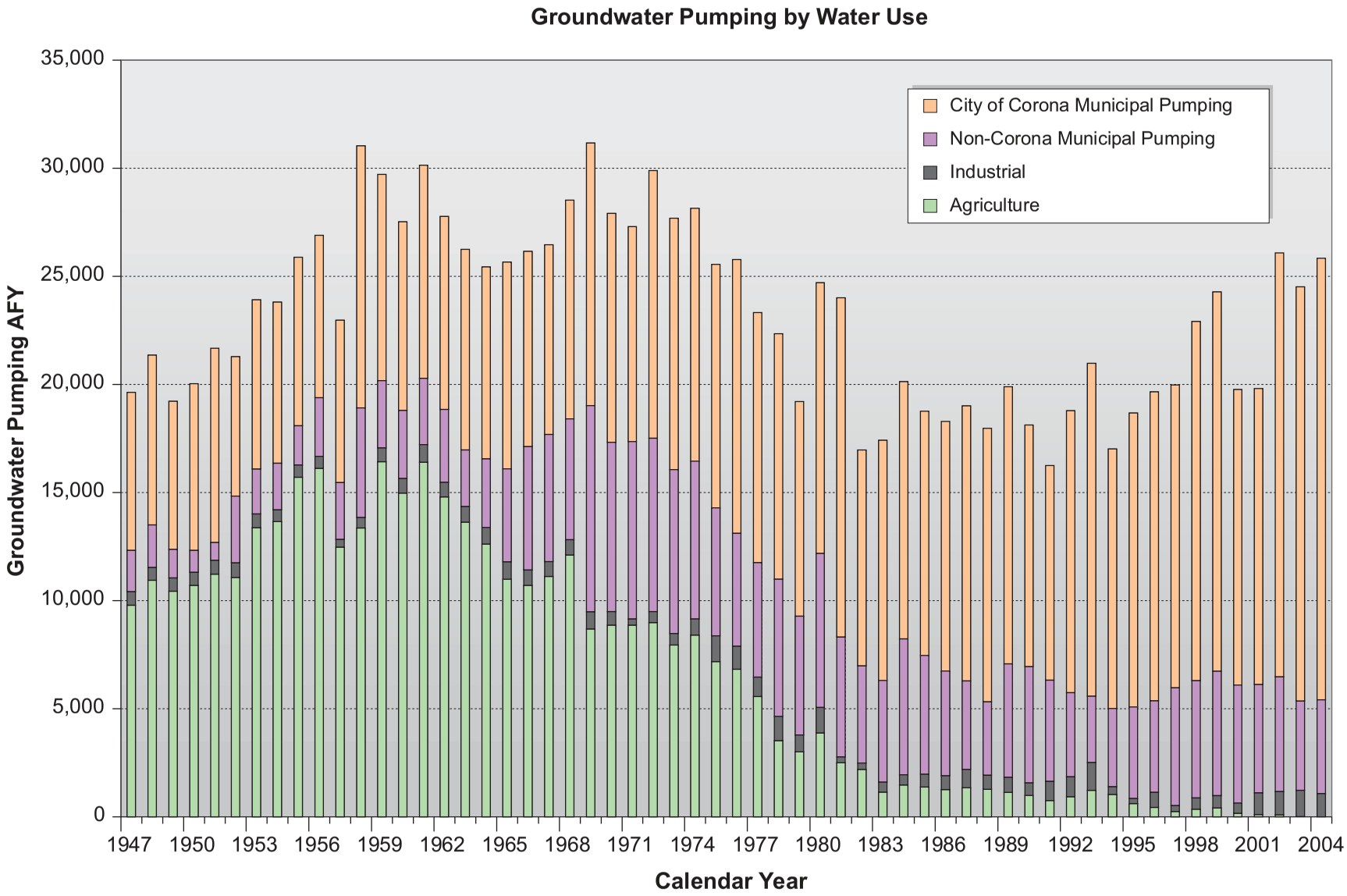
Figure 34
Water Balance Elements



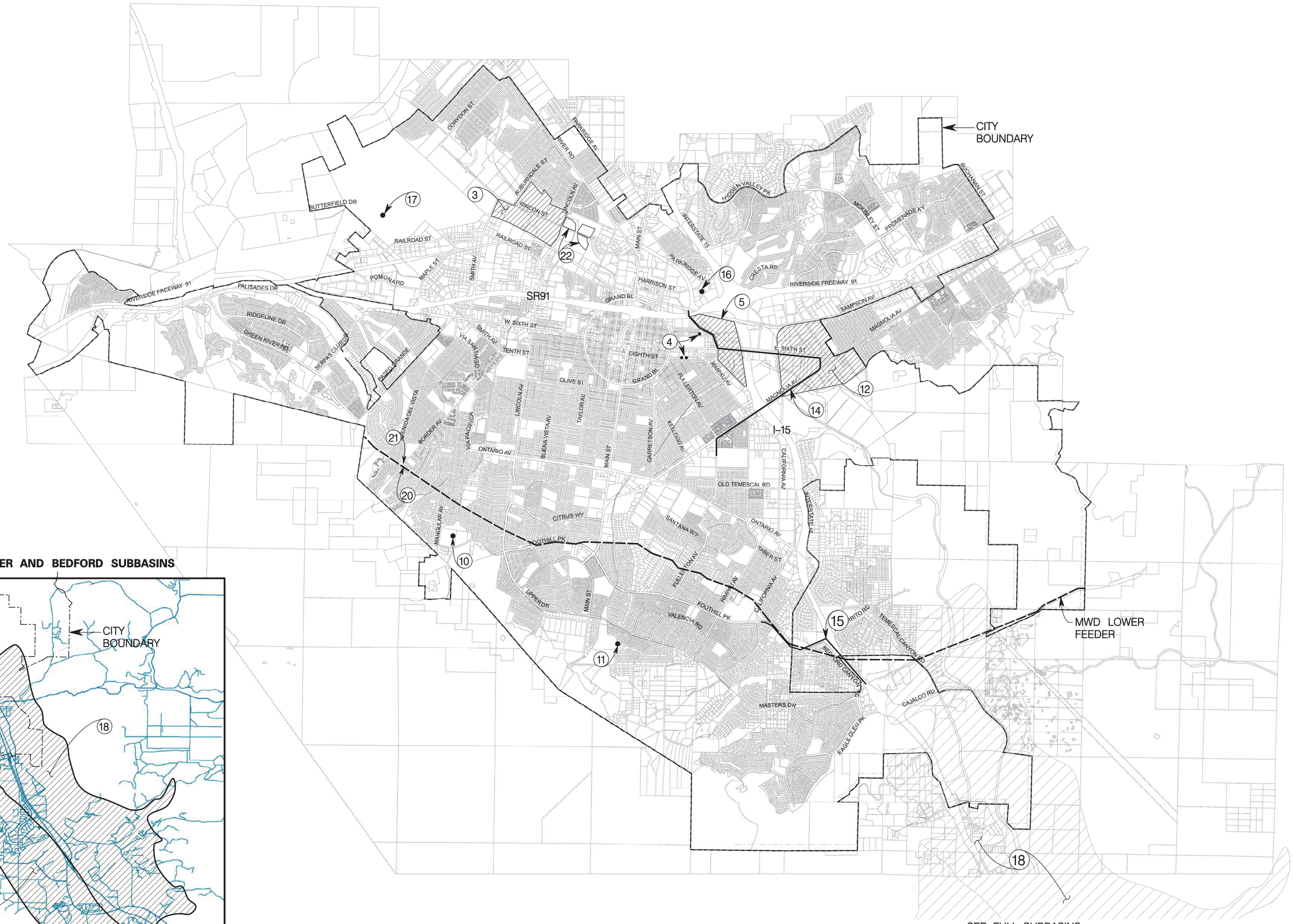
May 2008

TODD ENGINEERS
Alameda, California

Figure 35
Soil Categories for Water Balance



May 2008	**Figure 36**
TODD ENGINEERS Alameda, California	**Groundwater Pumping by Water Use**



PROJECT LOCATIONS	
ITEM	DESCRIPTION
①	NEW WATER WELLS (CITY WIDE)
②	REPLACEMENT WATER WELLS (CITY WIDE)
③	RINCON GROUNDWATER TREATMENT PROJECT
④	WELLHEAD TREATMENT FOR WELLS 6, 7, AND 17
⑤	EL SOBRANTE GROUNDWATER TREATMENT PROJECT
⑥	GROUNDWATER TREATMENT PROGRAM (CITY WIDE)
⑦	GROUNDWATER BLENDING PROGRAM (CITY WIDE)
⑧	IMPROVEMENT OF GROUNDWATER QUANTITY/QUALITY MONITORING PROGRAM (CITY WIDE)
⑨	COLDWATER SUBBASIN ENHANCED RECHARGE PROGRAM
⑩	RECHARGE BASINS WITHIN OAK AVENUE DETENTION BASIN
⑪	RECHARGE BASINS WITHIN MAIN STREET DETENTION BASIN
⑫	UPGRADIENT INJECTION WELLS
⑬	RECYCLED WATER INJECTION WELLS (LOCATION TO BE DETERMINED)
⑭	RECYCLED WATER ZONE 3 TO ZONE 2 INTERCONNECT
⑮	RECYCLED WATER ZONE 4 TO ZONE 3 INTERCONNECT
⑯	WWTP2 UPGRADE TO TERTIARY
⑰	WWTP1A UPGRADE TO TERTIARY
⑱	LEE LAKE WATER DISTRICT RECHARGE TO BEDFORD SUBBASIN
⑲	RECYCLED WATER IRRIGATION (PARKS AND URBAN LANDSCAPE AS IN–LIEU PUMPING)
⑳	PURCHASE OF METROPOLITAN WATER DISTRICT (MWD) IN–LIEU WATER
㉑	PIPELINE TO CONVEY METROPOLITAN WATER DISTRICT (MWD) IN–LIEU WATER TO BORDER AVENUE RECYCLED WATER RESERVOIR
㉒	LINCOLN AND COTA STREET PERCOLATION PONDS MAINTENANCE PROGRAM

COLDWATER AND BEDFORD SUBBASINS

AKM JOB No. 760683.00

AKM Consulting Engineers
553 Wald
Irvine, Ca. 92618
(949) 753-7333

CITY OF CORONA

GROUND WATER MANAGEMENT PLAN

POTENTIAL GROUNDWATER MANAGEMENT STRATEGIES

FIGURE 37

n:\0760 Corona\683 Ground Water Manangement Plan\Groundwtr_Pln.dgn 4/22/2008

Appendix A
Public Notice and Outreach

PUBLIC NOTICES

THE PRESS-ENTERPRISE PE.com Publication date: June 6, 2006.

YOU SHOULD KNOW....

The Press-Enterprise public notices serve to notice the entire community that an important government function is being carried out. This includes governmental events, activities, contracting, and other transactions of interest to every citizen. The Press-Enterprise public notices are a permanent record and source of information for the entire community.

CITATION TO APPEAR
Case No. RIJ-109375
SUPERIOR COURT OF THE STATE OF CALIFORNIA COUNTY OF RIVERSIDE, JUVENILE DIVISION

In re the Matter of:
HANNAH MARIE ROPER,
(dob: 09/07/99)
a Minor(s)

THE PEOPLE OF THE STATE OF CALIFORNIA
TO: THE UNKNOWN FATHER, AND ANYONE CLAIMING TO BE THE FATHER OF THE ABOVE STATED MINOR:

By order of this Court you are hereby cited and required to appear before a Judge of the Superior Court, located at 9991 County Farm Road, Riverside, California on August 9, 2006, at 8:00 a.m., in Department J-3, to show cause, if any, why the above-named minor(s) should not be declared free from the custody and control of her parents, pursuant to a hearing held in accordance with **Welfare and Institutions Code** Section 366.26. This hearing is for the purpose of terminating your parental rights forever and ordering that the minor be placed for adoption.

You are hereby notified of the following provisions of Welfare and Institutions Code:

Section 366.26(e) (2) provides that: "If you appear without counsel and are unable to afford counsel, the Court shall appoint counsel for you, unless such representation is knowingly and intelligently waived."

Section 366.26 provides: "The Court may continue the proceeding for a period not to exceed 30 days as necessary to appoint you counsel, and to enable counsel to become acquainted with your case."

Section 366.26(b) (1) provides: "At the hearing,...the court,...shall do one of the following: (1) Permanently sever your parental rights and order that the child be placed for adoption; (2) Without permanently terminating your parental rights, appoint a legal guardian for the minor and issue letters of guardianship; or (3) Order that the minor be placed in long-term foster care, subject to the regular review of the juvenile court."

Given under my hand and seal of the Superior Court of the County of Riverside, State of California, this 24th day of May 2006.
(SEAL)
INGA McELYEA
Executive Officer
Superior Court of the State California, in and for the County of Riverside.
By: , Deputy
JOE S. RANK
County Counsel
Lilia Wilkerson
Deputy County Counsel
9991 County Farm Road, Suite 113
Riverside, California, 92503
Telephone: 951-358-4125
Attorneys for the Petitioner
Department of Public Social Services 6/6,13,20,27

CITY OF CORONA
NOTICE OF PROPOSED RESOLUTION OF INTENTION TO DRAFT A GROUNDWATER MANAGEMENT PLAN FOR CITY OF CORONA DEPARTMENT OF WATER & POWER

NOTICE IS HEREBY GIVEN that at 7:00 p.m. on June 21, 2006, at City Hall, Council Chamber, 400 S. Vicentia Avenue, Corona, CA, a public hearing will be held to discuss whether or not the City of Corona, Department of Water & Power should adopt a resolution of intention to draft a groundwater management plan.

Section 10753 of the Californian Water Code permits the adoption and implementation of groundwater management plans to encourage authorized local agencies to manage groundwater resources within their service areas.

Landowners within the City of Corona and other interested parties are invited to attend the hearing. Copies of the proposed resolution and other relevant written materials will be available for review by the public at the hearing or may be obtained in advanced at the Department of Water & Power, 400 S. Vicentia Avenue, Corona, CA. Opportunity for public questions/input will be provided at the hearing.

In compliance with Water Code §10753.4 (b), landowners and other interested parties who wish to participate in developing the groundwater management plan may do so by attending the hearing, and indicating their interest, or by submitting a written letter to:

Asad Korgan,
Strategic Planning Manager
400 S. Vicentia Avenue,
Corona, CA 92882-2187

In compliance with the Americans with Disabilities Act, if you need special assistance to participate in this meeting, please contact the Building and Safety Director, (951) 736-2250. Notification 48 hours prior to the meeting will enable the City to make reasonable arrangements to ensure accessibility to this meeting.

The public is invited to attend and comment on the applications described above. Due to time constraints and the number of persons wishing to give oral testimony, each speaker will be limited to three minutes. You may make written comments and submit them to the City Clerk for inclusion into the public record. If you challenge any portion of these projects in court, you may be limited to raising only those issues you or someone else raised at the public hearing described in this notice, or in written correspondence delivered at, or prior to the public hearing. Any person unable to attend the public hearing may submit written comments to the City Clerk, 400 S. Vicentia Avenue, Corona, CA 92882. If you have questions regarding this notice or the applications to be heard, please call the City Clerk's Office at (951) 736-2201.

For additional information pertaining to the Groundwater Management Plan, please call Asad Korgan at (951) 736-2230. 6/6,13

Corona-Norco Unified School District
NOTICE OF PUBLIC HEARING

A public hearing by the Governing Board of the **Corona-Norco Unified** School District will be held prior to the adoption of the 2006-2007 budget. Such hearing will be held at **CNUSD-Board Room 2820 Clark Avenue, Norco, CA on June 20, 2006, at 6:35 p.m.** The budget will be available for public inspection between June 7 and June 20 at the following location(s):

Boulevard, Moreno Valley, California (business address) no later than
2:00 P.M. on JUNE 14, 2006

Proposals shall be in accordance with plans, specifications, other contract documents prepared by the Moreno Valley Unified School District and WLC Architects, Inc.

PROSPECTIVE BIDDERS WHO DID NOT ATTEND THE MANDATORY JOB WALK ON MAY 31 MUST SCHEDULE A JOB WALK WITH ROGER GAY AT WLC ARCHITECTS, (909) 987-0909, **NO LATER THAN JUNE 7, 2006.**

Prospective general contract bidders may secure up to three sets of said documents from the Office of WLC Architects, Inc., 10470 Foothill Blvd., Virginia Dare Tower, Rancho Cucamonga, CA 91730 (909) 987-0909, upon payment of a deposit of Seventy Five Dollars ($75.00) per set. **Deposits will be refunded upon the return of said documents in good condition within seven (7) days after bids on the project have been opened.** A non-refundable mailing charge of Twenty Dollars ($20.00) will be required for each set mailed to California cities.

Prospective subcontract bidders may secure one set of said documents from the office of WLC Architects, Inc., 10470 Foothill Blvd., Virginia Dare Tower, Rancho Cucamonga, California 91730 (909) 987-0909, upon non-refundable payment of Seventy Five Dollars ($75.00) per set. A non-refundable mailing charge of Twenty Dollars ($20.00) will be required for each set mailed to California cities.

For information regarding this project, prospective bidders are requested to contact Roger P. Gay, Project Manager at WLC Architects, Inc.

The Board of Education reserves the right to reject any or all bids, or any or all items of any bid, and to waive any informality on a bid.

Pursuant to Section 22300 of the Public Contract Code of the State of California, the contract will contain provisions permitting the successful bidder to substitute securities for any moneys withheld by the District to ensure performance under this contract.

Pursuant to the Labor Code, the governing board of the Owner has obtained from the Director of the Department of Industrial Relations, State of California, his determinations of per diem wages applicable to the work, and for holiday and overtime work, including employer payments for health and welfare, pension, vacation and similar purposes, as set forth on schedule which is on file at the principal office of the Owner, and which will be made available to any interested person upon request.

The bid shall be accompanied by the security referred to in the contract documents and the list of proposed subcontractors. **ALL BOND SURETIES MUST BE ADMITTED SURETIES LICENSED TO DO BUSINESS IN THE STATE OF CALIFORNIA AND MUST HAVE A FEDERAL TREASURY LISTING IN THE FEDERAL REGISTER WHICH EQUALS OR EXCEEDS THE BONDING AMOUNT. NO PERSONAL SURETIES WILL BE ACCEPTED.**

This Project is a "public work" as defined within California Labor Code Section 1720 and is subject to the requirement to pay prevailing wages to all workers on the "public work" without

der must maintain the license throughout the duration of this contract.

In accordance with Section 1773.2 of the California Labor Code, the Contractor shall post a copy of the determination of prevailing rate of wages at each job site.

It shall be mandatory upon the Contractor to whom the contract is awarded, and upon any subcontractors under him, to pay not less than the said prevailing rates to all workmen employed by them in the execution of this contract.

No bidder may withdraw his bid for a period of forty-five (45) days after the date set for the opening of bids.

As an equal opportunity employer, the District requires that all of its prospective contractors or bidders comply with the intent of the "equal opportunity clause" as set forth in Form HEA-514 (4-69). Contractor shall not discriminate in its recruiting, hiring, promotion, demotion or termination practices on the basis of race, religious creed, color, national origin, ancestry, physical handicap, medical condition, marital status or sex in the performance of this contract, and, to the extent they shall be found to apply hereto, shall comply with the provisions of the California Fair Employment Practices Acts (commencing with Section 1410 of the Labor Code), and the Federal Civil Rights Act of 1964 (P.O. 88-352).

The Moreno Valley Unified School District encourages vendors and contractors (subcontractors) representing the demographics of the local and surrounding community to actively pursue business opportunities with the School District. In order to advocate this participation, the District advertises requests/bids in newspapers and publications whose circulation reflects the various demographic groups of the local and surrounding community.

Assistant Superintendent
Bid packet Legal Counsel approved 11/89
Bid Opening:
2:00 p.m., June 14, 2006
6/6

MORENO VALLEY UNIFIED SCHOOL DISTRICT
25634 Alessandro Blvd.
Moreno Valley, California 92553
(951) 571-7535

NOTICE INVITING BIDS REVISED NOTICE DUE TO ADVERTISING ERROR

Moreno Valley Unified School District, herein called OWNER, invites sealed proposals for:

SUNNYMEADOWS ELEMENTARY SCHOOL REPAIRS (BUILDING A AND B ONLY) LICENSE REQUIRED IS B OR C-5

Proposals for these bids shall be delivered to the District Office, 25634 Alessandro Boulevard, Moreno Valley, California (business address) no later than
2:00 P.M. on JUNE 15, 2006

PROSPECTIVE BIDDERS WHO DID NOT ATTEND THE MANDATORY JOB WALK ON JUNE 1 MUST CALL ROGER GAY AT WLC ARCHITECTS, (909) 987-0909, **NO LATER THEN JUNE 7, 2006,** TO SCHEDULE A JOB WALK.

Proposals shall be in accordance with plans, specifications, other contract documents prepared by the Moreno Valley Unified School District and WLC Architects, Inc.

Prospective general contract bidders may secure up to

be required for each set mailed to California cities.

For information regarding this project, prospective bidders are requested to contact Roger P. Gay, project Manager at WLC Architects, Inc.

The Board of Education reserves the right to reject any or all bids, or any or all items of any bid, and to waive any informality on a bid.

Pursuant to Section 22300 of the Public Contract Code of the State of California, the contract will contain provisions permitting the successful bidder to substitute securities for any moneys withheld by the District to ensure performance under this contract.

Pursuant to the Labor Code, the governing board of the Owner has obtained from the Director of the Department of Industrial Relations, State of California, his determinations of per diem wages applicable to the work, and for holiday and overtime work, including employer payments for health and welfare, pension, vacation and similar purposes, as set forth on schedule which is on file at the principal office of the Owner, and which will be made available to any interested person upon request.

The bid shall be accompanied by the security referred to in the contract documents and the list of proposed subcontractors. **ALL BOND SURETIES MUST BE ADMITTED SURETIES LICENSED TO DO BUSINESS IN THE STATE OF CALIFORNIA AND MUST HAVE A FEDERAL TREASURY LISTING IN THE FEDERAL REGISTER WHICH EQUALS OR EXCEEDS THE BONDING AMOUNT. NO PERSONAL SURETIES WILL BE ACCEPTED.**

This Project is a "public work" as defined within California Labor Code Section 1720 and is subject to the requirement to pay prevailing wages to all workers on the "public work" without exception.

A payment bond and performance bond will be required of the General Contractor prior to the execution of the contract. In addition, a performance bond will be required of all subcontractor providing goods and services in excess of $15,000.00. These bonds shall be in the form and amount set forth in the Contract Documents.

In accordance with provisions of Public Contract Code Section 22300, substitution of eligible and equivalent securities for any monies withheld to ensure performance under this contract will be permitted at the request and expense of the Contractor.

Each Bidder will possess at the time of bid, the applicable Contractor's license, pursuant to Public Contract Code Section 3300 and Business and Professions Code Section 7028.15. The successful bidder must maintain the license throughout the duration of this contract.

In accordance with Section 1773.2 of the California Labor Code, the Contractor shall post a copy of the determination of prevailing rate of wages at each job site.

It shall be mandatory upon the Contractor to whom the contract is awarded, and upon any subcontractors under him, to pay not less than the said prevailing rates to all workmen employed by them in the execution of this contract.

No bidder may withdraw his bid for a period of forty-five (45) days after the date set for the opening of bids.

As an equal opportunity employer, the District requires that all of its prospective contractors or bidders comply with

tion, demotion or termination practices on the basis of religious creed, color, national origin, ancestry, physical handicap, medical condition, marital status or sex in the performance of this contract, and, to the extent they shall be found to apply hereto, shall comply with the provisions of the California Fair Employment Practices (commencing with Section 1410 of the Labor Code), and the Federal Civil Rights Act of 1964 (P.O. 88-352).

The Moreno Valley Unified School District encourages vendors and contractors (subcontractors) representing the demographics of the local and surrounding community to actively pursue business opportunities with the School District. In order to advocate this participation, the District advertises requests/bids in newspapers and publications whose circulation reflects the various demographic groups of the local and surrounding community.

Assistant Superintendent
Bid packet Legal Counsel approved 11/89
Bid Opening:
2:00 p.m., June 15, 2006

NOTICE INVITING B
School District: C
Norco Unified School D
of Riverside County, Cal
(hereinafter, "DISTRICT
Bid Deadline: 3:00 p.m. of the 20th day June
Bid Opening: 3:00 p.m. of the 20th day of 2006.
Place of Bid Receipt Opening: Business Se Office, 2820 Clark A Norco, California 92860
Bid Identification
Bid Number 2005/06-G dustrial Technology ment and Software Roosevelt High School
NOTICE IS HE GIVEN that the DIST acting by and through th erning Board, will rece to, but not later than the stated time, sealed bids award of a Contract above referenced bid.
Bids shall be received place identified above shall be opened and p read aloud at the above time and place.
All work, equipment supplies must be de within **Thirty (30)** cons calendar days from the the notice issued by th TRICT. Time is of the e Failure to deliver the ment and/or supplies the time set forth here constitute a breach of for which the DISTRI exercise any equitable legal remedies availab
Each Bid must conf be responsive to the Documents.
Pursuant to Public Code Sections 2011 20652, the Bidder ma other public entities State of California to pu equipment and supplie the same terms conditions.
The DISTRICT rese right to reject any and or to waive any irregula informalities in any bi the bidding.
No Bidder may w any bid for a period of days after the date se opening of bids.
Governing Board
CORONA-NORCO UN SCHOOL DISTRICT
Date: June 2, 2006
By: (Rosalie Aio)
Purchasing Manager

NOTICE INVITING
Bids will be opened in forum at 2:00 P.M. on 2006 for PROJECT Tract 31330 Winches Storm Drain Improv

RESOLUTION NO. 2006-074

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF CORONA, CALIFORNIA, APPROVING A NOTICE OF INTENTION FOR THE CITY OF CORONA DEPARTMENT OF WATER & POWER TO DRAFT A GROUNDWATER MANAGEMENT PLAN

WHEREAS, adoption of a Groundwater Management Plan is in furtherance of and consistent with the City's Water Master Plan as adopted by the City Council; and

WHEREAS, Section 10753 of the California Water Code permits the adoption and implementation of groundwater management plans to encourage authorized local agencies to manage groundwater resources within their services areas; and

WHEREAS, the City of Corona Department of Water & Power (CDWP) is an authorized local agency and may, therefore, adopt and implement such a Groundwater Management Plan; and

WHEREAS, a Public Notice of Intention was published in a newspaper of general circulation on June 6, 2006, and on June 13, 2006, announcing the City's intention to consider the adoption of a resolution of intention to draft a Groundwater Management Plan in accordance with the California Water Code Section 10753.2 and California Government Code Section 6066; and

WHEREAS, a public hearing was held on June 21, 2006, to discuss the adoption and implementation of a Groundwater Management Plan in accordance with California Water Code Section 10753.2; and

WHEREAS, the City Council believes the groundwater can best be managed, as in the past, by CDWP in coordination with owners of properties overlying the groundwater basin; and

WHEREAS, the City Council believes the adoption of a Groundwater Management Plan will be in the best interest of the city's property owners and water users and can help meet the projected long-term water needs of the City.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Corona, California, as follows:

Section 1: It is the intention of CDWP to draft a Groundwater Management Plan in accordance with Section 10753.4 of the California Water Code, and CDWP's consultant is hereby authorized and directed to draft such plan.

Section 2: This Resolution shall be deemed a resolution of intention in accordance with California Water Code Section 10753.2.

Section 3: The CDWP is authorized and directed to publish this resolution of intention to draft a Groundwater Management Plan in accordance with the provisions of California Water Code Section 10753.3 and to provide interested persons with a copy of this Resolution upon written request.

Section 4: The City Council hereby authorizes the CDWP General Manager to execute all documents and take any other action necessary or advisable to carry out the purpose of this Resolution.

Section 5: After the Groundwater Management Plan has been prepared, CDWP will conduct a second public hearing in accordance with California Water Code Section 10753.5, et seq. to determine whether to adopt the plan.

ADOPTED this 21st day of June 2006.

Karen Spiegel
Mayor of the City of Corona, California

ATTEST:

Victoria J. Wasko
City Clerk of the City of Corona, California

CERTIFICATION

I, VICTORIA J. WASKO, City Clerk of the City of Corona, California, do hereby certify that the foregoing Resolution was passed and adopted by the City Council of the City of Corona, California, at a regular adjourned meeting held on the 21st day of June 2006, by the following vote of the Council:

AYES:	**MILLER, MONTANEZ, NOLAN, SPIEGEL, TALBERT**
NOES:	**NONE**
ABSENT:	**NONE**
ABSTAINED:	**NONE**

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the City of Corona, California, this 21st day of June 2006.

Victoria J. Wasko
City Clerk of the City of Corona, California

(SEAL)

DEPARTMENT OF WATER & POWER
"Protecting Public Health"
General Manager's Office

(951) 279-3692 730 Corporation Yard Way Corona, California 92880

PRESS RELEASE

June 5, 2008
For Immediate Release
Contact: Matthew Bates, Utility Engineer, (951) 279-3692

Corona Groundwater Management Plan

As part of the City's on-going efforts to efficiently manage its finite water resources, the Corona Department of Water and Power contracted with AKM Consulting Engineers and Todd Engineering in January 2006 to prepare an Assembly Bill 3030 compliant Groundwater Management Plan (GWMP). The Plan recommends approaches the City can utilize to increase the efficient usage of its groundwater to ensure its availability in the future.

AKM Consulting Engineers and Todd Engineering recently completed the Plan and the Department of Water and Power will recommend its adoption at the City Council meeting on June 18th, 2008 at 7:00 p.m. in Council Chambers.

If you have any questions or require additional information regarding the Plan, please contact Matthew Bates, Utility Engineer at (951) 279-3692.

#####

Table A-1
List of Potential Stakeholders
City of Corona Groundwater Management Plan

Stakeholder Organization	Contact	Title	Address	City	State	Zip Code
County of Orange	Ms. Angela Burrell	Public Information Officer	PO Box 4048	Santa Ana	CA	92702-4048
Riverside County Flood Control District	Mr. Steve Stump	Chief of Operations and Maintenance	1995 Market Street	Riverside	CA	92501
City of Norco	Mr. Bill Thompson	Director of Public Works	2870 Clark Avenue	Norco	CA	92860
Dept. of Environmental Health	Mr. Damien Meins	Deputy Director	4080 Lemon Street, 9th Floor	Riverside	CA	92501
City of Riverside, Planning Division	Ms. Diane Jenkins		3900 Main St., 4th Floor	Riverside	CA	92501
Santa Ana Watershed Project Authority	Mr. Eldon Horst		11615 Sterling Avenue	Riverside	CA	92503
Santa Ana Region	Mr. Gerard Thibeault	Regional Water Quality Control Board	3737 Main Street, Ste. 500	Riverside	CA	92501
Riverside County Waste Management Dept.	Mr. Hans Kernkamp	General Manager	14310 Frederick Street	Moreno Valley	CA	92553
Lee Lake Water District	Mr. Jeff Pape	General Manager	22646 Temescal Canyon Road	Corona	CA	92883
Western Municipal Water District	Mr. John Rossi	General Manager	PO Box 5286	Riverside	CA	92508
Chandler's Sand & Gravel & Temescal Mining LLC	Mr. John Robertson	Vice President & General Manager	PO Box 295	Lomita	CA	90717
Municipal Water District of Orange County	Ms. Karen Warren	Assistant to the General Manager	PO Box 20895	Fountain Valley	CA	92728
Chino Basin Water master	Mr. Kenneth Manning	CEO	9641 San Bernardino Road	Rancho Cucamonga	CA	91730
Orange County Resources & Development Mgmt Dept.	Mr. Nadeem H. Majaj, P.E.	Manager, Flood Control Division	PO Box 4048	Santa Ana	CA	92702-4048
Mission Clay Products	Mr. Owen Garret		PO Box 549	Corona	CA	92878
Elsinore Valley Municipal Water District	Mr. Ron Young	General Manager	31315 Chaney Street	Lake Elsinore	CA	92530
City of Riverside, Planning Division	Mr. Craig Aaron		3900 Main Street	Riverside	CA	92522
Santa Ana Watershed Project Authority	Mr. Mark Norton		11615 Sterling Avenue	Riverside	CA	92503
Western Municipal Water District	Mr. Jeff Sims		PO Box 5286	Riverside	CA	92517

Appendix B
Monitoring Program and Protocols

Appendix B – Monitoring Program and Protocols

B-1 Introduction

One of the groundwater management strategies (Strategy 8) presented in this GWMP is an improved groundwater monitoring program capable of characterizing groundwater conditions in the subbasins of interest and tracking future changes in water levels, water quality, and groundwater storage. This appendix documents the City's current monitoring program and makes recommendations for improvements going forward.

B-2 Background

The City has monitored water quality in production wells in the Temescal, Coldwater, and Bedford subbasins to ensure a high quality supply and to comply with regulations over time. Since 1998, the City has conducted a more formal monitoring program including water level measurements in about 23 production wells and maintaining these data in a water level database. Data on water levels in City production wells dating back to 1994 have been provided to a consultant for the Santa Ana River Watermaster (Watermaster Support Services). This firm provided these data in a publicly-available database to Todd Engineers in support of this project. Those data have been combined with other water level data and entered into the City's Data Management System (DMS) constructed for this GWMP. Although the City water level data were noted as being measured either during pumping or non-pumping (static) conditions, some static measurements have been overly influenced by well drawdowns and indicate that the well had not completely recovered when levels were recorded. In addition, some of the noted pumping water levels appear to correlate more closely to static water levels in other wells. In addition, surveyed reference elevations are not always recorded for a well.

Over the last two years, the City expanded the water level monitoring program to include wells that are not currently pumping (or pump on a limited basis). These wells are a combination of inactive irrigation wells, inactive or periodically-used production wells, and dedicated monitoring wells installed by the City. These data are less influenced by pumping and are more representative of overall subbasin conditions. In connection with this GWMP, the City wishes to document and formalize the monitoring program and consider additional improvements to the program over time.

B-3 Objectives of Monitoring Program

Objectives of the monitoring program include the following:

- characterize water levels and water quality in various aquifers across the subbasins

- monitor areas of concern to continue to address specific problems
- evaluate the performance of groundwater management activities
- track changes in groundwater levels, quality, and storage over time.

The spatial distribution of the monitoring points should focus on key areas based on specific subbasin hydrogeologic conditions. In addition, the program should maintain an element of random locations to allow for the identification of unanticipated changes within the system. To achieve these objectives, protocols of the monitoring program including the locations, measurements, equipment, frequencies, and constituents to be monitored are reviewed below. This program is evaluated with respect to the hydrogeologic conditions described in Chapter 3 of the GWMP and recommendations are made for program improvements.

B-4 Current Groundwater Monitoring Program

The City maintains a groundwater monitoring program consisting of about 39 wells, 21 of which are active production wells owned and operated by the City for drinking water supply. The remaining 18 wells are a combination of inactive production wells and wells installed specifically for monitoring groundwater conditions. For the purposes of this discussion, the 18 wells are referred to as monitoring wells and the 21 wells in the City's system are referred to as City production wells. The selection of monitoring locations has generally been based on the following criteria:

- Availability of unused wells owned by others
- Easy access to wells
- Ability to physically access the well with a sounder or sampling pump/bailer
- Well screens across aquifer of interest
- Well location monitors specific activity of interest (e.g., installed for a pilot test for enhanced recharge)
- Network spatially distributed throughout the subbasins of interest.

Wells included in the monitoring program are shown on Figure B-1 with the City's active production wells identified separately. For the purposes of this discussion, the wells in the monitoring program that are not wells in the City's active production water system are referred to as monitoring wells. Well data and monitoring components are summarized in Table B-1.

B-4.1. Water Levels

As shown on Figure B-1, the 18 monitoring wells are located in about eight separate locations with more than one well at four locations. Clusters of four monitoring wells are located

near City production Well 11, Oak Avenue Detention Basin, and Main Street Detention Basin. Two wells are located in the eastern arm at Arlington Gap.

The monitoring and production wells in the water level monitoring program are well distributed across Temescal Subbasin and cover most key areas (Figure B-1). Nine of the monitoring wells track water levels in or near the Channel Aquifer along with most of the production wells. Two inactive production wells owned by Home Gardens County Water District allow the City to share water level data. These are key wells located near the Arlington Gap and provide data for the assessment of groundwater storage and the subbasin water balance. In addition, shallow monitoring wells have been drilled in the Oak Avenue and Main Street detention basins in the upland portion of the alluvial fan in Temescal Subbasin.

Water levels at the downgradient extent of Bedford Subbasin are monitored by the irrigation well at Dos Lagos. No dedicated monitoring wells are currently located in the Coldwater Subbasin, but the City is making attempts to locate a former state monitoring well to track water levels there. Currently, water levels in the Coldwater Subbasin are available from City production wells.

Water levels are measured at each of the 18 monitoring wells on a monthly basis. The City uses an electric sounding probe for measuring depth to water in most of the wells. For the Home Gardens Well 5, data are available from a transducer pressure gauge. Depth-to-water measurements are made by City personnel on an established field monitoring form. Also recorded are the status of the well (pumping or not), the date, and the initials of the field person.

B-4.2. Water Quality

Groundwater quality monitoring has occurred at the City's active production wells, providing extensive water quality data in the Channel Aquifer. To date, no formal water quality monitoring program has been established at the monitoring wells, primarily because of an inability to pump some of the wells. The high concentration of water quality monitoring in the Channel Aquifer is appropriate given the unconfined nature of the aquifer and the City's reliance on the aquifer for its drinking water supply.

More than 7,400 records of water quality analyses from 1948 through 2004 were compiled for 25 City wells (including historical data from now-abandoned wells) and entered into the GWMP DMS. Currently, groundwater sampling occurs in all active production wells (Table B-1).

The laboratory analyses of groundwater samples include constituents set forth in Title 22 of the California Code of Regulations in compliance with federal standards and state regulations. These constituents allow for testing of both inorganic and organic chemicals of concern in the subbasins. These data are summarized in Consumer Confidence Reports provided to City water users.

B-4.3. Groundwater Storage

Changes in groundwater storage as estimated in this GWMP were based primarily on an assessment of individual water balance inflows and outflows. The resulting change in storage was compared to changes in water levels in production wells for reasonableness. In the future, this assessment can be improved by comparing the water balance results to water level contour maps that depict change in groundwater storage over the entire subbasin based on data from monitoring wells. This assessment removes the near-wellbore effects of pumping from the analysis of changes in water levels over time. The current monitoring program is not sufficient to conduct such a detailed assessment, but the addition of dedicated non-pumping wells to the program is a step in the right direction. Increased monitoring at non-pumping wells, including City wells that have been turned off sufficiently long for water level recovery, will also improve the City's ability to track changes in groundwater storage over time.

B-5 Surface Water Monitoring Program

Releases to Temescal Wash are monitored by various dischargers through NPDES permit requirements. One active stream gage in the City is monitored by local agencies (11072100, Figure 7 in the GWMP figures). Streamflow data are generally unavailable on Temescal Wash as it enters and exits Bedford Subbasin and as it enters Temescal Subbasin. Improved gaging in these areas could assist in developing a water balance for Bedford Subbasin and improving the water balance analysis in Temescal Subbasin.

As Temescal Wash enters the Prado Management Area, a surface water sampling station is maintained by Orange County Water District. Other stream gage data are available from additional flows into the management area to account for surface outflow at Prado Dam. Additional streamflow measurements by the City in this area seems unnecessary at this time.

Pool elevation data from the Prado Management Area allow for the assessment of rising groundwater that is considered subsurface outflow from the Temescal Subbasin water balance. More detailed data likely exist for this area than were compiled for the GWMP. Additional data compiled from this area could allow for a more detailed assessment of basin outflow than estimated from the groundwater flow model in this analysis. The City is in the process of assessing outflow conditions in connection with a hydrogeologic characterization for their wastewater percolation ponds. Data from this study should be incorporated into the DMS for future assessments of subbasin outflow.

B-6 Land Subsidence Monitoring

Excessive groundwater pumping in certain aquifer systems can cause subsurface compaction, resulting in subsidence of the overlying land surface. Land subsidence resulting from overdraft conditions has been documented throughout the state including the Santa Clara Valley

and Central Valley of California. The most susceptible systems contain sufficient thickness of semiconsolidated silt and clay layers (aquitards) that can result in a vast one-time release of "water of compaction" (Galloway, et al., 1999). As this water is permanently released from the structure of the fine-grained units, the layers collapse, impacting overlying units and reducing the storage capacity of the aquifer system.

Land subsidence in the form of ground fissuring has been identified in the adjacent Chino Groundwater Basin since the 1970s. The susceptible area is located about 2.5 miles north of the Prado Management Area (WE, 2006). An extensometer and other monitoring techniques have been employed to track land subsidence in this area.

To our knowledge, neither land subsidence nor ground fissuring have been identified as issues in the Temescal, Bedford, or Coldwater subbasins. The absence of thick, fine-grained aquitards in these areas suggest that land subsidence should not be a concern. The Channel Aquifer contains very little fine-grained sediments as confirmed by lithologic logs and the few geophysical logs in the subbasin. Fine-grained units are likely more predominant in the distal portions of the Temescal Subbasin alluvial fan, south and southwest of the City's current production wells. If the City develops groundwater on the Temescal Subbasin alluvial fan, the potential for land subsidence should be considered. In the Coldwater Subbasin, production wells are located in the proximal and mid-fan portions of a large alluvial fan characterized by coarse-grained sediments. Gravel mining down to 300 feet confirms the nature of these aquifers.

In consideration of these conditions, land subsidence monitoring does not appear to be an issue for the City and is not recommended for expansion of the monitoring program at this time. The City will investigate any reports of ground fissures and consider ground surface monitoring if land subsidence is identified as a potential concern in the future.

B-7 Recommendations for Monitoring Program Improvements

The City will continue to make improvements to their monitoring program as groundwater management strategies are implemented over the next two years. Ongoing efforts include the exploration and identification of additional wells for possible inclusion into the program. In particular, certain non-pumping wells are being researched in the Coldwater Subbasin for increased monitoring there.

B-7.1. Improvements in Spatial Distribution

The monitoring program should be sufficient to characterize water levels and quality throughout the subbasins and focus on key areas where data collection could prove most beneficial. In addition, the program should be scoped to include an element of random spacing to allow for detections of unanticipated changes. One strategy is to target key areas of subbasin inflows and outflows as identified by the subbasin water balance analysis. For the Temescal

Subbasin, inflows are evaluated by the wells in Arlington Gap and in the upland detention basins. Outflow areas are monitored by the wells at Butterfield Park and Corona High School. Additional inflow monitoring would be beneficial in the area where Temescal Wash enters the basin (south of Magnolia Avenue near All American Way) and the area with inflow from Norco (north of City production Well 26). Additional outflow monitoring could be accomplished with an additional well west of the City percolation ponds (in the vicinity of the Rincon Groundwater Treatment Project included in this GWMP as Strategy 3). With regard to the random element of spatial distribution, additional wells are needed on the slope of the alluvial fan to the south of current production wells.

In the Coldwater Subbasin, only production wells are currently available for monitoring. Since most of the production occurs in the southern half of the subbasin, it would be optimal to secure a monitoring point both in the south near production and in the north away from the wells to evaluate groundwater storage changes in the subbasin. A well just west of the Glen Ivy fault near Coldwater Wash would be most beneficial for also evaluating subsurface outflow across the fault plane. With respect to Bedford Subbasin, no wells currently exist in the southern portion of the subbasin and additional monitoring there would allow for better understanding of the subbasin groundwater system.

It would be helpful to add monitoring wells to the water quality monitoring program as analyses are currently conducted only in production wells. Extraction wells pull in large volumes of groundwater from a large area, which can mix and dilute specific chemicals of concern. Additional understanding of groundwater quality away from pumping wells would add significant value to the data collection efforts.

These improvements can be accomplished by securing access to existing wells or installation of new monitoring wells. If new wells are constructed, the diameter should be sufficiently large to allow for both groundwater level and quality monitoring.

B-7.2. Expanded List of Constituents for Analysis

For water quality monitoring, the list of constituents should be responsive to how the data are to be applied. For continued characterization of inorganic water chemistry and assistance with determining the source direction for groundwater types, the monitoring program should contain a full suite of cations and anions and a cation/anion balance. This analysis allows for the designation of water types and fingerprinting of groundwater in various parts of the basin. In addition, the analysis is cost effective and adds very little to the cost of monitoring already conducted by the City.

Because of the large number of underground storage tanks over the shallow and unconfined Channel Aquifer, additional constituents should be added to the monitoring program to ensure no impacts from leaking tanks. In particular, total petroleum hydrocarbons, benzene,

toluene, ethylbenzene, xylenes, and methyl-tertiary butyl ether (MTBE) should be included. These analyses should be conducted on all wells for several sampling events to ensure no current impacts. After initial sampling, specific wells could be targeted for continued monitoring of these constituents.

B-7.3. Monitoring Frequency

A review of hydrographs indicates that water levels change seasonally and are most responsive to changes in groundwater pumping. In order to continue to characterize water level changes with monthly pumping patterns, water level monitoring should be conducted on a monthly basis.

Ambient groundwater quality is not expected to vary on a monthly basis and is less susceptible to seasonal changes. As such, annual to semi-annual monitoring seems sufficient for the groundwater quality monitoring program. Exceptions to this include areas where groundwater contamination has been identified as a threat to groundwater quality. These areas should be monitored more frequently to better understand the potential impacts as contaminants migrate downgradient. This increased frequency in monitoring will likely be conducted by the site responsible for the groundwater quality impact and may not result in increased monitoring by the City. However, the City should periodically acquire and review the monitoring data for incorporation into their DMS. Water quality monitoring at the active production wells will continue at the frequencies required for compliance with state regulations for drinking water supply.

B-7.4. Quality Assurance/Quality Control Measures

To ensure that data are properly collected and analyzed, a quality assurance/quality control (QA/QC) plan should be implemented for the monitoring program. This program would provide details on the equipment and sampling procedures for ensuring reliable data. For example, the City should continue and improve the use of monitoring data collection forms for both water levels and water quality. Key details from these forms such as sampling date, time, location, and conditions should be extracted from the forms and input into the City DMS. All water quality sampling should use clean, new containers specific to the constituent to be analyzed. Specific QA/QC samples should be taken (approximately one QA/QC sample per every ten monitoring samples) and all samples should be properly preserved in the field. Water quality sampling should follow standard QA/QC procedures specific to the constituents analyzed. All sampling events should contain a strict chain of custody procedure with proper chain of custody forms completed in the field. State-certified laboratories should be used for analyses. Data should be requested in both paper and electronic format from the laboratories to facilitate updating the DMS and minimize data-entry errors.

B-7.5. Summary of Recommendations

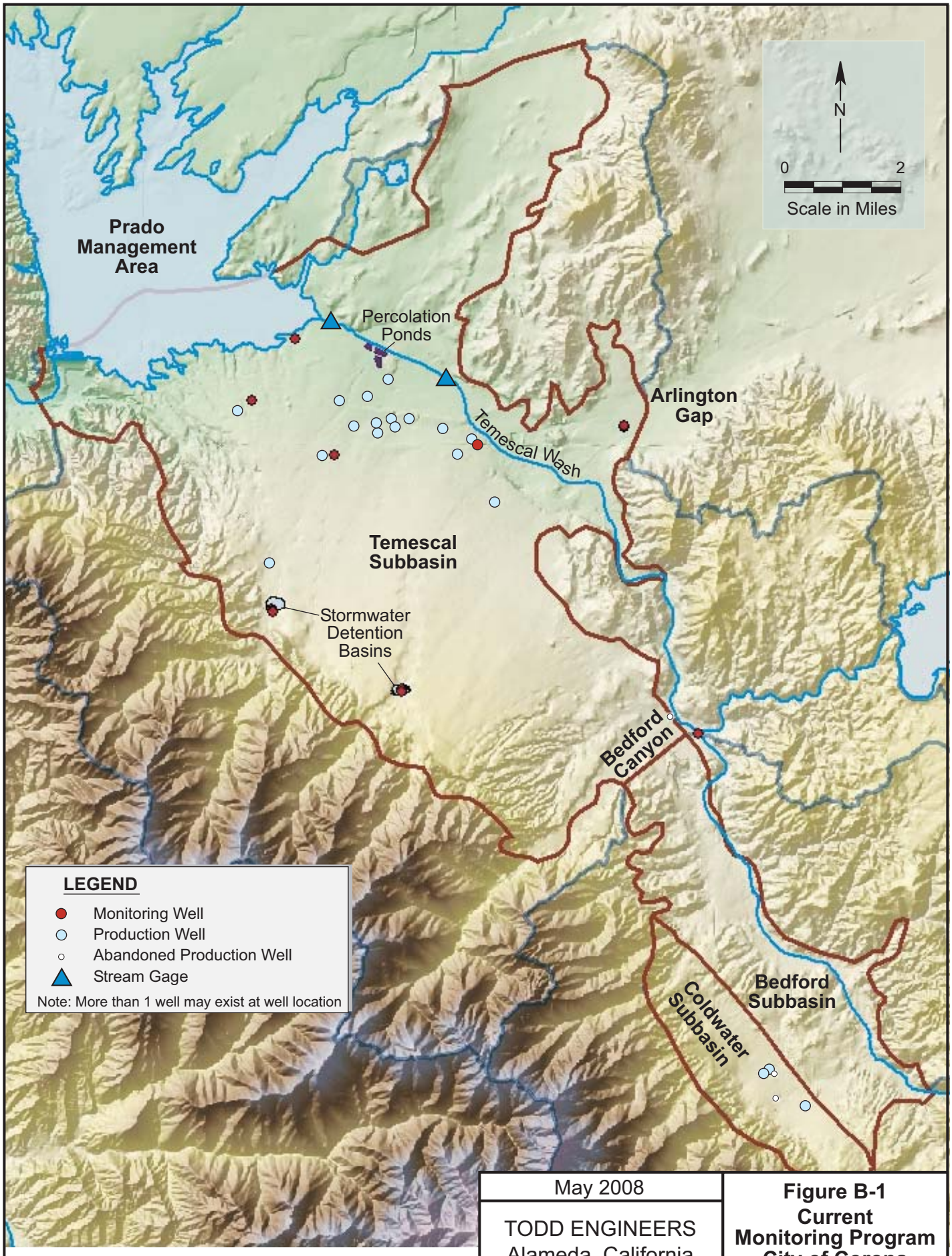
Recommendations for monitoring program improvements are summarized below.

- Continue to locate and add wells to the monitoring program with an emphasis on obtaining detailed construction data for any wells added to the program
- Increase locations in key inflow and outflow areas to improve the ability to depict changes in groundwater storage
- Add wells in any un-monitored areas of the subbasin to include a random component to the monitoring program
- Expand water quality sampling to monitoring wells
- Analyze water quality samples for a full suite of inorganic constituents to allow for fingerprinting of water types throughout the subbasins
- Conduct analyses for a full suite of inorganic chemicals to allow for geochemical plotting techniques for analysis
- Add petroleum hydrocarbon constituent including MTBE to ensure that leaking underground storage tanks have not impacted water quality
- Monitor water levels monthly and water quality annually to semi-annually for improved understanding of changes in groundwater conditions
- Implement a QA/QC program to ensure data reliability
- Re-evaluate the monitoring programs on an annual basis to determine if additional monitoring points are required or if duplicative data collection efforts can be eliminated.

The monitoring program will evolve over time and be modified for performance monitoring of specific management strategies as implemented. The program should be periodically evaluated to optimize the data collection efforts and achieve monitoring objectives.

Table B-1
City of Corona Monitoring Well Program

State Well Number	Well Owner	Well Name	Well No.	Date Drilled	Well Use	GSE ft, msl	Ref. Elev. ft, msl	Total Depth	Screen Depth		Groundwater Monitoring Data		
									Top ft	Bottom ft	Water Levels	Water Quality	Groundwater Storage
MONITORING WELLS													
T04S/R07W-10	City of Corona	Oak Street Channel 1	OMW-1	10/29/2003	Monitoring	1023	1026	65	35	65	X		X
T04S/R07W-10	City of Corona	Oak Street Channel 2	OMW-2	10/14/2003	Monitoring	1024	1026	1070	100	200	X		X
T04S/R07W-10	City of Corona	Oak Street Channel 3	OMW-3	10/30/2003	Monitoring	1020	1022	70	40	70	X		X
T04S/R07W-10	City of Corona	Oak Street Channel 4	OMW-4	10/16/2003	Monitoring	1020	1022	200	100	200	X		X
T04S/R07W-13	City of Corona	Main Street Channel 1	MMW-1	10/247/03	Monitoring	1249	1252	420	20	400	X		X
T04S/R07W-13	City of Corona	Main Street Channel 2	MMW-2	10/22/2003	Monitoring	1244	1246	500	20	400	X		X
T04S/R07W-13	City of Corona	Main Street Channel 3	MMW-3	10/21/2003	Monitoring	1248	1250	260	20	260	X		X
T04S/R07W-13	City of Corona	Main Street Channel 4	MMW-4	10/22/2003	Monitoring	1237	1240	400	20	400	X		X
T04S/R06W-16	Canyon Properties	Dos Lagos Golf Course	IW-1		Standby Irrigation	799					X		X
T03S/R06W-28M2	Home Gardens County Water District	Home Gardens 1	HG-1	1/1/1927	Production	666	668	165			X		X
T03S/R06W-28M	Home Gardens County Water District	Home Gardens 5	HG-5	5/10/1988	Production	666	669	500	330	495	X		X
T03S/R07W-35	Joy Street Water Company	Corona High Parking Lot	CHS-1		Inactive Irrigation	730					X		X
T03S/R07W-27	City of Corona	Well 11 Gate West	11MW-1		Monitoring	645					X		X
T03S/R07W-27	City of Corona	Well 11 Gate South	11MW-2		Monitoring	645					X		X
T03S/R07W-27	City of Corona	Well 11 Gate East	11MW-3		Monitoring	645					X		X
T03S/R07W-27	City of Corona	Well 11 Gate North	11MW-4		Monitoring	645					X		X
T03S/R07W-22	City of Corona	Butterfield Park	BP-1		Standby Irrigation	597					X		X
T03S/R06W-30N	City of Corona	City Park	CP-1		Standby Irrigation	657		140			X		X
PRODUCTION WELLS													
T05S/R06W-03K01	City of Corona	Well No. 3	3	1/26/1935	Active Production	1141		543	100	530	X	X	X
T03S/R06W-30N03S	City of Corona	Well No. 7A	7A	6/16/2002	Active Production	688		250	125	230	X	X	X
T03S/R07W-25J02S	City of Corona	Well No. 8A	8A	6/6/2002	Active Production	641		210	100	190	X	X	X
T03S/R07W-25M03S	City of Corona	Well No. 9A	9A	8/21/2002	Active Production	657		250	113	230	X	X	X
T03S/R07W-27G01	City of Corona	Well No. 11	11	11/20/1953	Active Production	660			126	234	X	X	X
T03S/R07W-27F02	City of Corona	Well No. 12A	12A	10/19/2000	Active Production	665		320	180	320	X	X	X
T03S/R06W-31K01	City of Corona	Well No. 13	13	1952	Active Production	728			152	260	X	X	X
T03S/R07W-35C01	City of Corona	Well No. 14	14	11/27/1936	Active Production	753		515	200	250	X	X	X
T03S/R07W-26G01	City of Corona	Well No. 15	15	4/13/1946	Active Production	633		220	108	204	X	X	X
T03S/R07W-27A01	City of Corona	Well No. 16	16	11/12/1980	Inactive Production	662		775	415	755	X	X	X
T03S/R06W-30N03S	City of Corona	Well No. 17A	17A	5/24/2002	Active Production	653		210	100	188	X	X	X
T03S/R07W-25L01	City of Corona	Well No. 19	19	5/11/1990	Active Production	615			100	210	X	X	X
T05S/R06W-11D01S	City of Corona	Well No. 20	20	10/02/1998	Active Production	1140		600	200	580	X	X	X
T05S/R06W-03J05S	City of Corona	Well No. 21	21	5/221998	Active Production	1120		600	200	580	X	X	X
T03S/R07W-26J03S	City of Corona	Well No. 22	22	12/20/1998	Active Production	672		410	150	390	X	X	X
T03S/R07W-25L02S	City of Corona	Well No. 23	23	10/21/1998	Active Production	640		560	180	540	X	X	X
T03S/R07W-25K02S	City of Corona	Well No. 24	24	11/18/1998	Active Production	633		450	200	450	X	X	X
T03S/R07W-25E02S	City of Corona	Well No. 25	25	2/13/1999	Active Production	645		210	90	190	X	X	X
T03S/R07W-25C03S	City of Corona	Well No. 26	26	3/12/1999	Active Production	570		448	90	446	X	X	X
T04S/R07W-01A01S	City of Corona	Well No. 27	27	4/28/1980	Active Production	954		545	288	530	X	X	X
T03S/R07W-26K S	City of Corona	Well No. 28	28	8/20/2003	Active Production	610		190	105	165	X	X	X



May 2008

TODD ENGINEERS
Alameda, California

Figure B-1
Current Monitoring Program
City of Corona

Appendix C
Model Development

Appendix C - Model Development

A numerical model was developed to assess and quantify the impacts of the management strategies in the Temescal Subbasin described in the Groundwater Management Plan (GWMP), Chapter 6. The model was constructed using data from 1990 through 2004. This Study Period was selected based on hydrologic conditions and climate, as discussed in Chapter 2. Calibration involved testing and changing model variables to better match observed water levels and estimated water budgets. The calibrated model was then used as a foundation for simulating future conditions. The future conditions included the expected buildout pumping, wastewater recharge, and return flows in the model, while repeating previously observed hydrologic conditions (i.e. recharge). This future baseline model was used to compare management scenarios for the Temescal Subbasin.

The groundwater system of the Temescal Subbasin was simulated using the finite difference numerical model, MODFLOW (McDonald and Harbaugh, 1983). Groundwater Vistas 4 was used as a pre and post processor. The model simulated the conceptual model and the water balance described in detail in GWMP Chapter 3.

C-1. Model Area

The numerical model area for layers 1 and 2 are shown on Figure C-1. The model differs slightly from the DWR defined basin (shown in yellow) due to several factors including adjustment of the area based on bedrock outcrops and possible groundwater divides. Specifically, the western and northwestern model area was moved slightly eastward to the contact of bedrock and the more permeable alluvial materials. The groundwater divide identified in Chapter 3 was used as the south model boundary. The Norco area was not included in the model area due to lack of available data. The contribution from the Norco area is simulated as a boundary condition. The model gird was rotated 30 degrees to align with the typical groundwater flow direction in the Channel Aquifer. The grid is made up of 4,470 active cells, each 500 feet by 500 feet. The active area and no-flow cells in the model are shown in Figure C-1. The transient part of the model simulates 1990 through 2004 with monthly stress periods.

C-2. Layers

The numerical model of the Temescal Subbasin is divided into two layers, as shown in Figure C-1. The base of layer 2, the bottom of the model, is defined by the underlying bedrock. The top of layer 1, the top of the model, is defined by the ground surface elevation from the USGS digital elevation model (DEM) files. The depth of layer 1 was set at the approximate base of the Channel Aquifer, estimated at 450 feet above mean sea level (msl).

C-3. Steady State Condition

The model begins with a steady state stress period. The steady state period assures that the initial heads in the model are internally consistent and mathematically sound. The steady state period is roughly based on 1989, a year characterized by little to no change in storage. The initial heads for the steady state condition are based on actual water level data from the late 1980s and early 1990s (Figure C-2). The contours were transformed into a continuous surface using GIS.

C-4. Boundary Conditions

A numerical model seeks to simulate a small portion of a larger system. To represent the interaction of Temescal Subbasin with the larger systems, boundaries were simulated using constant head, general head, and specified flux cells. In most cases, only limited data were available to document the inflow or outflow from these boundaries. The locations and types of boundaries selected are shown on Figure C-3. Changes made to these boundaries during calibration are discussed in the calibration section.

C-4.1. Specified Flux

Subsurface inflow from bedrock was simulated as specified flux along the western (Santa Ana Mountains) and eastern boundaries of the model. Estimates for total flow were derived from recharge calculations used in the water balance, Chapter 3, and adjusted during calibration. As the lag time between precipitation and recharge to the basin is uncertain, a steady state flux, constant over time, was used to simulate inflow. Inflow from the Santa Ana Mountains and the eastern bedrock outcrops was estimated at 721 AFY and 62 AFY respectively.

Inflow from the Norco area of the basin was also simulated as a steady state specified flux. Due to the low permeability in the area, the flow from Norco is expected to be small. However, the lack of recent water level data in the area made calculations uncertain. A simple flux calculation using Darcy's equation was used to estimate flow at 52 AFY, an amount held constant in the model.

Temescal Creek overlies the Temescal Subbasin in some reaches. The creek is in bedrock in the south, enters the subbasin west of Arlington Gap, and then flows in a concrete-lined channel to the Prado Management Area. The creek’s contribution to groundwater recharge is limited to a small area north of Temescal Canyon as described in Chapter 3. Recharge here is estimated at 113 AFY; as such, this amount is simulated in the model as a specified flux. The monthly distribution ranges from 5 AF/month to 15 AF/month, lower in the summer months and higher during the rainy winter months.

C-4.2. Constant Head

The inflow or outflow from Arlington Gap was simulated using 14 constant head cells located on the eastern boundary of the model. The level of the constant head for each month was selected using water levels from Home Gardens Wells 3, 4 and Todd_0180 Well (data from SAWPA). Water level measurements from these three wells were infrequent and collected at various times over the Study Period. The water levels from these three wells were combined to compile a complete record of water levels for the constant head boundary. The head at the constant head cells were varied monthly based on available data.

The model-simulated flow across this boundary was compared to flow estimates calculated using Darcy's equation as discussed in Chapter 3. Based on Darcy's equation, the flow into the basin through Arlington Gap was estimated as a steady annual average of 4,800 AFY. Using a range of gradients calculated from water levels in nearby wells over the entire period of record, the inflow was estimated to range between 2,225 AFY and 4,880 AFY over the Study Period.

C-4.3. General Head Boundary

The inflow or outflow from the basin through Prado Dam was simulated as a general head boundary, located along the northwestern boundary of the model. Interaction between the Santa Ana River and the Temescal Subbasin was assumed to be a no–flow boundary. The conductance of the general head boundary was adjusted during calibration. The water level of the general head boundary was derived from the elevation of the reservoir behind Prado Dam. These elevation data are available from 1999 to the present from the California Data Exchange Center. The average monthly elevation of the reservoir was used for the study period. During calibration the elevation was increased by five feet to better match water level measurements and outflow estimates. The model simulates annual outflow that varied from 3,944 AFY to 4,123 AFY.

C-5. Recharge

Recharge in the model simulated deep percolation from precipitation, irrigation return flows, wastewater, and stormwater. Areal recharge was based on the analysis prepared for the water balance in Chapter 3, simplified to include 15 zones of recharge representing different soils, land use, and percolation rates. The area of the zones varied over time as land use in the basin changed; the zones for the last year of the model are shown in Figure C-4. The return flows associated with each land use type were added to the rate of deep percolation. Recharge from return flows and deep percolation ranged from 902 AFY in 1996 to 14,269 AFY in 1993.

Wastewater was simulated by three cells in the northern part of the basin, shown in purple in Figure C-4. Annual wastewater totals were estimated in Chapter 3 using available data and population estimates from the City. As seasonal or monthly variation information was not available, an annual distribution was derived from the available water use data. It was assumed that months with higher water use (groundwater pumping and imported water) also indicated months with higher wastewater discharge. As such, wastewater percolation is expected to peak in the summer months June through August. The average monthly rate of wastewater recharge was based on the monthly urban water use distribution (Table C-1). The annual wastewater recharge ranged from 3,650 AFY to 9,474 AFY over the Study Period.

Two stormwater detention ponds located along Main Street and Oak Avenue are sources of increased recharge during winter months. The ponds capture excess runoff from the Santa Ana Mountains and detain this water until it can slowly be released to the stormwater system. The ponds are simulated by two recharge cells in the model, shown in light green on Figure C-4. As discussed in Chapter 3, the average annual inflow to the basin from these ponds was approximately 480 AFY. This volume was divided equally between the two ponds during the rainy winter months November through March.

C-6. Pumping

Twenty eight wells were active in the Temescal Subbasin between 1990 and 2004. Pumping in these wells was simulated in the model using the well package with monthly stress periods. Annual pumping data were available for all wells and monthly pumping amounts were available for some wells. To account for wells or time periods for which monthly pumping data were not available, estimates were derived by using an annual distribution based on use type (Table C-1). The urban monthly pumping distribution was based on the observed annual distribution of pumping wells with monthly data. For agricultural pumping, a monthly distribution was developed using the distribution of evapotranspiration less monthly precipitation over the year. Pumping occurred only in layer 1 in the model. The active wells are shown in Figure C-3 (flux pumping); total pumping ranged from 7,294 AFY to 20,112 AFY.

Table C-1

Monthly Pumping Distribution

Month	Urban	Agriculture
January	3%	0%
February	3%	0%
March	5%	6%
April	7%	10%
May	7%	13%
June	10%	14%
July	17%	15%
August	17%	15%
September	15%	11%
October	7%	7%
November	5%	5%
December	3%	2%

C-7. Aquifer Parameters

Hydraulic conductivity (K) was first estimated in the model and then adjusted through calibration. A total of nine zones of K values were originally defined. After calibration, the zones were simplified to three zones in layer 1 and two zones in layer 2. The layer 1 zones represented the Channel Aquifer, Norco area, and Alluvial Fan with K values of 125 feet/day, 20 feet/day, and 0.5 feet/day respectively. The layer 2 zones included the area directly below the channel and the deeper Alluvial Fan with K values of 60 feet/day and 0.5 feet/day respectively. These zones are shown in Figure C-5. The assumed ratio of horizontal conductivity to vertical conductivity was 10 to 1. A specific yield of 0.2 was selected for Channel Aquifer and 0.1 was used for all other areas.

C-8. Calibration

The conceptual model and water balance discussed in Chapter 3 was simulated as a numerical model. Variables including the volume of bedrock inflow, conductance and elevation of the Prado Dam boundary, hydraulic conductivity, and location of the channel sediments were adjusted to match water levels observed in target wells and the conceptual understanding of the water budget.

C-8.1. Targets

Eight wells were selected as calibration targets, based on available water level measurements over the Study Period and spatial distribution. Target wells are listed below and shown on Figure C-6. The City's water level monitoring over the Study Period occurred solely in the City's pumping municipal wells and it is uncertain if these data reflect pumping water levels or static water levels. While pumping wells generally are not included as model targets, a lack of any other consistent or reliable water level data prevented the addition of other targets. No wells with consistent water levels were available in the Alluvial Fan; however limited data were available near the stormwater ponds from Corona Well 27 in 2003. These data indicated water levels near 850 feet msl. Since very little production has occurred during the Study Period in this area, water levels in this area were assumed to be relatively stable. As such, a hypothetical target with constant water levels of 850 feet msl was developed to aid in calibration.

Table C-2

Targets Used in Model Calibration

TODD ID	Agency Name	Local Name
TODD_0347	City of Corona	27
TODD_0191	Home Gardens	3
TODD_0257	City of Corona	13
TODD_0738	City of Corona	8
TODD_0743	City of Corona	19
TODD_0783	City of Corona	15
TODD_0839	City of Corona	11
TODD_0923	City of Corona	14

The simulated and observed water levels for each target are shown on Figures C-7 and C-8. Water level contours at the end of the model simulation, December 2004, are shown on Figure C-9. Generally, simulated water levels showed a reasonable fit to the elevation and trend of observed water levels. Simulated water levels in wells located in the main part of the Channel Aquifer (Corona Wells 8, 11, 15, and 19) match the elevation and trends of the observed water levels. Simulated water levels on average are slightly higher than observed (by less than five feet). The observed water levels may be reflecting pumping water levels and not static water levels in the area. Simulated water levels in the target located on the edge of the northern portion of the channel, Corona Well 14, were similar to observed water levels.

Simulated water levels in the target located on the southern edge of the channel, Corona Well 13, are slightly lower than observed (about 10 feet). However, the simulated water levels match the overall trend of the observed water levels. Corona Well 13 is located near the outflow of Temescal Wash, an area of observed high water levels. This area is likely to be significantly

more heterogeneous than modeled. However, detailed geologic information was not available to refine this area of the model.

Home Gardens Well 3 was included as a target, however, its close proximity to the constant head cells simulating Arlington Gap controlled the simulated water levels. The well was left as a target to check on the specified head of the boundary, rather than as an indication of model fit.

The final target was based on limited data from Corona Well 27. Data from this well were available only from March to October 2003. A constant water level of 850 feet msl over the entire time period was used to check the model fit in the area. The target showed a difference of about 13 feet between the simulated and estimated water levels. This difference is due, in part, to the constant water level estimated from limited data. The simulated water levels showed variation over the study period including a decline near the end of the time period.

A comparison of observed to simulated water levels is shown on Figure C-10. Ideally, simulated and observed water levels would fall along the 1:1 trend line on the chart. Overall, the observed water levels show more variability than the simulated water levels. This variability is most likely caused by pumping in or near the target wells. This local effect of pumping on the water levels is not simulated in the model. Simulated water levels tend to be lower than observed in higher elevations and higher than observed in lower elevations. This relationship could be the result of the channel sediments simulated as one hydraulic conductivity zone. Specifically, the model does not simulate the complex geology and the thinning of the channel along the edges. Again, many of the wells used as targets are production wells, so measured water levels may reflect a pumping water level rather than a static water level. The target on the alluvial fan was not included on this chart as the observed targets were estimated and not based on actual measurements.

C-8.2. Budget

In addition to targets, the overall water budget was evaluated during calibration. The simulated budget, derived from the “reach report” output in Groundwater Vistas, was compared to the conceptual water balance described in Chapter 3. The conductance of the Prado Dam outflow and the hydraulic conductivity of the channel sediments were adjusted to better match the conceptual water balance as well as water levels.

C-9. Sensitivity Analysis

During calibration, the model response to changes of each variable was evaluated seperately to determine its relative sensitivity. As described below, the model results were

determined to be sensitive to 1) estimated conductivity and location of the Channel Aquifer, 2) hydraulic conductivity of the Alluvial Fan materials, and 3) the general head boundary at Prado Dam. The location and hydraulic conductivity of the channel sediments (particularly the southern extent of the channel) was found to control local and regional water level elevations. Hydraulic conductivity for the channel sediments were adjusted from 200 feet per day to 100 feet per day. Using a K value of 200 feet/day resulted in water levels that were consistently 10 to 20 feet higher than those simulated with a K value of 125 feet/day. Water levels in the model, specifically at selected targets, were sensitive to the southern extent of the channel sediments. The location of the high K zone was adjusted to better fit the observed data. While the southern extent of the channel differs slightly from the original geologic interpretation, the width and depth of the channel is uncertain. The model-simulated location of the channel is consistent with the overall geologic understanding of its formation.

Water levels in the Alluvial Fan were very sensitive to the hydraulic conductivity of the area. Various K values were simulated in the area ranging from 0.5 feet/day to 50 feet/day. Using high K values resulted in lower water levels at the hypothetical well in the Alluvial Fan area (567 feet msl using 10 feet/day, compared with 837 feet msl using 0.5 feet/day). Higher K in the alluvial fan resulted in slightly lower water levels in the channel area, a decrease of 3 feet when the K value was adjusted from 0.5 feet/day to 10 feet/day.

Because Prado Dam is the primary outflow of groundwater from the basin (aside from pumping), the volume of outflow was sensitive to the conductance of the general head cells representing Prado Dam. A higher boundary conductance increased the outflow and decreased water levels in the channel. The conductance was adjusted during calibration to obtain a good match with water levels and the expected outflow from Prado, on the order of thousands of AFY. Conductance was adjusted over a range of 1,000 feet/day to 200,000 feet/day.

Less sensitive variables included the seasonal variation of water levels at Arlington Gap, hydraulic conductivity of the area north of the channel, inflow from bedrock on the eastern edge of the model, and inflow from Temescal Wash.

C-10. Model Limitations

The limited availability and accuracy of data in the Temescal Subbasin constrains the ability to develop detailed conceptual and numerical models. Overall, the numerical model is a good simulation of the conceptual model, but both the conceptual and numerical model can be improved with additional data and understanding of the basin. Possible improvements include consistent static water level monitoring across the entire subbasin, more information on geology and faulting along the western edge of the model, frequent monitoring at the boundaries

(Arlington Gap, Prado Dam, Chino, Norco), and detailed information on the inflow from the stormwater basins.

The model was designed to simulate the basin on a regional scale and should not be used to examine local issues such as well drawdown or solute transport. The model can be used to compare and relatively quantify management alternatives on a regional scale.

C-11. Management Scenario Application

C-11.1. Baseline

The numerical model calibrated to the 15-year Study Period, 1990-2004 was used as the foundation for a baseline model that simulates future conditions at build out. The 15-year future simulation repeats the hydraulic conditions observed over the Study Period, including the rate of recharge. Land use from 2004 was used to develop recharge zones in the baseline model to better simulate a developed urban area and the amount of return flows and deep percolation from precipitation.

Boundary conditions were also adjusted to simulate expected future conditions. The water levels from Home Gardens Well 3 from 1990 to 2004 were repeated over the 15-year simulation to represent the range of observed conditions at that Arlington Gap boundary. The future water levels at this boundary are uncertain as groundwater management on the Arlington side of the boundary has a large influence on the water levels and therefore flow into the basin. The height of the Prado Reservoir was also repeated over the 15-year period, and the boundary conductance was held constant.

Expected pumping at buildout, 21,726 AFY, was used for each year of the baseline model. (Rounding of model output resulted in numbers of 21,722 AFY to 21, 725 AFY being displayed in report tables). The increase in pumping over 2004 amounts was distributed among wells based on the 2004 pumping distribution (with small changes to prevent simulated dry cells in the model). Pumping from Wells 25 and 9 were decreased slightly and pumping in Well 17 was increased slightly. Estimated wastewater recharge at buildout is expected to be about 16,350 AFY, based on population projections in the City's General Plan (2003) and the Water Master Plan (AKM, April 2005). Current irrigation demand for recycled water is approximately 5,600 AFY. In addition, an outflow to Prado Dam of approximately 2,240 AFY (adjusted for water quality) is required. Subtracting these two demands from total wastewater leaves a total of about 8,510 AFY, an amount repeated over the baseline model to represent levels of recharge at the percolation ponds. (Again, rounding of model output numbers resulted in the small variation of numbers included in report tables). Other recharge components such as bedrock inflow and Temescal Wash inflow remained constant.

The baseline model was used to simulate management scenarios. Changes made to the model for each scenario are discussed below.

C-11.2. Scenario 1: Pumping Redistribution

This scenario redistributed pumping in the aquifer. Two new wells were added in the northwestern part of the channel, near Prado Management Area. These wells were simulated as pumping 2,500 AFY each and the remaining 16,742 AFY of buildout pumping was distributed among the existing wells based on the same proportion as used in the baseline model. Aside from the well package, no other changes were made to the baseline numerical model for Scenario 1.

C-11.3. Scenario 2: Additional Recharge at Oak Detention Basin

This scenario examined additional recharge in the Oak Avenue Detention Basin and a slight reduction in wastewater recharge. The Oak Avenue Detention Basin recharge (simulated in the recharge package) was increased to 5,000 AFY. Wastewater flows, also simulated in the recharge package, were decreased to 8,250 AFY to reflect the use of recycled water for one-half of the enhanced recharge water. The distribution of monthly wastewater recharge was maintained. No changes were made to the well package (including bedrock inflows or pumping).

C-11.4. Scenario 3: Additional Recharge at Main Street Detention Basin

This scenario, similar to scenario 2, examined additional recharge in the Main Street Detention Basin and an increase in wastewater recharge. The Main Street Detention Basin recharge was increased to 1,500 AFY. Since recharge with recycled water was not as high in this scenario, wastewater flows were increased from Scenario 2. In addition, it was assumed that the outflow to Prado Management Area could be maintained through subsurface outflow and wastewater recharge was increased to the current permit amount of 9,520 AFY recharge at the percolation ponds, using the same monthly distribution (rounding results in an average of 9,507 AFY). No changes were made to the well package (including bedrock inflows or pumping).

C-11.5. Scenario 4a: Recharge wells near Arlington Gap (4 wells)

This scenario examined the addition of recharge wells near Arlington Gap. It was determined that approximately 5 mgd of recycled water could be dedicated to recharge wells during the non-irrigation season. Four wells, recharging a total of 2,762 AFY (5 mgd over six months of recharge), were simulated near the eastern boundary of the model. Wastewater recharge at the percolation ponds were increased from baseline to 9,369 AFY, while maintaining the same monthly distribution. Extraction pumping remained the same as baseline.

C-11.6. Scenario 4b: Recharge wells near Arlington Gap (7 wells)

This scenario is similar to scenario 4a; however a total of seven recharge wells were used to recharge near the Arlington Gap. The amount of recharge was 5,524 AFY (10 mgd over six months). In this scenario wastewater recharge at the ponds were decreased to an average of 7,988 AFY, assuming that a portion of that water would be dedicated to recharge. Extraction pumping remained the same as baseline.

C-11.7. Results

Chapter 6 includes discussion of these management scenarios that were simulated using the numerical model. The water levels and budgets of each scenario were compared to the baseline model and the effectiveness of each management scenario is discussed. Tables with water budgets on an average basis for each management scenario are provided in Chapter 6. The complete water budgets for the baseline model and the five scenarios are provided here in Tables C-3 through C-8. Water levels for the baseline evaluation and the five scenarios at the eight targets are shown in Figures C-11 through C-14.

Table C-3
Baseline Simulation

Water Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Ave.
INFLOWS																
Deep Percolation from Precipitation	0	0	384	13,937	0	1,343	0	0	3,500	15	13	1,460	3,151	617	909	**1,689**
Infiltration of Runoff in Detention Basins	482	478	478	478	482	478	478	478	482	478	478	478	482	478	478	**479**
Recharge from Wastewater Discharge	8,511	8,502	8,502	8,502	8,511	8,502	8,502	8,502	8,511	8,502	8,502	8,502	8,511	8,502	8,502	**8,504**
Subsurface Inflow Subtotal	6,601	6,356	5,191	4,212	4,603	5,407	5,948	5,417	5,492	5,662	5,219	4,635	3,756	4,302	4,648	**5,163**
- Arlington Gap	5,618	5,375	4,211	3,232	3,620	4,427	4,968	4,437	4,509	4,681	4,239	3,655	2,773	3,322	3,668	4,182
- Temescal Wash (Temescal Canyon)	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
- Bedrock in Watershed	817	815	815	815	817	815	815	815	817	815	815	815	817	815	815	816
- Norco	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
Return Flows Subtotal	2,404	2,760	2,760	2,760	2,040	2,760	933	2,389	2,760	2,760	2,760	2,760	2,760	2,760	2,760	**2,542**
TOTAL INFLOWS (AFY)	**17,997**	**18,096**	**17,316**	**29,889**	**15,636**	**18,491**	**15,862**	**16,786**	**20,744**	**17,417**	**16,973**	**17,835**	**18,659**	**16,659**	**17,297**	**18,377**
OUTFLOWS																
Groundwater Pumping	21,725	21,722	21,722	21,722	21,725	21,722	21,722	21,722	21,725	21,722	21,722	21,722	21,725	21,722	21,722	**21,722**
Subsurface Outflow to Santa Ana River	6,472	6,011	5,732	5,604	5,512	5,436	5,382	5,337	5,313	5,284	5,255	5,231	5,231	5,215	5,195	**5,481**
TOTAL OUTFLOWS (AFY)	**28,196**	**27,733**	**27,454**	**27,325**	**27,236**	**27,157**	**27,104**	**27,059**	**27,037**	**27,005**	**26,976**	**26,953**	**26,956**	**26,936**	**26,917**	**27,203**
CHANGE IN STORAGE (AF)																**-8,826**

Table C-4
Scenario 1: Pumping Redistribution

Water Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Ave.
INFLOWS																
Deep Percolation from Precipitation	0	0	384	13,937	0	1,343	0	0	3,500	15	13	1,460	3,151	617	909	**1,689**
Infiltration of Runoff in Detention Basins	482	478	478	478	482	478	478	478	482	478	478	478	482	478	478	**479**
Recharge from Wastewater Discharge	8,511	8,502	8,502	8,502	8,511	8,502	8,502	8,502	8,511	8,502	8,502	8,502	8,511	8,502	8,502	**8,504**
Subsurface Inflow Subtotal	6,586	6,276	5,051	4,018	4,379	5,159	5,676	5,128	5,182	5,341	4,890	4,292	3,407	3,950	4,287	**4,908**
- Arlington Gap	5,576	5,269	4,044	3,012	3,369	4,152	4,670	4,121	4,172	4,334	3,884	3,286	2,397	2,943	3,281	3,901
- Temescal Wash (Temescal Canyon)	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
- Bedrock in Watershed	844	841	841	841	844	841	841	841	844	841	841	841	844	841	841	842
- Norco	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
Return Flows Subtotal	2,404	2,760	2,760	2,760	2,040	2,760	933	2,389	2,760	2,760	2,760	2,760	2,760	2,760	2,760	**2,542**
TOTAL INFLOWS (AFY)	**17,982**	**18,016**	**17,175**	**29,695**	**15,411**	**18,242**	**15,590**	**16,497**	**20,434**	**17,096**	**16,643**	**17,493**	**18,310**	**16,307**	**16,937**	**18,122**
OUTFLOWS																
Groundwater Pumping	21,749	21,740	21,740	21,740	21,749	21,740	21,740	21,740	21,749	21,740	21,740	21,740	21,749	21,740	21,740	**21,742**
Subsurface Outflow to Santa Ana River	6,472	6,011	5,732	5,604	5,512	5,436	5,381	5,336	5,310	5,282	5,249	5,225	5,222	5,196	5,158	**5,475**
TOTAL OUTFLOWS (AFY)	**28,221**	**27,751**	**27,472**	**27,343**	**27,261**	**27,175**	**27,120**	**27,076**	**27,059**	**27,021**	**26,989**	**26,965**	**26,971**	**26,935**	**26,898**	**27,217**
CHANGE IN STORAGE (AF)																**-9,095**

Table C-5
Scenario 2: Enhanced Recharge at Oak Avenue Basin

Water Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Ave.
INFLOWS																
Deep Percolation from Precipitation	0	0	384	13,937	0	1,343	0	0	3,500	15	13	1,460	3,151	617	909	**1,689**
Infiltration of Runoff in Detention Basins	5,265	5,240	5,240	5,240	5,265	5,240	5,240	5,240	5,265	5,240	5,240	5,240	5,265	5,240	5,240	**5,246**
- Oak Street	5,023	5,000	5,000	5,000	5,023	5,000	5,000	5,000	5,023	5,000	5,000	5,000	5,023	5,000	5,000	5,006
- Main Street	241	240	240	240	241	240	240	240	241	240	240	240	241	240	240	240
Recharge from Wastewater Discharge	8,252	7,768	8,244	8,244	8,252	8,244	8,244	8,244	8,252	8,244	8,244	8,244	8,252	8,244	8,244	**8,214**
Subsurface Inflow Subtotal	6,627	6,385	5,223	4,246	4,639	5,444	5,983	5,454	5,531	5,702	5,257	4,674	3,794	4,340	4,687	**5,199**
- Arlington Gap	5,618	5,378	4,216	3,239	3,629	4,437	4,976	4,448	4,521	4,696	4,251	3,668	2,784	3,334	3,680	4,192
- Temescal Wash (Temescal Canyon)	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
- Bedrock in Watershed	844	841	841	841	844	841	841	841	844	841	841	841	844	841	841	842
- Norco	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
Return Flows Subtotal	2,404	2,760	2,760	2,760	2,040	2,760	933	2,389	2,760	2,760	2,760	2,760	2,760	2,760	2,760	**2,542**
TOTAL INFLOWS (AFY)	**22,548**	**22,153**	**21,850**	**34,425**	**20,196**	**23,030**	**20,399**	**21,327**	**25,307**	**21,960**	**21,513**	**22,378**	**23,222**	**21,200**	**21,839**	**22,890**
OUTFLOWS																
Groundwater Pumping	21,725	21,722	21,722	21,722	21,725	21,722	21,722	21,722	21,725	21,722	21,722	21,722	21,725	21,722	21,658	**21,718**
Subsurface Outflow to Santa Ana River	6,472	6,011	5,732	5,604	5,512	5,436	5,382	5,337	5,313	5,284	5,255	5,231	5,231	5,215	5,195	**5,481**
TOTAL OUTFLOWS (AFY)	**28,196**	**27,733**	**27,454**	**27,325**	**27,236**	**27,157**	**27,104**	**27,059**	**27,037**	**27,005**	**26,976**	**26,953**	**26,956**	**26,936**	**26,853**	**27,199**
CHANGE IN STORAGE (AF)																**-4,309**

Table C-6
Scenario 3: Enhanced Recharge at Main St Basin

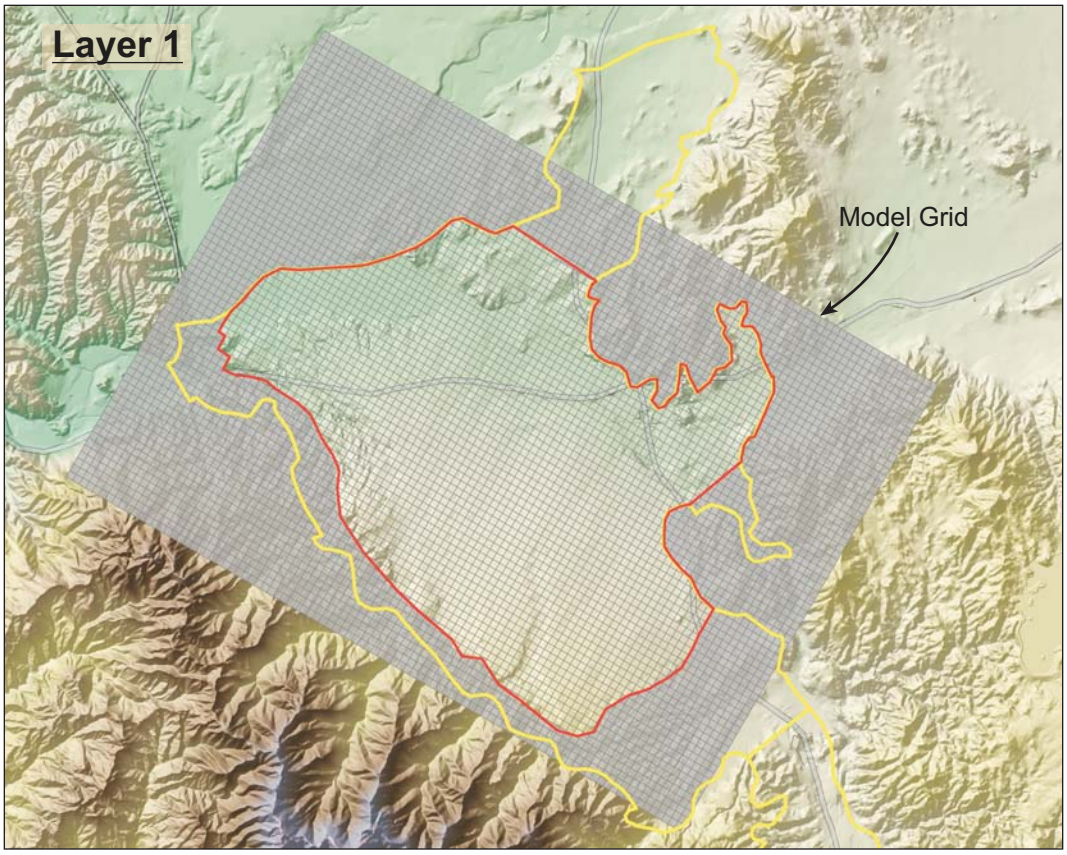
Water Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Ave.
INFLOWS																
Deep Percolation from Precipitation	0	0	384	13,937	0	1,343	0	0	3,500	15	13	1,460	3,151	617	909	**1,689**
Infiltration of Runoff in Detention Basins	1,749	1,740	1,740	1,740	1,749	1,740	1,740	1,740	1,749	1,740	1,740	1,740	1,749	1,740	1,740	**1,743**
- Oak Street	241	240	240	240	241	240	240	240	241	240	240	240	241	240	240	240
- Main Street	1,507	1,500	1,500	1,500	1,507	1,500	1,500	1,500	1,507	1,500	1,500	1,500	1,507	1,500	1,500	1,502
Recharge from Wastewater Discharge	9,515	9,505	9,505	9,505	9,515	9,505	9,505	9,505	9,515	9,505	9,505	9,505	9,515	9,505	9,505	**9,507**
Subsurface Inflow Subtotal	6,627	6,379	5,208	4,222	4,607	5,407	5,939	5,410	5,481	5,651	5,210	4,619	3,740	4,284	4,629	**5,161**
- Arlington Gap	5,618	5,373	4,201	3,216	3,597	4,401	4,932	4,404	4,471	4,645	4,204	3,613	2,731	3,278	3,622	4,154
- Temescal Wash (Temescal Canyon)	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
- Bedrock in Watershed	844	841	841	841	844	841	841	841	844	841	841	841	844	841	841	842
- Norco	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
Return Flows Subtotal	2,404	2,760	2,760	2,760	2,040	2,760	933	2,389	2,760	2,760	2,760	2,760	2,760	2,760	2,760	**2,542**
TOTAL INFLOWS (AFY)	**20,295**	**20,384**	**19,597**	**32,164**	**17,910**	**20,756**	**18,117**	**19,044**	**23,004**	**19,671**	**19,228**	**20,085**	**20,915**	**18,906**	**19,543**	**20,642**
OUTFLOWS																
Groundwater Pumping	21,725	21,722	21,722	21,722	21,725	21,722	21,722	21,722	21,725	21,722	21,722	21,722	21,725	21,722	21,722	**21,722**
Subsurface Outflow to Santa Ana River	6,472	6,011	5,732	5,604	5,512	5,436	5,382	5,337	5,313	5,292	5,255	5,231	5,232	5,215	5,196	**5,481**
TOTAL OUTFLOWS (AFY)	**28,196**	**27,733**	**27,454**	**27,325**	**27,236**	**27,157**	**27,104**	**27,059**	**27,037**	**27,013**	**26,976**	**26,953**	**26,957**	**26,937**	**26,917**	**27,204**
CHANGE IN STORAGE (AF)																**-6,562**

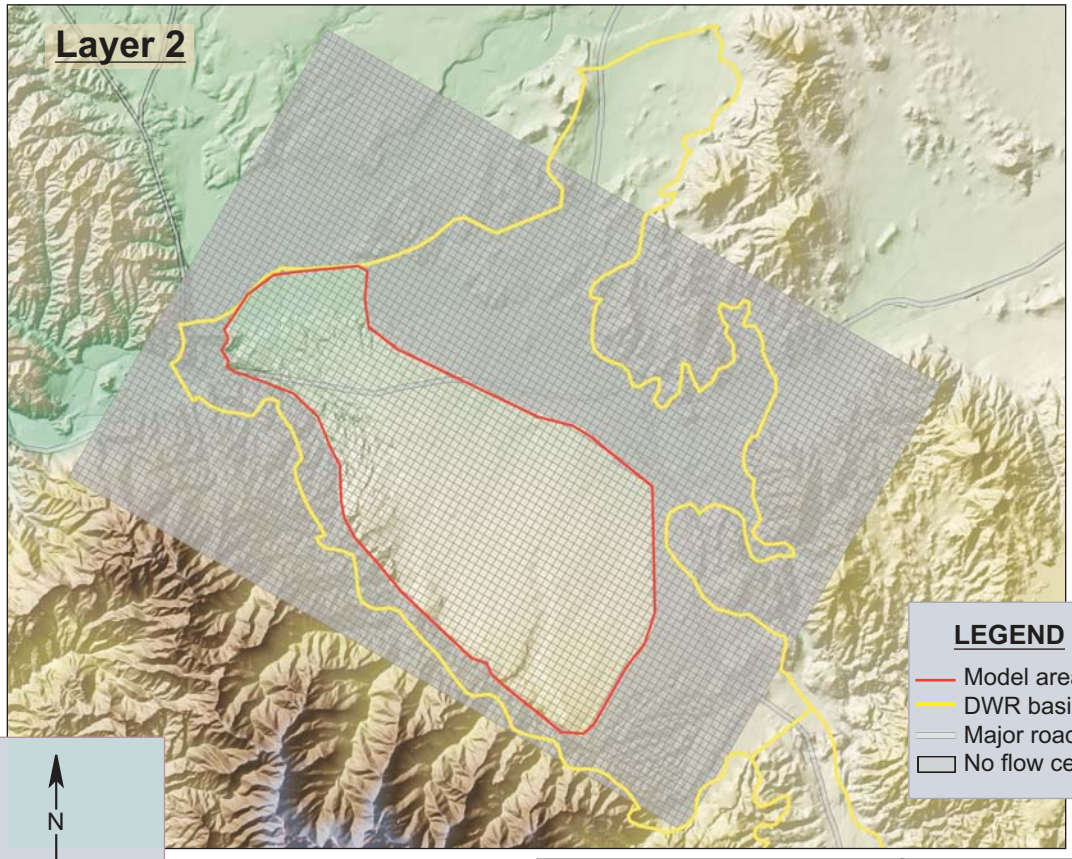
Table C-7
Scenario 4a: Arlington Gap Recharge (4 Wells)

Water Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Ave.
INFLOWS																
Deep Percolation from Precipitation	0	0	384	13,937	0	1,343	0	0	3,500	15	13	1,460	3,151	617	909	**1,689**
Infiltration of Runoff in Detention Basins	482	478	478	478	482	478	478	478	482	478	478	478	482	478	478	**479**
Recharge from Wastewater Discharge	9,397	9,388	9,388	9,388	9,397	9,388	9,388	9,388	9,397	9,388	9,388	9,388	9,397	9,388	9,388	**9,390**
Subsurface Inflow Subtotal	6,136	5,547	4,252	3,190	3,561	4,338	4,853	4,302	4,352	4,519	4,074	3,486	2,608	3,157	3,497	**4,125**
- Arlington Gap	5,140	4,554	3,259	2,197	2,564	3,345	3,860	3,309	3,355	3,526	3,081	2,492	1,611	2,163	2,504	3,131
- Temescal Wash (Temescal Canyon)	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
- Bedrock in Watershed	835	832	832	832	835	832	832	832	835	832	832	832	835	832	832	833
- Norco	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Return Flows Subtotal	2,404	2,760	2,760	2,760	2,040	2,760	933	2,389	2,760	2,760	2,760	2,760	2,760	2,760	2,760	**2,542**
Recharge Wells at Arlington	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762	**2,762**
TOTAL INFLOWS (AFY)	**21,181**	**20,935**	**20,024**	**32,515**	**18,241**	**21,069**	**18,415**	**19,319**	**23,252**	**19,922**	**19,475**	**20,334**	**21,160**	**19,162**	**19,795**	**20,987**
OUTFLOWS																
Groundwater Pumping	21,705	21,722	21,722	21,722	21,705	21,722	21,722	21,722	21,705	21,722	21,722	21,722	21,705	21,722	21,722	**21,717**
Subsurface Outflow to Santa Ana River	6,472	6,011	5,732	5,604	5,512	5,436	5,382	5,337	5,313	5,292	5,255	5,231	5,232	5,215	5,196	**5,481**
TOTAL OUTFLOWS (AFY)	**28,177**	**27,733**	**27,454**	**27,325**	**27,217**	**27,157**	**27,104**	**27,059**	**27,018**	**27,013**	**26,977**	**26,953**	**26,937**	**26,937**	**26,917**	**27,199**
CHANGE IN STORAGE (AF)																**-6,212**

Table C-8
Scenario 4b: Recharge Wells at Arlington Gap (7 Wells)

Water Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Ave.
INFLOWS																
Deep Percolation from Precipitation	0	0	384	13,937	0	1,343	0	0	3,500	15	13	1,460	3,151	617	909	**1,689**
Infiltration of Runoff in Detention Basins	482	478	478	478	482	478	478	478	482	478	478	478	482	478	478	**479**
Recharge from Wastewater Discharge	7,994	7,986	7,986	7,986	7,994	7,986	7,986	7,986	7,994	7,986	7,986	7,986	7,994	7,986	7,986	**7,988**
Subsurface Inflow Subtotal	5,381	4,407	3,010	1,904	2,253	3,016	3,521	2,960	2,990	3,167	2,721	2,132	1,264	1,816	2,148	**2,846**
- Arlington Gap	4,371	3,400	2,004	897	1,244	2,009	2,514	1,954	1,981	2,160	1,714	1,126	254	809	1,142	1,839
- Temescal Wash (Temescal Canyon)	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
- Bedrock in Watershed	844	841	841	841	844	841	841	841	844	841	841	841	844	841	841	842
- Norco	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
Return Flows Subtotal	2,404	2,760	2,760	2,760	2,040	2,760	933	2,389	2,760	2,760	2,760	2,760	2,760	2,760	2,760	**2,542**
Recharge Wells	5,524	5,524	5,524	5,524	5,524	5,524	5,524	5,524	5,524	5,524	5,524	5,524	5,524	5,524	5,524	**5,524**
TOTAL INFLOWS (AFY)	**21,785**	**21,155**	**20,143**	**32,589**	**18,293**	**21,107**	**18,443**	**19,338**	**23,250**	**19,930**	**19,482**	**20,341**	**21,175**	**19,181**	**19,806**	**21,068**
OUTFLOWS																
Groundwater Pumping	21,690	21,723	21,723	21,723	21,690	21,723	21,723	21,723	21,690	21,723	21,723	21,723	21,690	21,723	21,723	**21,715**
Subsurface Outflow to Santa Ana River	6,472	6,011	5,732	5,604	5,512	5,436	5,382	5,337	5,313	5,284	5,255	5,231	5,231	5,215	5,195	**5,481**
TOTAL OUTFLOWS (AFY)	**28,162**	**27,735**	**27,456**	**27,327**	**27,202**	**27,159**	**27,106**	**27,061**	**27,003**	**27,007**	**26,978**	**26,955**	**26,922**	**26,938**	**26,919**	**27,195**
CHANGE IN STORAGE (AF)																**-6,127**





LEGEND

- Model area
- DWR basin boundary
- Major road
- No flow cells

N

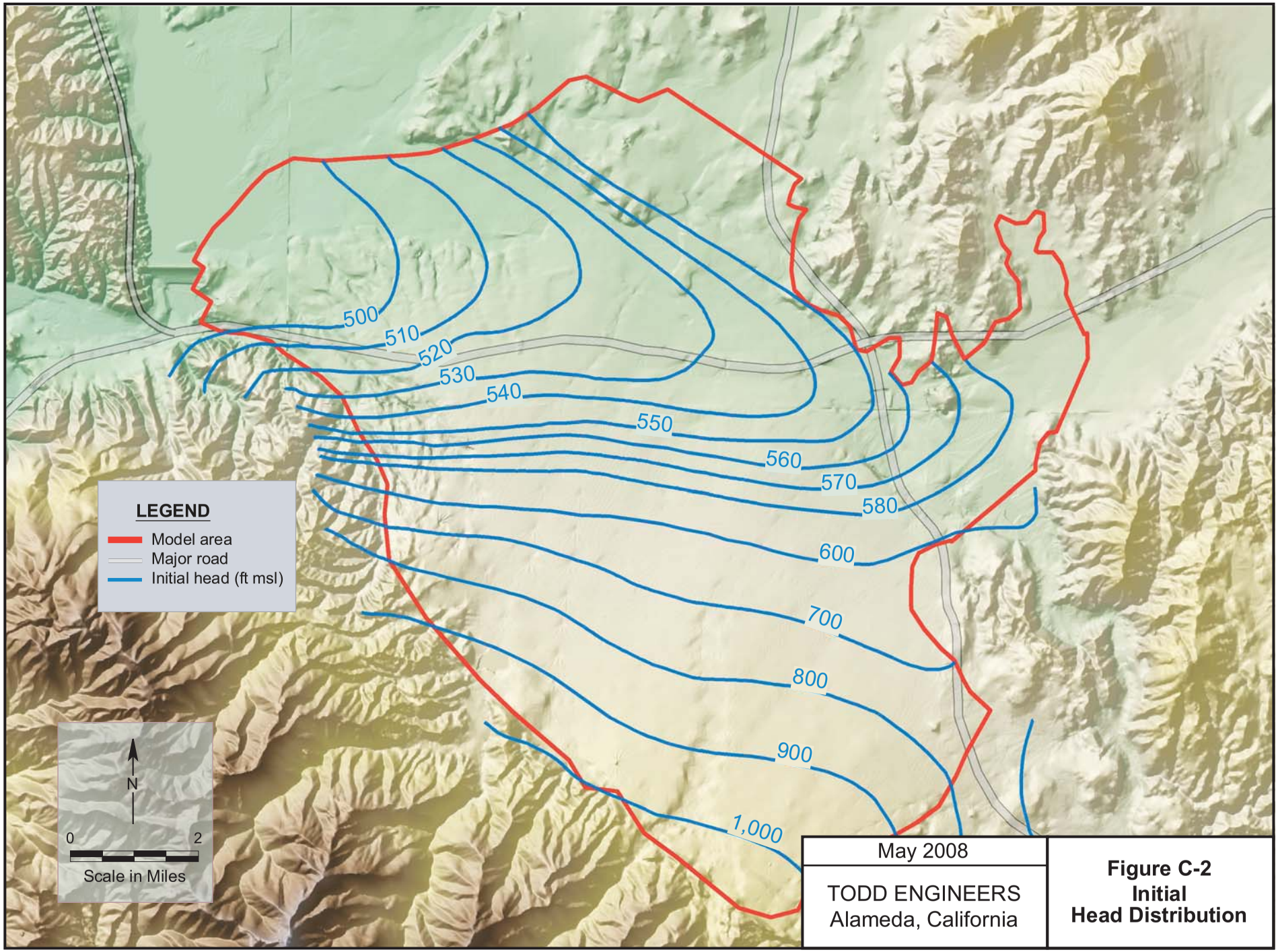
0 2

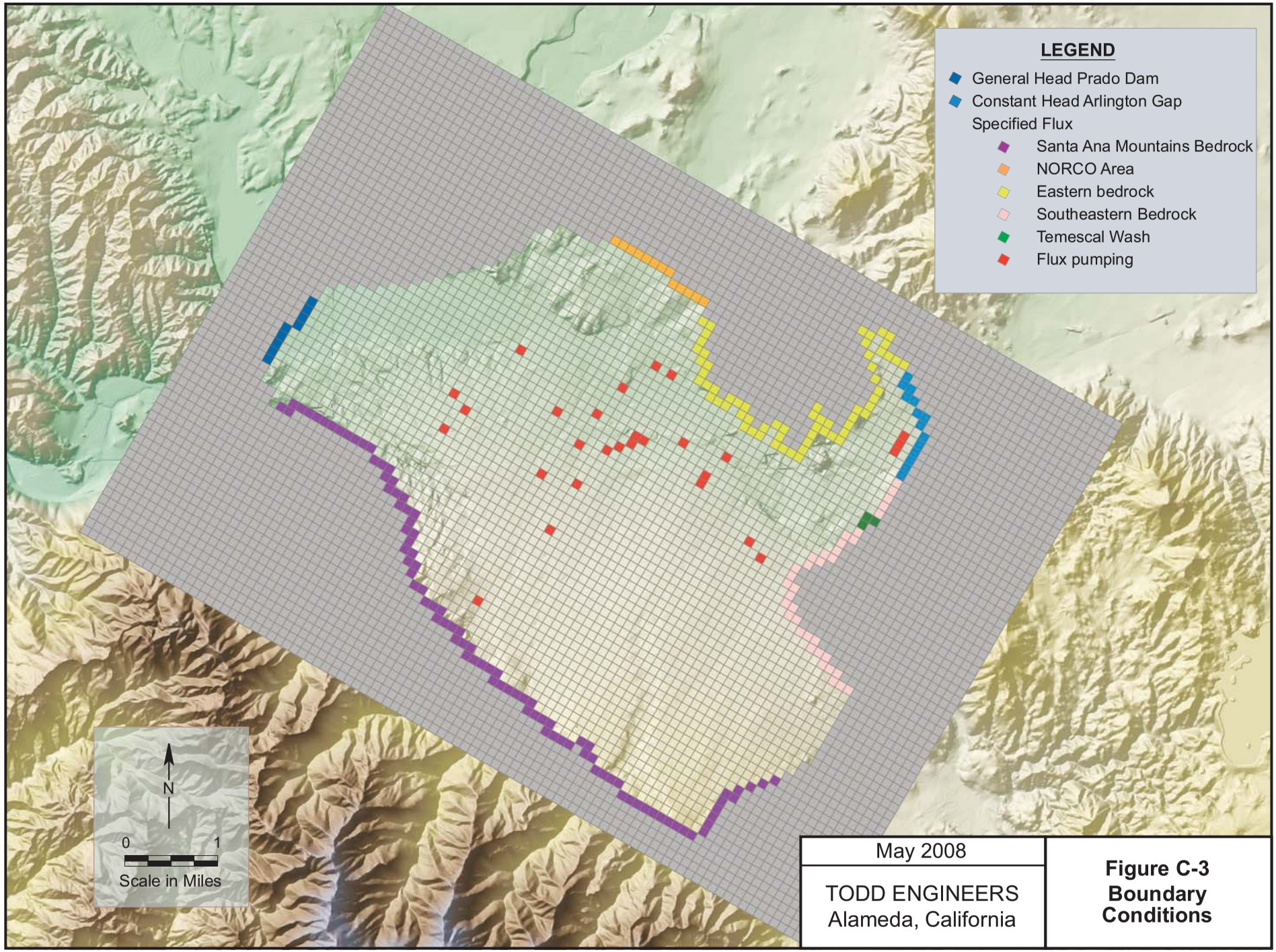
Scale in Miles

May 2008

TODD ENGINEERS
Alameda, California

Figure C-1
Model Area

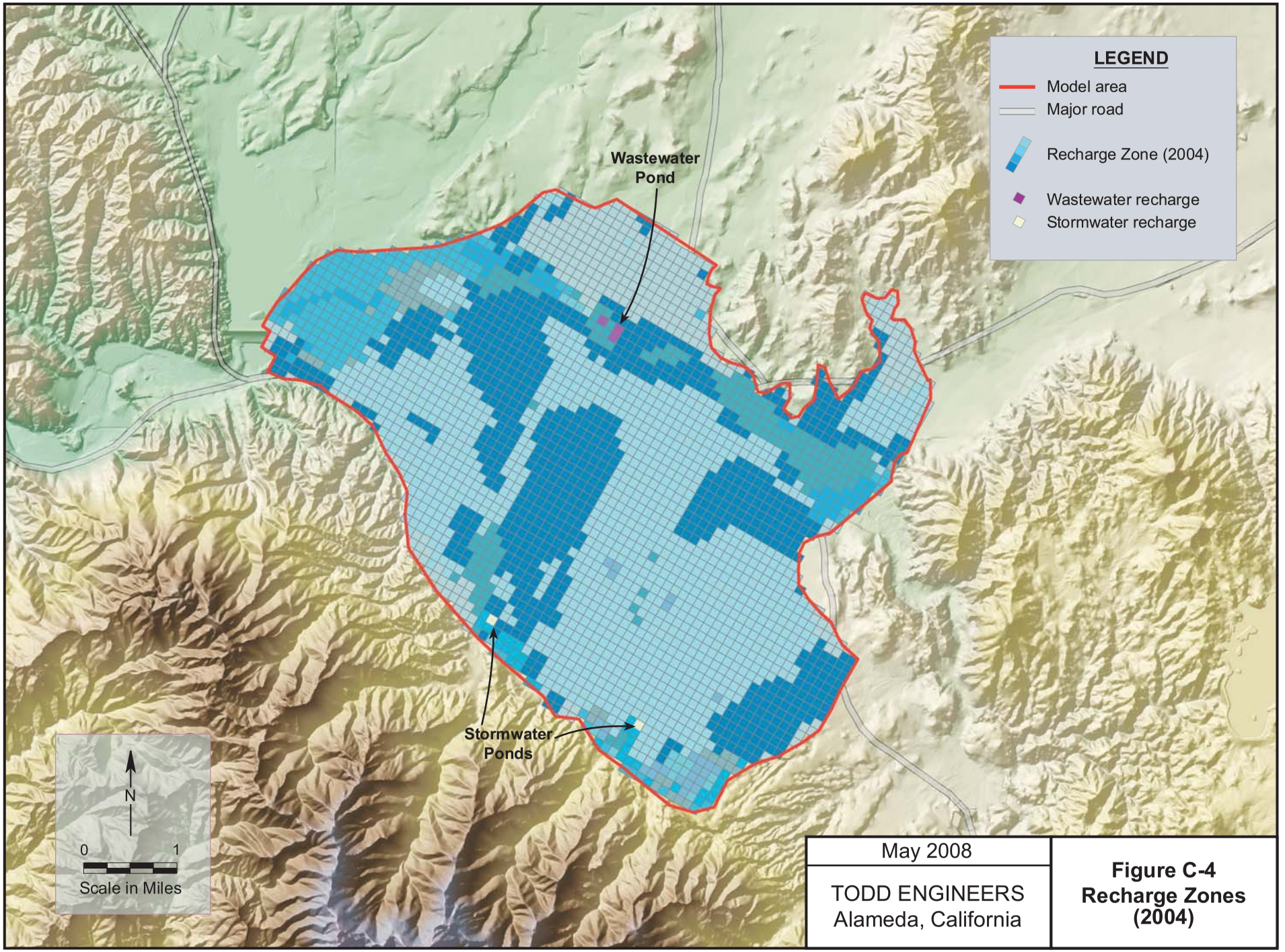

500
510
520
530
540
550
560
570
580
600
700
800
900
1,000
LEGEND
Model area
Major road
Initial head (ft msl)
N
0
2
Scale in Miles
May 2008
TODD ENGINEERS
Alameda, California
Figure C-2
Initial
Head Distribution



May 2008

TODD ENGINEERS
Alameda, California

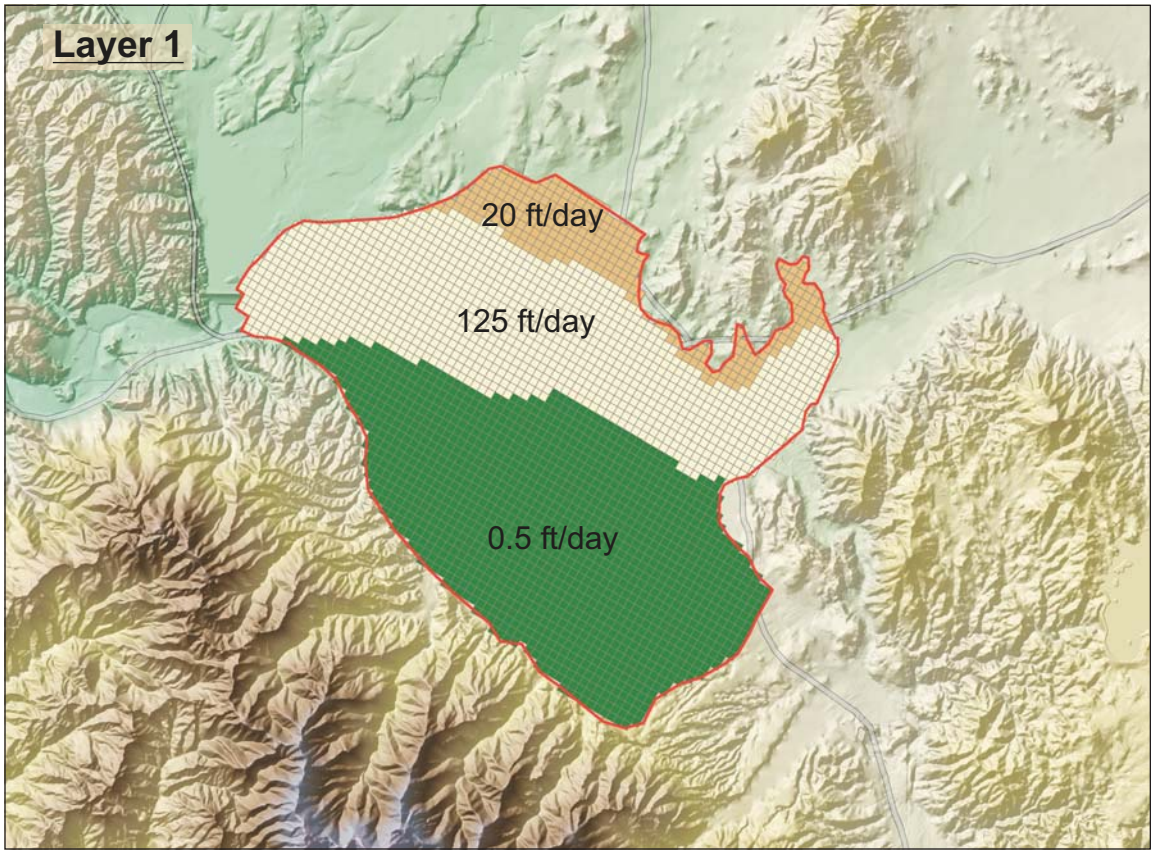
Figure C-3
Boundary Conditions

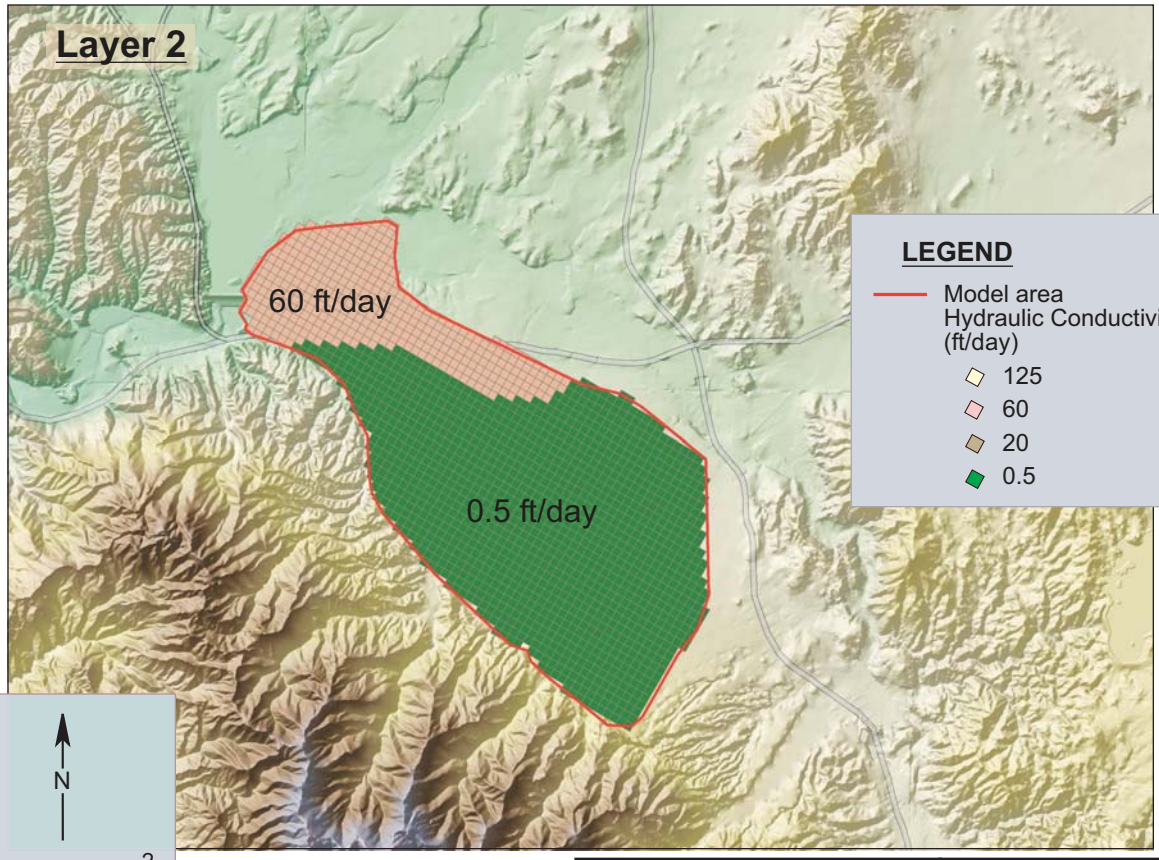


May 2008

TODD ENGINEERS
Alameda, California

Figure C-4
Recharge Zones (2004)





LEGEND

Model area
Hydraulic Conductivity (ft/day)

- 125
- 60
- 20
- 0.5

N

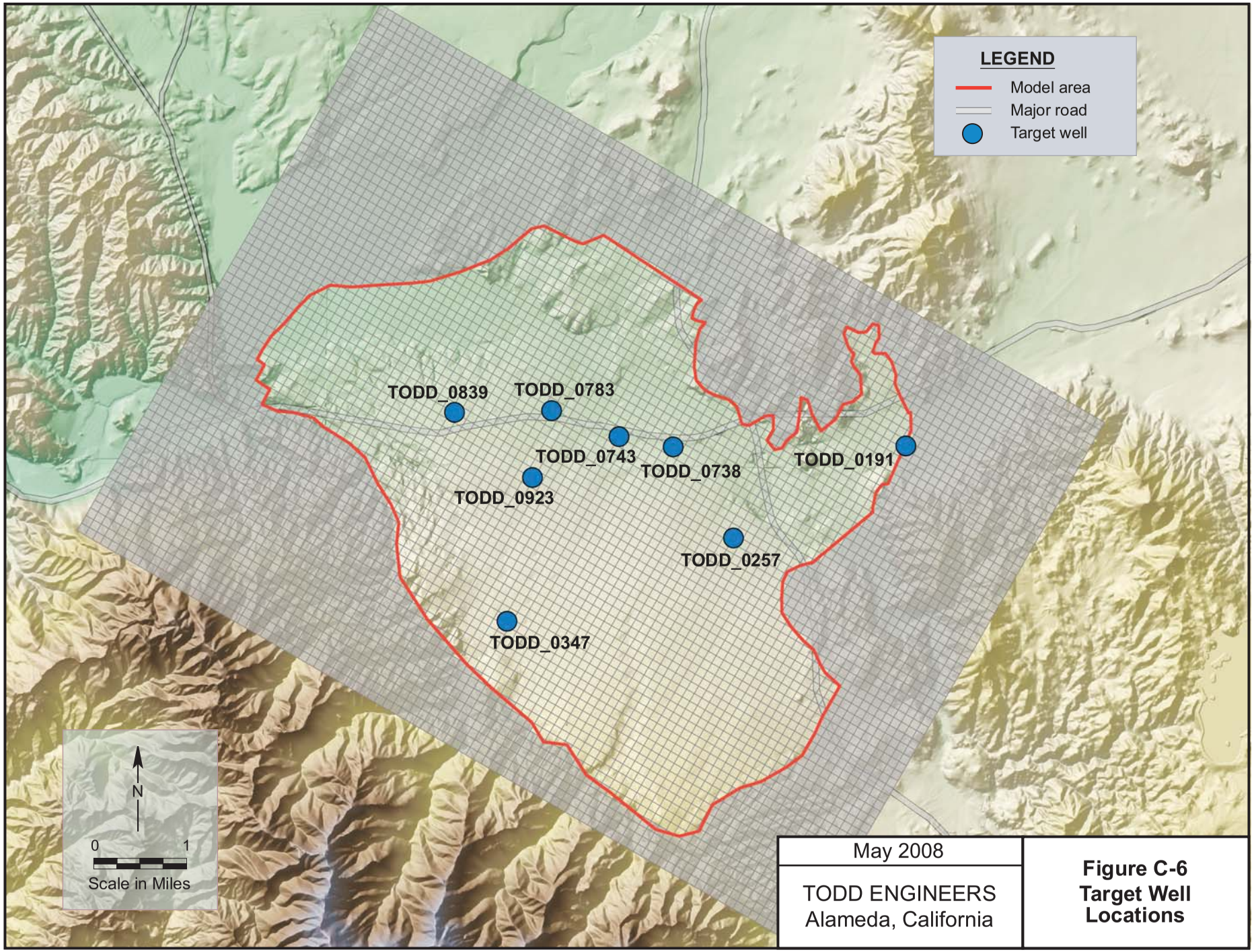
0 2

Scale in Miles

May 2008

TODD ENGINEERS
Alameda, California

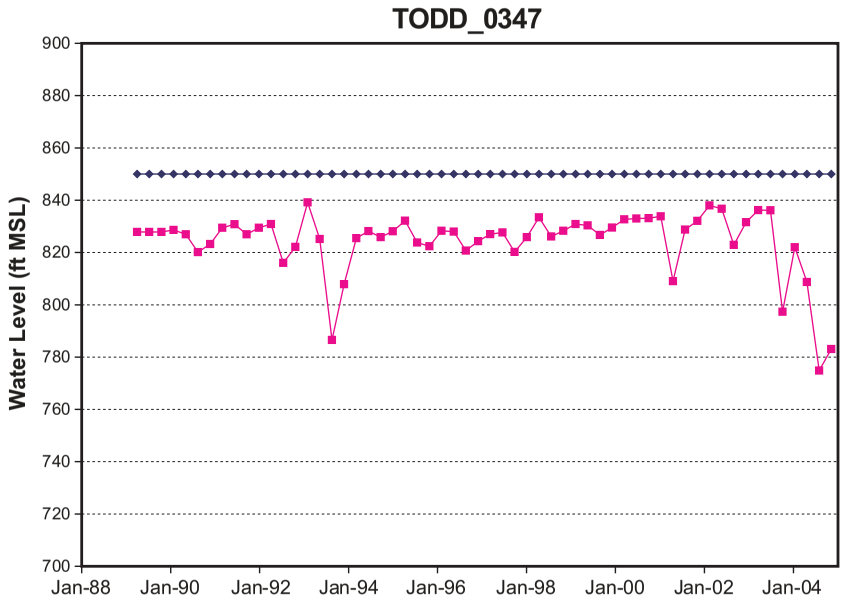
Figure C-5
Hydraulic Conductivity Distribution

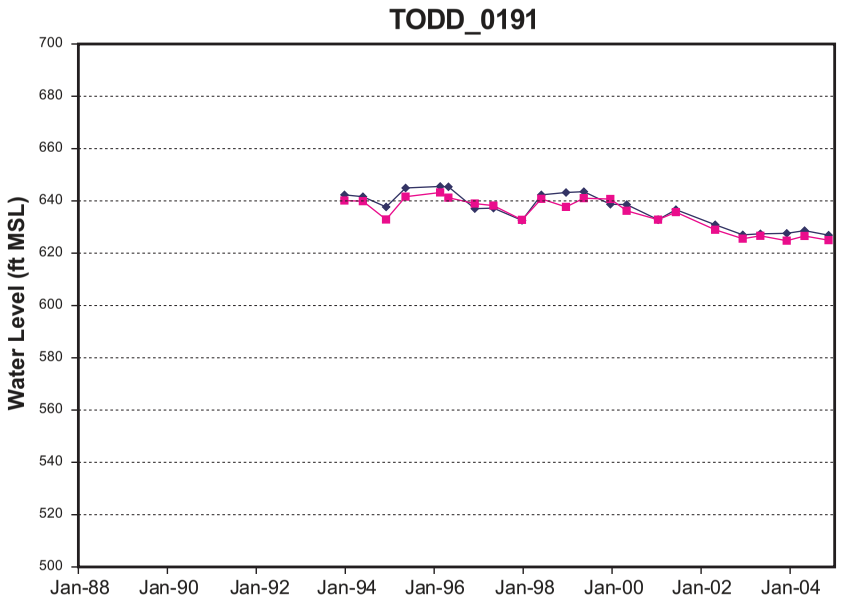


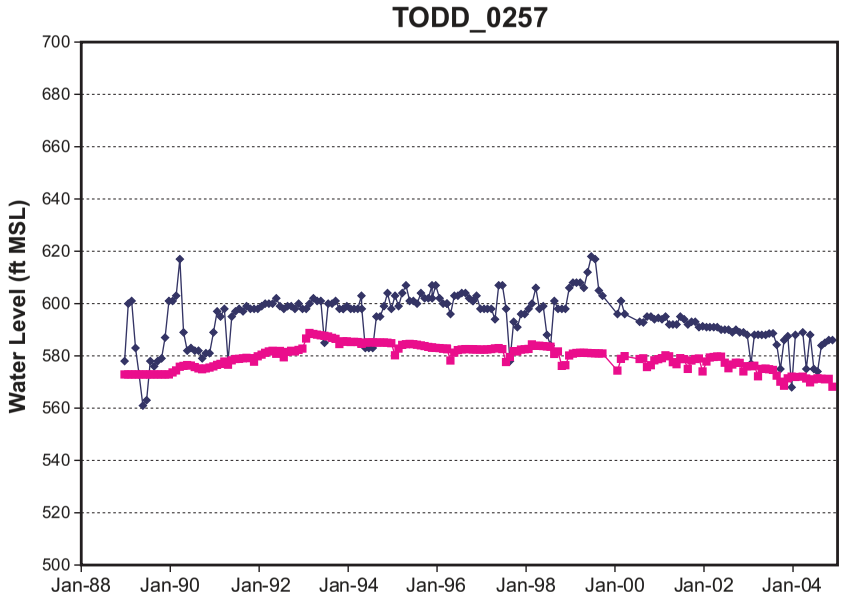
May 2008

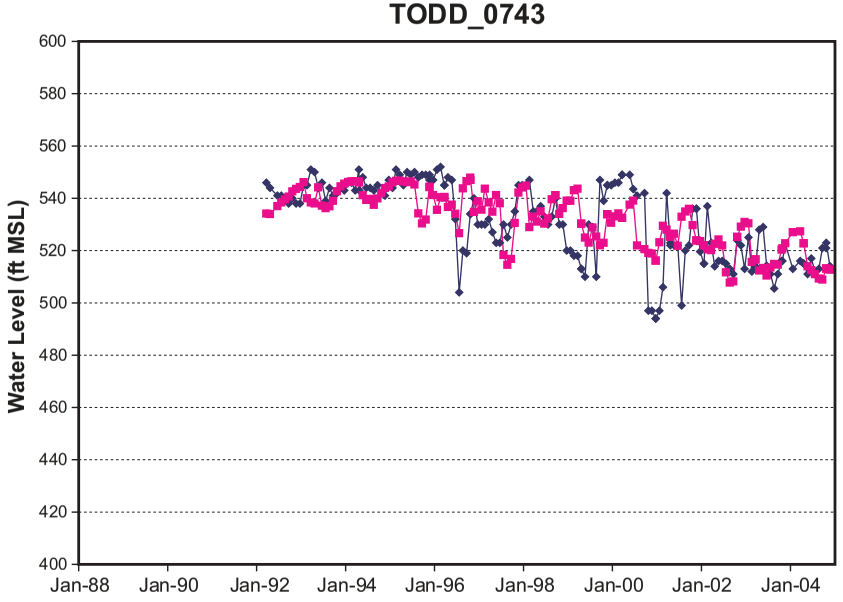
TODD ENGINEERS
Alameda, California

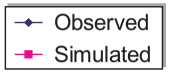
Figure C-6
Target Well Locations







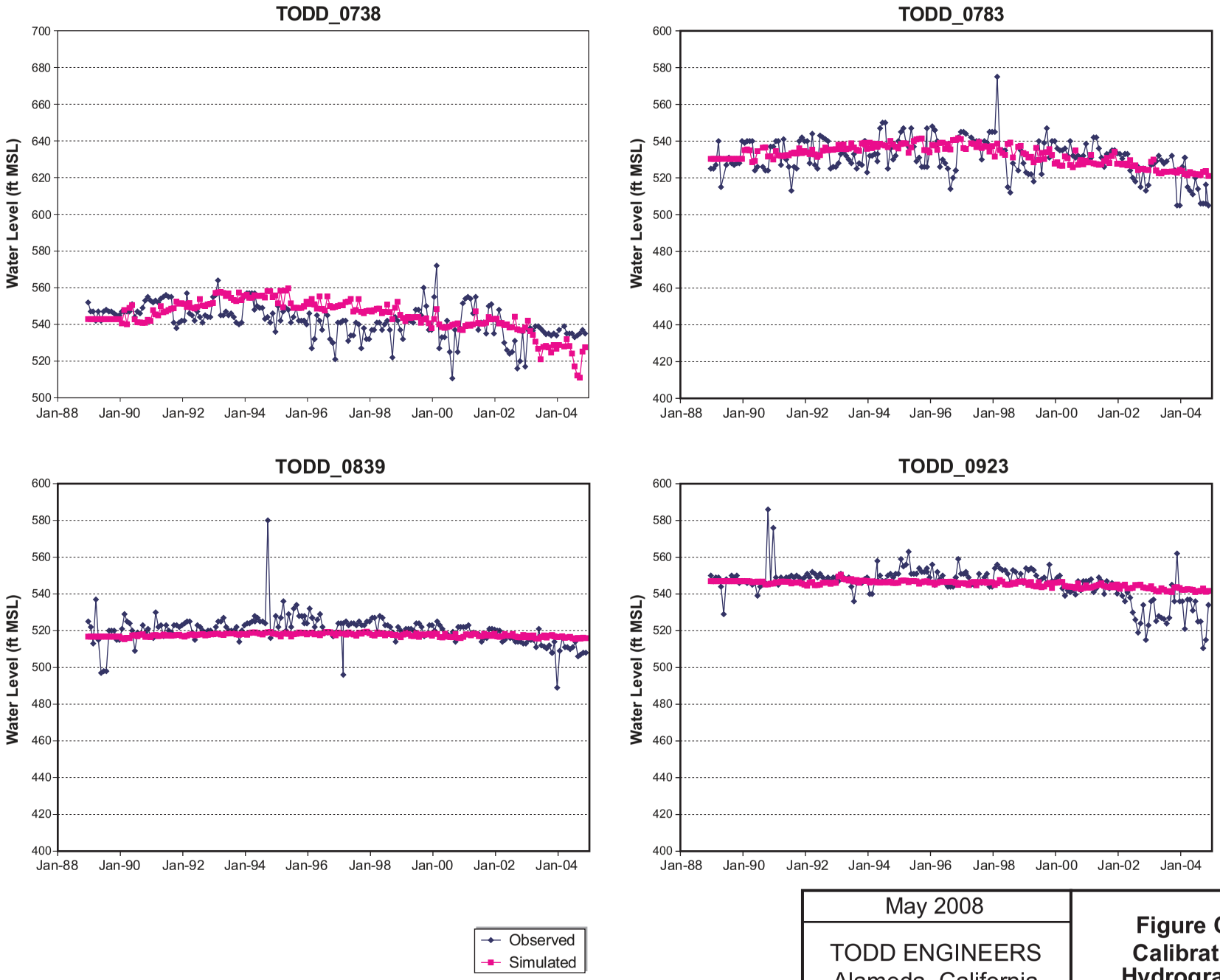




May 2008

TODD ENGINEERS
Alameda, California

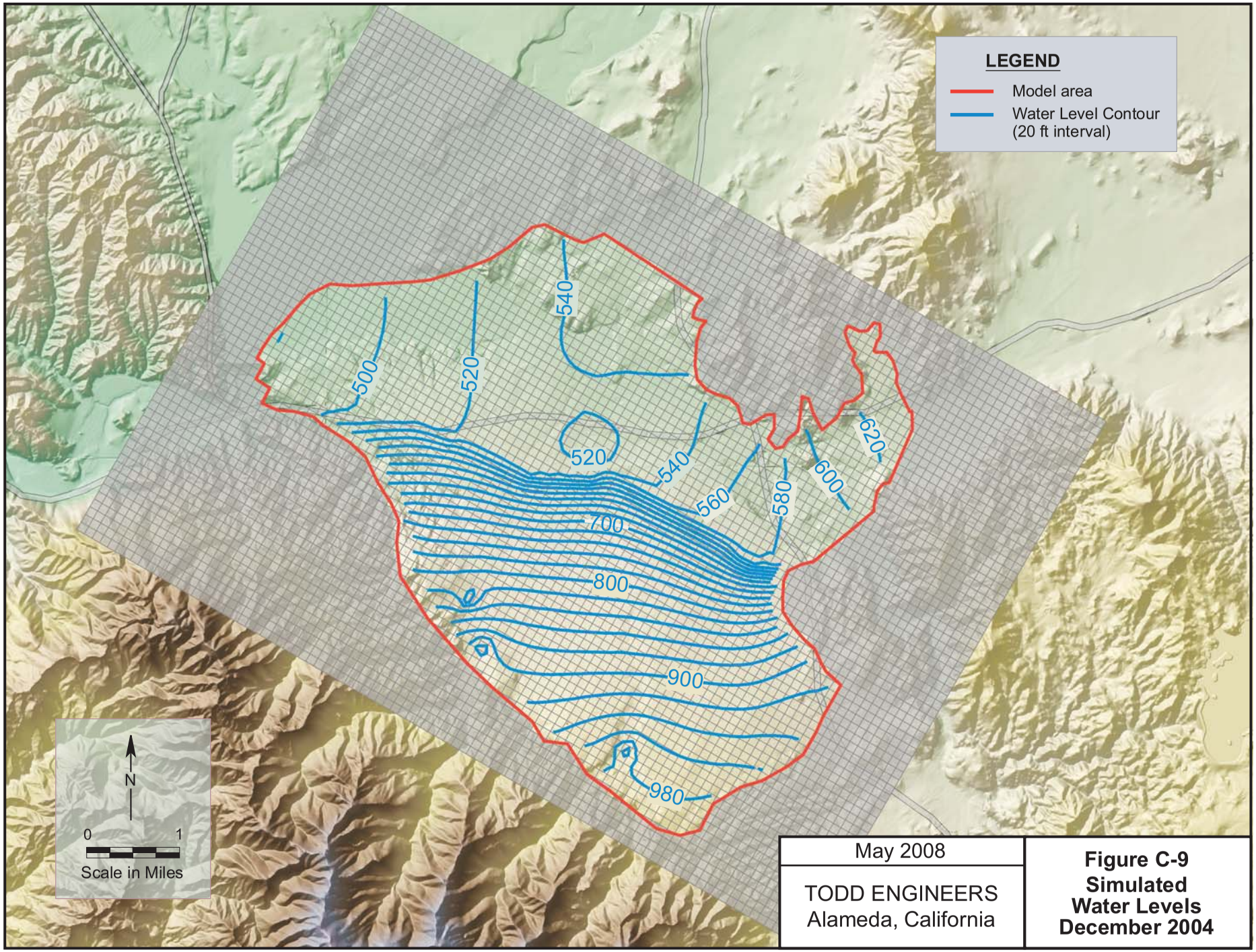
Figure C-7
Calibration Hydrographs



May 2008

TODD ENGINEERS
Alameda, California

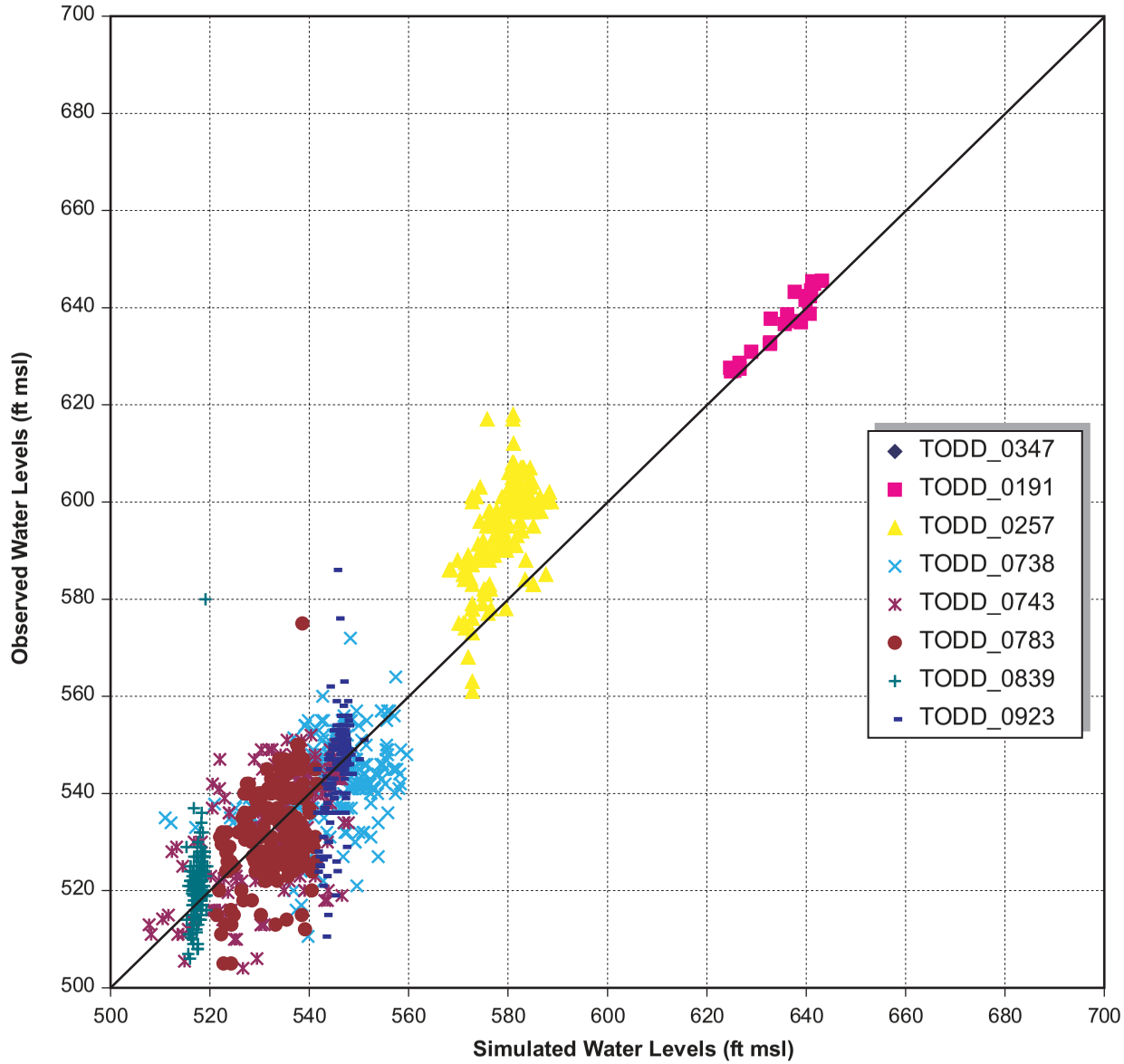
Figure C-8
Calibration Hydrographs



May 2008

TODD ENGINEERS
Alameda, California

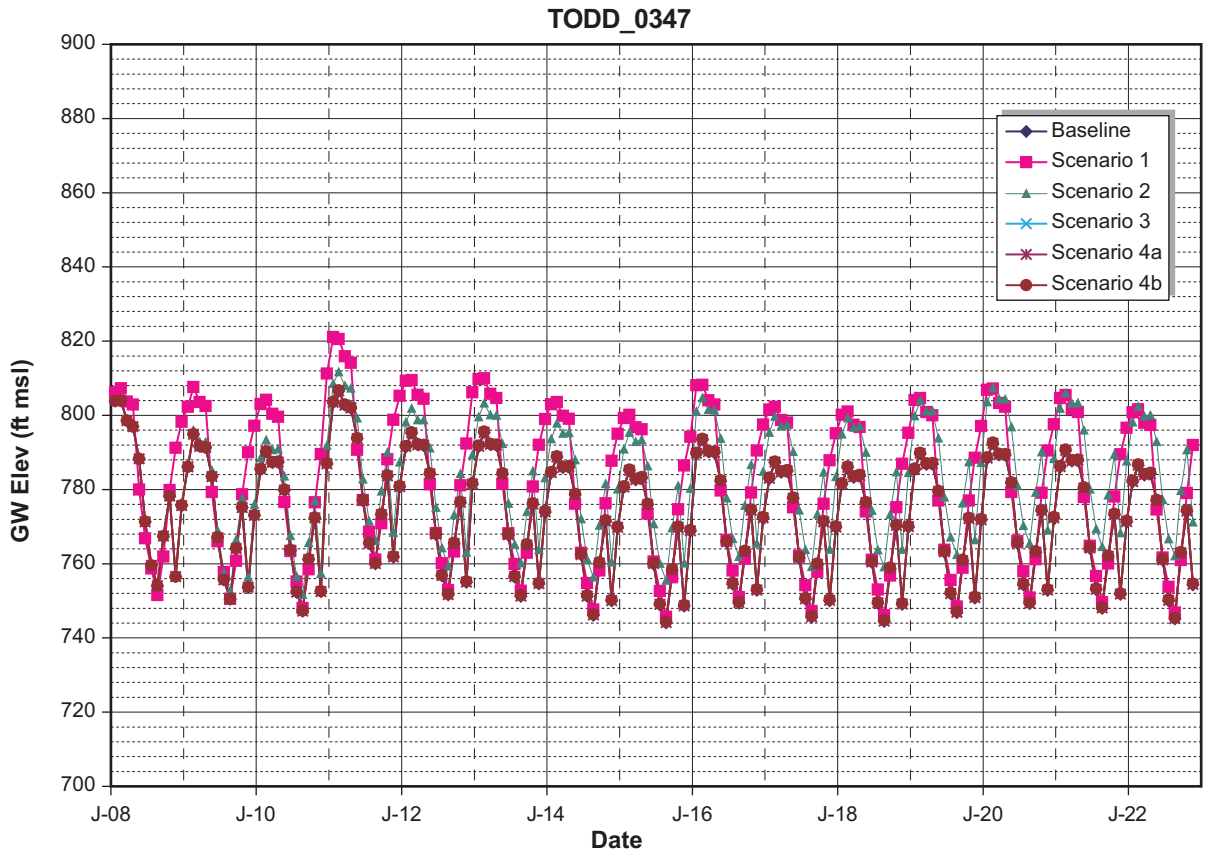
Figure C-9
Simulated Water Levels December 2004

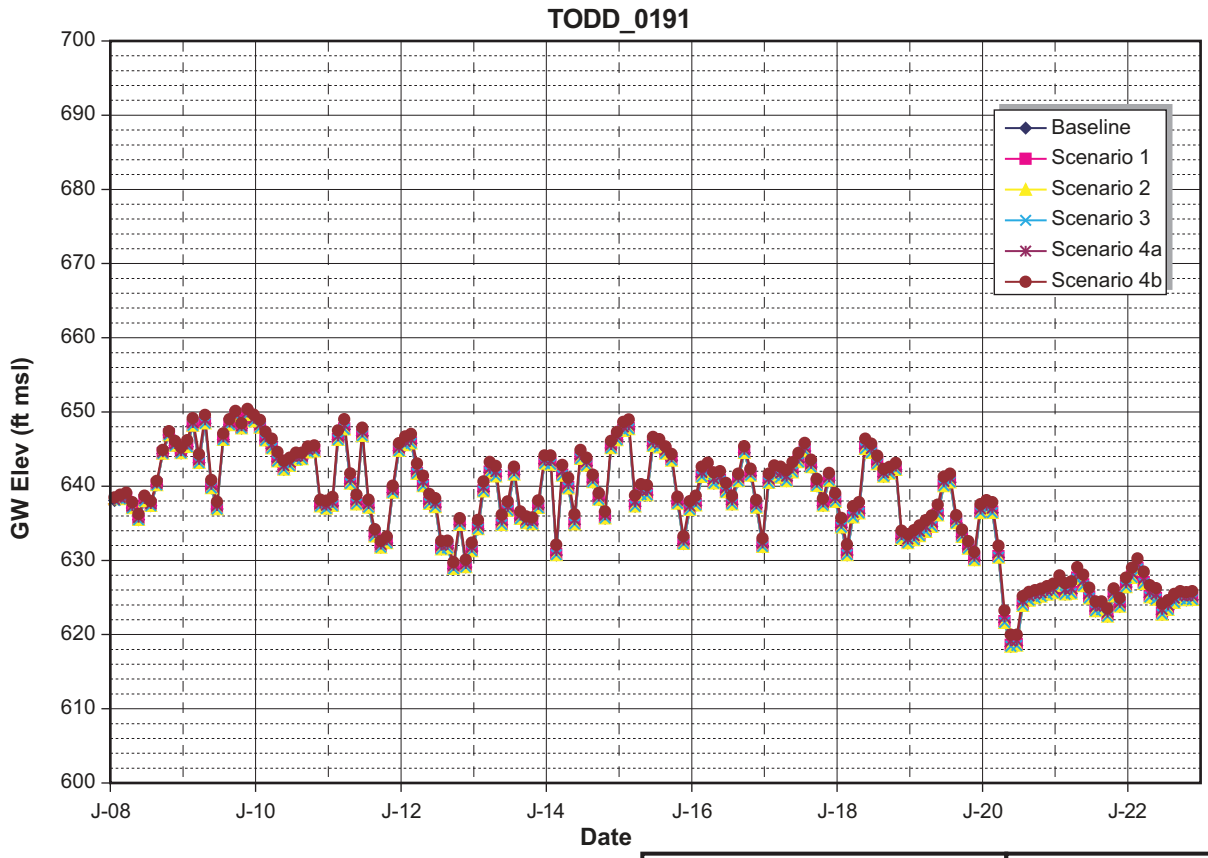


May 2008

TODD ENGINEERS
Alameda, California

Figure C-10
Observed vs. Simulated Water Levels

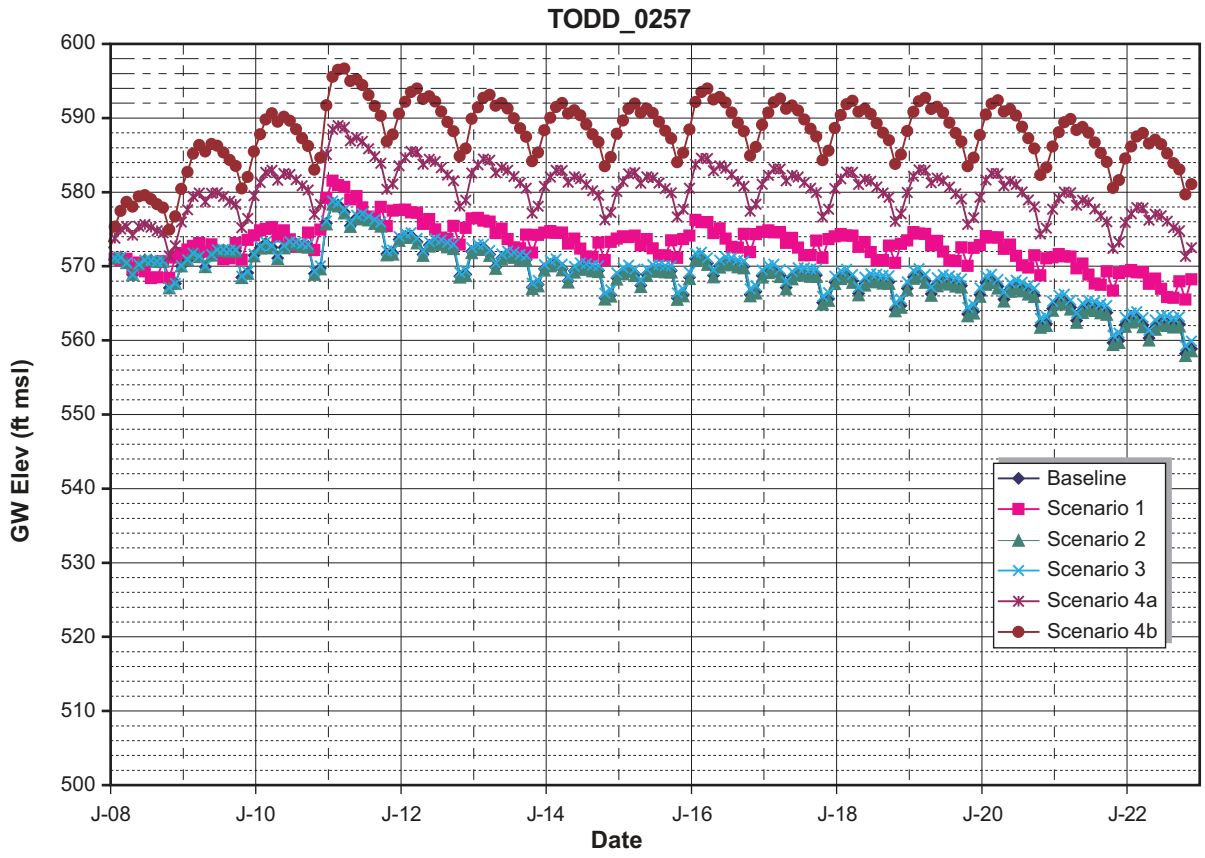


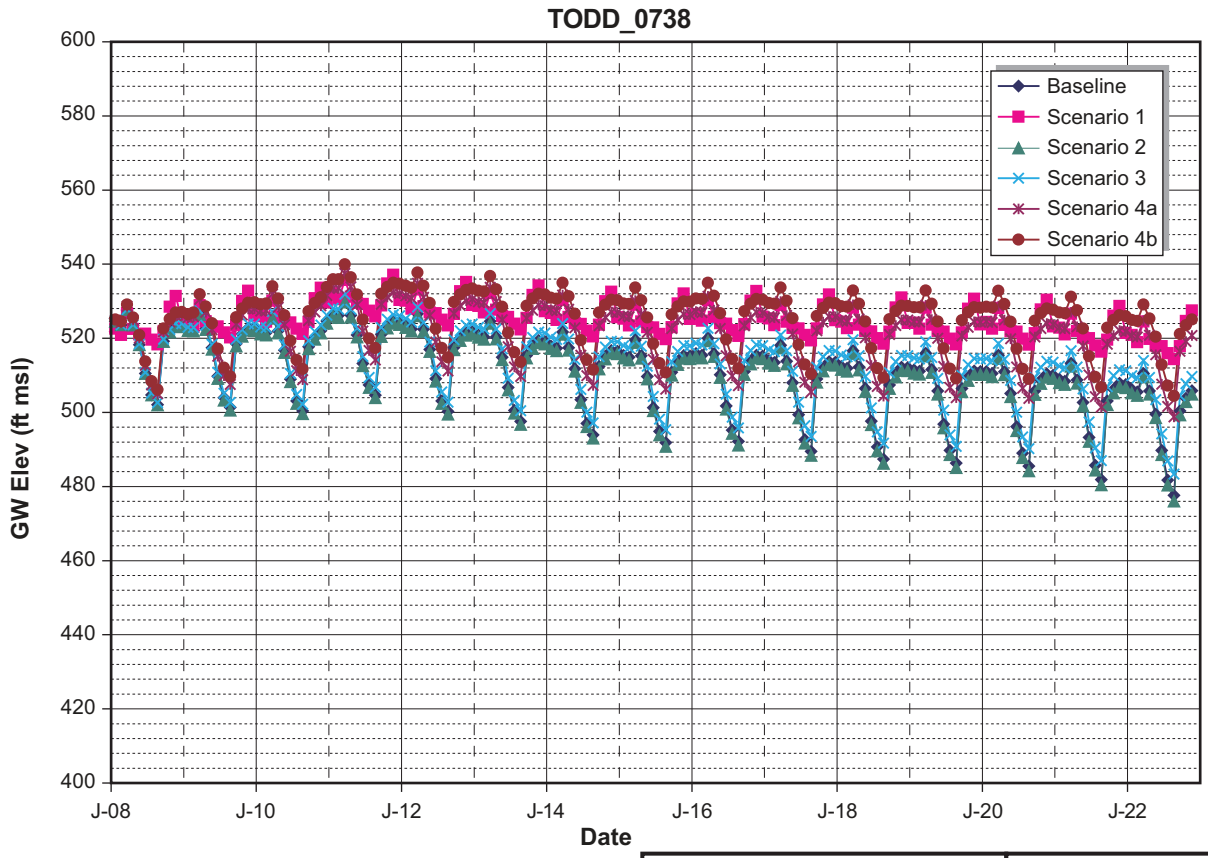


May 2008

TODD ENGINEERS
Alameda, California

Figure C-11
Baseline and Scenario - Hydrographs

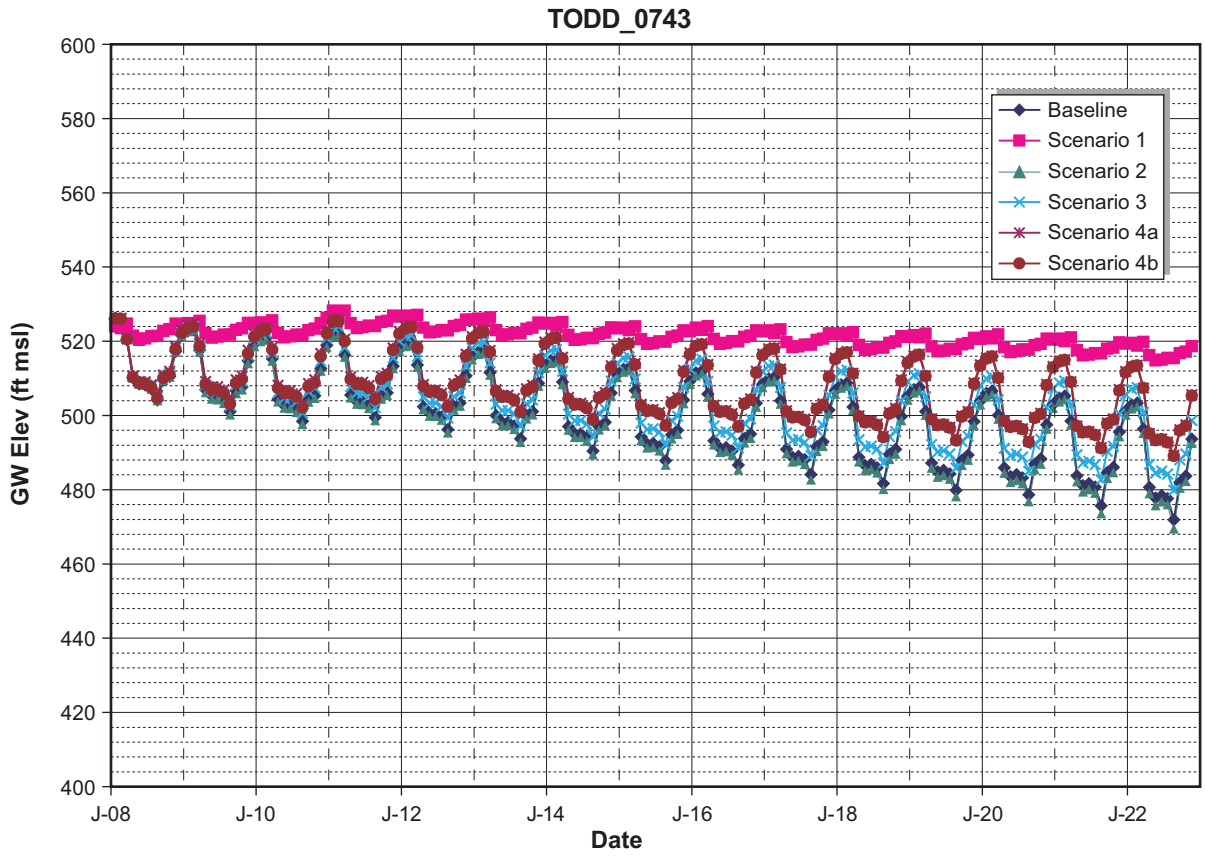


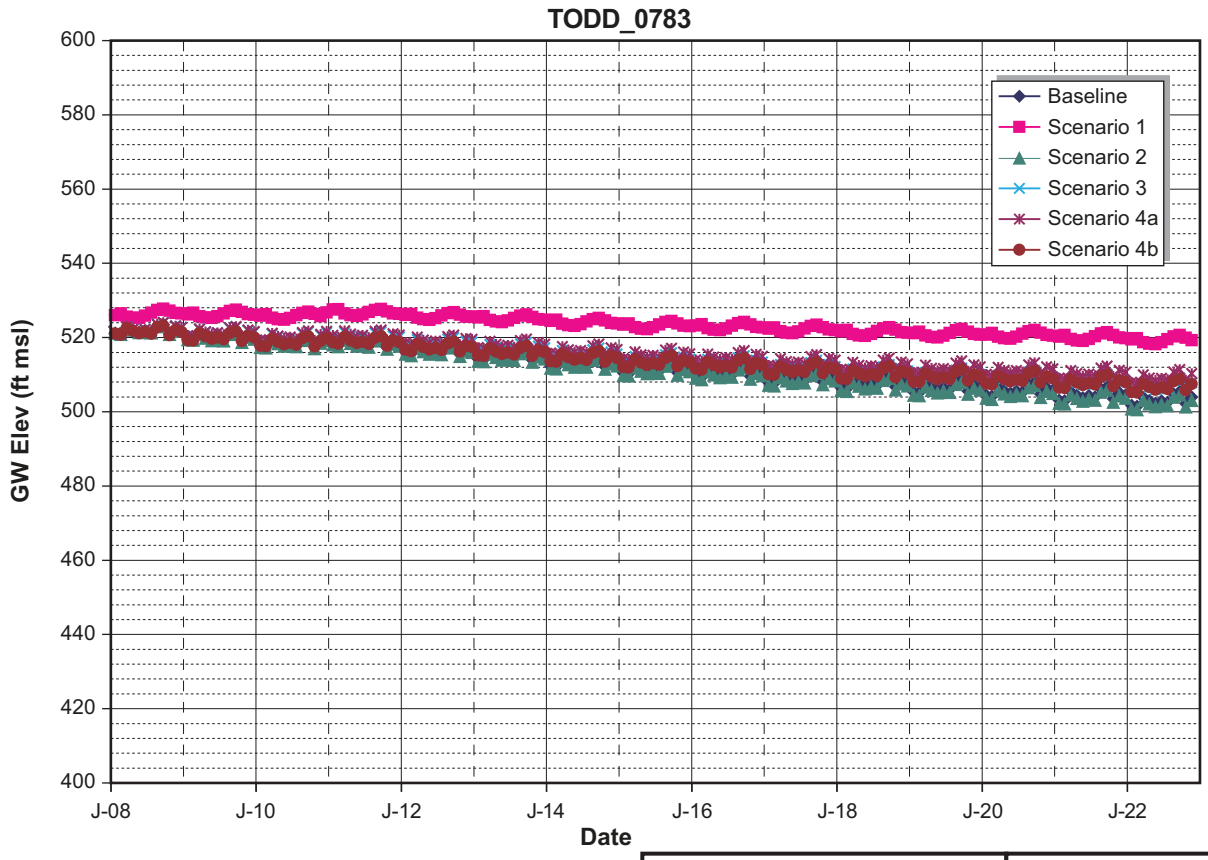


May 2008

TODD ENGINEERS
Alameda, California

Figure C-12
Baseline and Scenario - Hydrographs

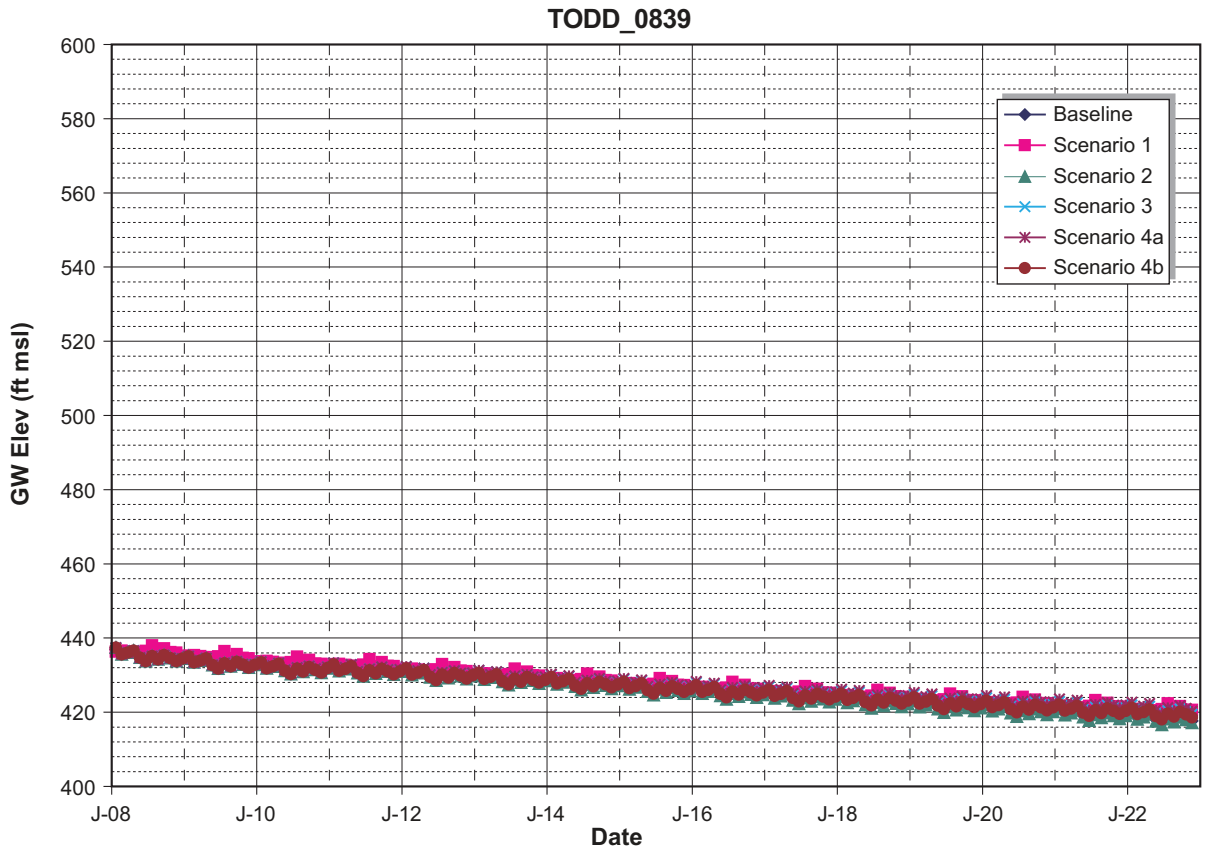


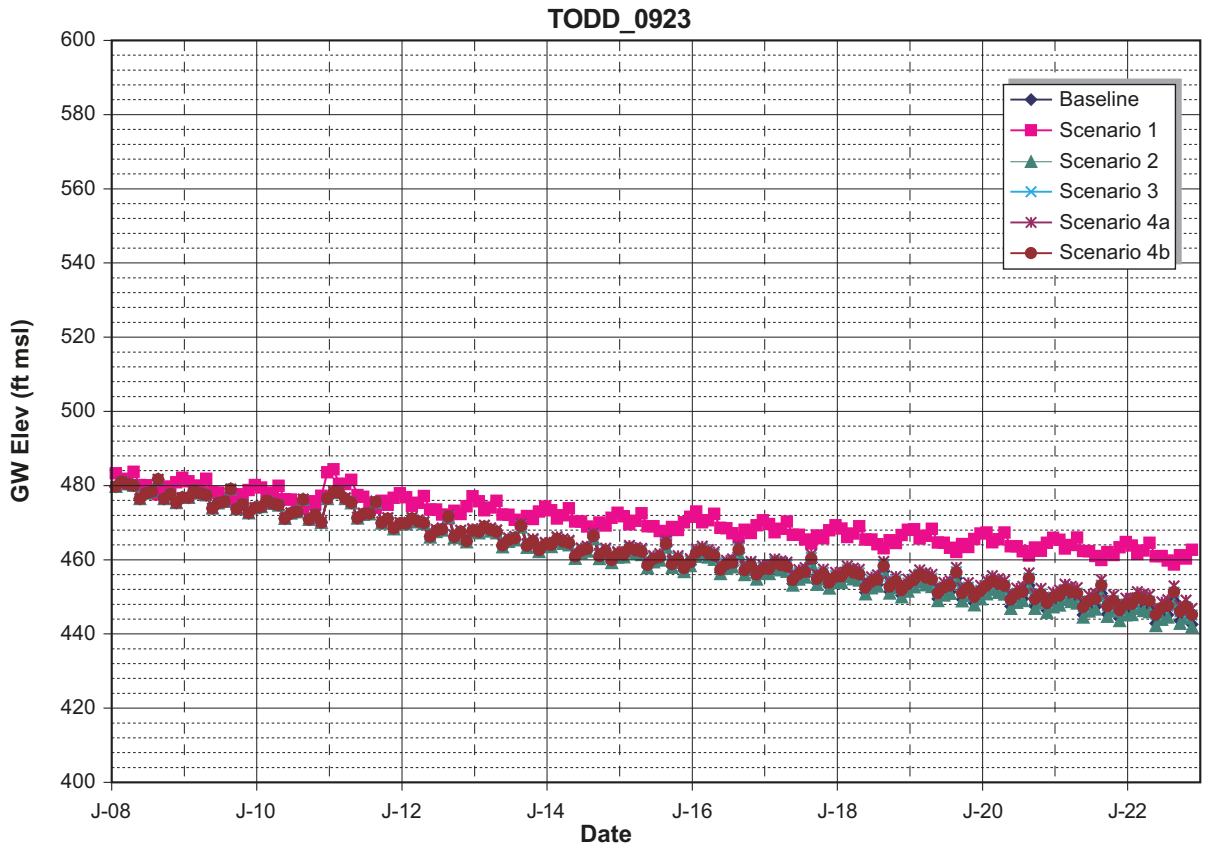


May 2008

TODD ENGINEERS
Alameda, California

Figure C-13
Baseline and Scenario Hydrographs





May 2008

TODD ENGINEERS
Alameda, California

Figure C-14
Baseline and Scenario Hydrographs

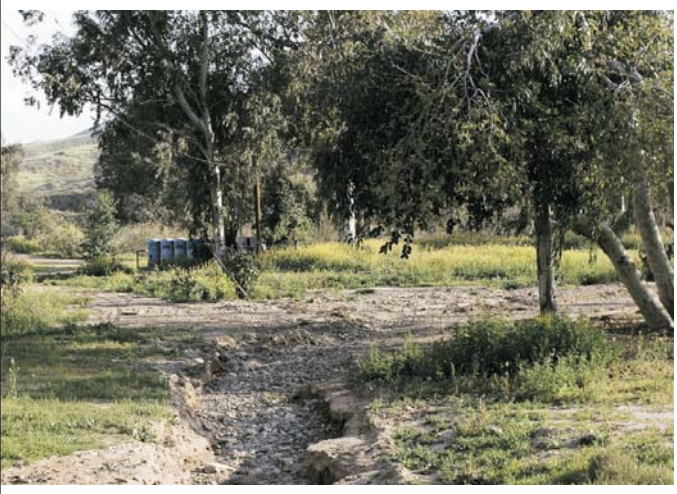
Appendix D
Feasibility Study
Recycled Water Recharge
Bedford Subbasin
Prepared for Lee Lake Water District



Feasibility Study

Recycled Water Recharge
Bedford Subbasin

Prepared for
Lee Lake Water District



May 2008



Todd Engineers

Feasibility Study
Recycled Water Recharge
in Bedford Subbasin

Prepared for:

Lee Lake Water District

22646 Temescal Canyon Road

Corona, CA 92883

Prepared by:

Todd Engineers

2490 Mariner Square Loop, Suite 215

Alameda, CA 94501-1080

May 2008

Table of Contents

1. Introduction 1

1.1. Background 1

1.2. Goals and Objectives 2

2. Hydrogeologic Setting 3

2.1. Study Area 3

2.1.1. Subbasin Boundaries 3

2.1.2. Land Use 4

2.1.3. Subbasin Hydrology 4

2.2. Geology and Faulting 5

2.2.1. Geologic Units 6

2.2.2. Depth to Bedrock 6

2.3. Subbasin Aquifers 7

2.3.1. Aquifer Geometry 7

2.3.2. Aquifer Parameters 7

2.4. Groundwater Use and Wells 8

2.4.1. Subbasin Production 9

2.4.2. Domestic Wells 9

2.5. Groundwater Occurrence and Flow 10

2.5.1. Water Levels and Depth to Water 10

2.5.2. Groundwater Flow 11

2.5.3. Groundwater Quality 12

3. Considerations for Groundwater Recharge 14

3.1. Recharge Water Parameters 14

3.1.1. Quantity Available for Recharge 14

3.1.2. Recycled Water Quality 14

3.2. Hydrogeologic Considerations 19

3.2.1. Potential Recharge Methods 21
3.2.2. Selection of Favorable Areas 23
3.2.3. Groundwater Mounding Estimates 24
3.3. Regulatory Requirements 26
3.3.1. Distance from Extraction Wells 26
3.3.2. Diluent Water 27
3.3.3. Water Quality Requirements 27
3.3.4. Monitoring 28
3.3.5. Other Requirements 28
4. Benefits for Groundwater Management 29
4.1. Subbasin Yield 29
4.2. Groundwater Quality 29
4.3. Surface Water 29
5. Conclusions and Recommendations 31
6. References 33

List of Tables

Page No.

2-1 Groundwater Basins and Watersheds 3

2-2 Groundwater Quality Data 12

3-1 Recycled Water Analytical Results, Average Concentrations 2002-2007 15

List of Figures

1. Groundwater Basins and Study Area
2. Lee Lake Water District and Local Water Agencies
3. Aerial Photograph Bedford Subbasin
4. Detailed Geologic Map
5. Generalized Bedrock and Alluvial Deposits
6. Well Locations
7. Depth to Bedrock
8. Generalized Cross Section
9. Pumping Test Analysis, Well 1A, February 2003
10. Bedford Subbasin Groundwater Production
11. Depth to Groundwater
12. Recharge Methods Schematic Diagram
13. Priority Areas for Recycled Water Recharge
14. Potential Recharge Areas and Approximate Recharge Mounds After Six Months

1. Introduction

Lee Lake Water District (District) provides water and wastewater services to residents in the Temescal Valley south of the City of Corona. Tertiary treated wastewater from the Lee Lake Water Reclamation Facility (WRF) is currently being recycled for landscape irrigation and other non-potable uses. Excess recycled water is discharged to nearby Temescal Wash in compliance with regulatory requirements. The District is considering recharging the recycled water into the underlying groundwater basin, locally referred to as the Bedford Subbasin.

To evaluate the feasibility of the project, the District retained Todd Engineers to conduct a study of the Bedford Subbasin hydrogeology and evaluate potential recharge options. The location of the Bedford Subbasin and adjacent groundwater basins and subbasins are shown on Figure 1.

In a parallel effort, the District is coordinating with the City of Corona in the preparation of a Groundwater Management Plan (GWMP). The GWMP evaluates three groundwater subbasins within the City's water service area and recommends strategies for active groundwater basin management. The District's recharge project has been included in the GWMP as a potential management strategy. Three groundwater subbasins – Temescal, Coldwater, and Bedford subbasins – are included in the GWMP (Figure 1). Plan adoption is scheduled for June 2008.

The City and the District are also cooperating on the environmental review of the GWMP in compliance with the California Environmental Quality Act (CEQA). This process involves the preparation of a Programmatic Environmental Impact Report (PEIR). The District's recharge project for Bedford Subbasin is included in this review.

This technical memorandum summarizes the analyses and results of the hydrogeologic study and provides support for the GWMP, the PEIR, and the implementation of the District project.

1.1. Background

Lee Lake Water District was formed in 1965 to provide water and wastewater services to a growing population in the Temescal Valley area between Corona and Lake Elsinore (LLWD, 2008). The District currently serves about 4,400 residential and commercial customers within an approximate 10 square mile service area as shown on Figure 2. The City of Corona water service area is located primarily to the northwest, but overlaps a small portion of the District in the Bedford and Coldwater subbasins (Figure 2). Elsinore Valley Municipal Water District (EVMWD) is located south of the District, but also provides some water supply to portions of the Bedford Subbasin (Figure 2). Lee Lake Water District imports

their water supply from Western Municipal Water District (WMWD) through the Metropolitan Water District State Water Project (SWP) system. The water is treated at the Mills Filtration Plan in Riverside and conveyed to the District through the Mills Pipeline.

The District also operates several groundwater wells in the subbasin and has historically used groundwater to supplement water supply. Although the wells have only produced a few acre feet per year (AFY) over the last several years, the District maintains these wells for anticipated future production. The District's project evaluated herein will enhance recharge in the subbasin to support increased future demand.

The District's wastewater services consist of three wastewater treatment plants: Butterfield Estates, California Meadows, and the District's Water Reclamation Facility (WRF). The WRF is located in the northern portion of the subbasin and provides tertiary treatment to reclaim the wastewater for reuse including landscape and golf course irrigation. Most of the demand for the recycled water occurs during the summer months. Recycled water that exceeds demand is discharged to nearby Temescal Wash. Currently, approximately 700,000 gallons per day (gpd) are discharged in compliance with NPDES Permit No. 8000100, administered by the California Regional Water Quality Control Board, Santa Ana Region (Water Board). The District's permits allow the expansion of their WRF to a full build-out capacity of 1,570,000 gpd.

1.2. Goals and Objectives

The goal of this evaluation is to identify feasible alternatives for recharge of tertiary treated wastewater into the Bedford Subbasin. The evaluation considered project feasibility on a technical and regulatory basis. Project objectives include the identification of recharge options involving various locations within the subbasin and various recharge methods (e.g., recharge basins or injection wells).

To meet these goals and objectives, Todd Engineers evaluated the hydrogeology of the Bedford Subbasin, assessed the technical feasibility of subbasin recharge, selected areas judged favorable for a recharge project, and identified potential regulatory constraints. Analyses and results of the study are summarized in this technical memorandum.

2. Hydrogeologic Setting

The hydrogeologic setting provides the framework for evaluation of the recharge project. This section summarizes groundwater conditions in the subbasin and presents specific analyses conducted for the project.

2.1. Study Area

The Study Area includes the Bedford Subbasin, covering approximately 6.5 square miles (4,133 acres) of the central Temescal Valley in western Riverside County. The Bedford Subbasin is a relatively small subdivision of the larger Elsinore Groundwater Basin (Figure 1). The Bedford and Coldwater subbasins form the northern portion of the Elsinore Groundwater Basin northwest of a bedrock constriction along Temescal Wash (Figure 1). According to current basin nomenclature used by the California Department of Water Resources (DWR), the Elsinore Groundwater Basin is not formally divided into subbasins (DWR, 2003). The Bedford and Coldwater subbasin nomenclature originates from former DWR basin boundaries in historical documents (DWR, 1959). Since the hydrogeologic conditions, including the bedrock constriction, clearly allow the subbasins to be evaluated separately from the remaining Elsinore Groundwater Basin to the southeast, the nomenclature is preserved in this analysis. Subbasins and contributing watershed areas, as digitized using Geographic Information System (GIS) software, are shown on Figure 1 and summarized on the table below.

Table 2-1
Groundwater Basins and Watersheds

DWR Groundwater Basin* (Basin No.)	Subbasin**	Area (acres)	Contributing Watershed (acres)
Elsinore (8-4)	Bedford	4,133	11,858
	Coldwater	2,176	9,525
	Elsinore	19,391	Not evaluated

*DWR, 2004.
**Bedford and Coldwater Subbasins defined and digitized for this project

2.1.1. Subbasin Boundaries

The Bedford Subbasin is defined by hydrologic and hydrogeologic boundaries. The eastern and southern boundaries are the approximate intersection of alluvial deposits with bedrock outcrops of the El Sobrante de San Jacinto hills (Figure 1). The Coldwater Subbasin lies to the west, separated from the Bedford Subbasin by the North Glen Ivy fault. The fault trace and

the subbasin boundary shown on Figure 1 were recently modified from previous historical documents for the City of Corona's GWMP project. Revisions were based on recent geologic maps from the U.S. Geological Survey (USGS, 2004). On the northwest, the subbasin boundary is defined by the contact between alluvial sediments and the outcropping bedrock of the Santa Ana Mountains. The northern boundary of the Bedford Subbasin is generally defined by the southern edge of Bedford Canyon where the subbasin connects with the Temescal Subbasin of the larger Upper Santa Ana Valley Groundwater Basin (Figure 1).

The subbasin floor is characterized by a narrow sloping valley interrupted by bedrock outcrops and surrounded by uplands. Ground surface elevations range from above 1,300 feet above mean sea level (msl) in the southwest to about 800 feet msl at the northern subbasin boundary near the base of Bedford Canyon. Average ground surface elevations are about 1,000 feet over most of the subbasin. The nature of the land surface can be seen on the aerial photograph on Figure 3. The main drainageway is Temescal Wash (also locally referred to as Temescal Creek), which flows from south to north across the subbasin. Average annual rainfall on the basin is about 13 inches per year (OCS, 2007).

2.1.2. Land Use

The Bedford Subbasin has a rich history as an agricultural area supporting numerous crops including citrus. Through the 1950s and 1960s, almost all of the water use in the subbasin was for agriculture (DWR, 1965). At that time, water supply was a mix of local groundwater, local surface water and imported surface water. In 1954, Western Municipal Water District was annexed to Metropolitan Water District and began providing imported water from the Colorado River (stored at Lake Mathews) to the Temescal Valley (DWR, 1959). In recent years, the I-15 corridor of the Temescal Valley has experienced significant growth. Residential development can be seen on Figure 3 and is especially prevalent west of I-15. Residential communities such as the Retreat, Wildrose Ranch, California Meadows and others have been developed in the area, bringing additional landscaping and golf courses to the subbasin. The community of Dos Lagos has been developed east of I-15 in the northern portion of the subbasin. Commercial and light industrial development occurs along the east side of I-15 in the northern half of the subbasin. Large portions of the southern subbasin east of I-15 remain relatively undeveloped (Figure 3).

In the adjacent Coldwater Subbasin, residential development has occurred primarily in the northern half of the subbasin. The southern half of the Coldwater Subbasin is dominated by active and inactive sand and gravel mining operations (Figure 3). Both the District and EVMWD provide potable and non-potable water supply for Bedford and Coldwater subbasins.

2.1.3. Subbasin Hydrology

As shown on Figure 3, Temescal Wash is the main surface water drainage for both Coldwater and Bedford subbasins. The Santa Ana Region Water Board Basin Plan lists beneficial uses for the creek as groundwater recharge, water contact recreation, non-contact water recreation,

warm water fish habitat, industrial service supply, and agricultural supply. Notwithstanding these designated uses, the creek is typically dry throughout most of the subbasin during the summer. The creek is tributary to the Santa Ana River and joins the main river channel at the Prado Management Area near Prado Dam (Figure 1).

Temescal Creek receives surface water runoff from contributing watersheds to the east and west (Figure 1). Although the eastern watersheds are slightly larger in area (approximately 11,858 acres) than the western watersheds (9,525 acres), runoff is generally lower. This is due to the lower elevations and lower average annual rainfall of about 13 to 16 inches per year (OCS, 2007; Environmental Solutions, 1994). This amount compares to an average annual rainfall of about 18 to more than 25 inches per year in the higher elevations west of Coldwater Subbasin. North of the Bedford Subbasin, the creek is fed by surface runoff from Bedford Canyon and rising groundwater in Temescal Canyon (Figure 1). North of Temescal Canyon, the creek flows into lined channels of the City of Corona's stormwater system and receives stormwater runoff from most of the Temescal Subbasin.

Surface water inflows into Bedford Subbasin along Temescal Wash are the result of runoff from surrounding areas. South of Bedford Subbasin, flows along the creek are diverted and bermed to create a small area of impounded surface water, locally known as Corona Lake (Figure 1). Historically, releases from this lake supplemented other agricultural water supplies. Currently, EVMWD provides non-potable supply to Coldwater and Bedford subbasins through releases from this impoundment, contributing to surface water inflows during summer months. Historically, overflow from Lake Elsinore (located about six miles south of Bedford Subbasin) provided surface water to the creek. However, increased water use in the vicinity halted surface water outflow from the lake in the early 1900s (DWR, 1959; MWH, 2003). With the exception of some upstream releases of recycled water to Temescal Creek there are no significant surface or subsurface inflows to the Bedford Subbasin from the Elsinore Subbasin to the south (MWH, 2003) (Figure 1).

2.2. Geology and Faulting

The Study Area is located within one of the structural blocks of the Peninsular Ranges of Southern California. The groundwater basins in this area occur in a linear low-lying block, referred to as the Elsinore-Temecula trough, between the Santa Ana Mountains on the west and the Perris Plain on the east (Norris and Webb, 1990). The trough extends from Corona to the southeast some 30 miles and was formed along an extensive northwest-southeast trending fault zone including the Elsinore, Chino, and related faults. The Elsinore and Chino fault zones bound the subbasins on the west and trend along the mountain front.

2.2.1. Geologic Units

Figure 4 presents a detailed geologic map illustrating the large number of units in the subbasin as mapped by USGS (2004). The oldest rocks in the Study Area crop out along the eastern edge or the Bedford subbasin. These uplands are composed principally of Mesozoic-age metasedimentary and volcanic rocks including the Estelle Mountain Volcanics (Mzu and Kvem, respectively, on Figure 4). There are also outcrops of Mesozoic metamorphic rocks including the Bedford Canyon Formation to the west of the subbasins in the Santa Ana Mountains (Jbc on Figure 4). Younger sedimentary units of Tertiary age crop out along the mountain front and in the subbasins. In northern Bedford Subbasin, a variety of Tertiary sedimentary units crop out including the Paleocene Silverado (Tsi), Miocene Vaqueros (Tvs), and Miocene Topanga (Tt) formations (Figure 4). Erosion of these units has filled in the trough over time resulting in quaternary-age alluvial fan, channel, and other alluvial deposits, making up the permeable portions of the Bedford and Coldwater groundwater subbasins.

The main surficial deposits on the floor of Bedford Subbasin include younger and older alluvial fans (Qvofg, Qofg, and Qy on Figure 4) deposited from the erosion of Bedford Canyon Formation and granitic rocks to the west. These units prograde across the basin to the northeast and are truncated by channel deposits along Temescal Wash (Qyag).

For analysis of the District's recharge project, similar alluvial and bedrock geologic units have been combined on Figure 5 to show the areal extent of relative high and low permeability units. The bedrock units, shown by the gray color, group together all of the consolidated units in the subbasin for a better understanding of low permeability areas to avoid for the recharge project. Alluvial deposits shown in the various shades of green illustrate the surface area of alluvial fans, valley fill, and channel deposits where more permeable sediments occur.

2.2.2. Depth to Bedrock

Although the geologic map shows alluvial sediments covering most of the surface of the Bedford Subbasin, the frequency of bedrock outcrops and shallow depth of many wells are good indications that sediments are likely very thin in some areas. For this reason a bedrock surface was interpolated for the subbasin. Depths to bedrock were noted from water well driller's logs obtained from the Department of Water Resources. The locations of these wells were approximately plotted using GIS software. The locations of these wells are shown on Figure 6. These data were combined with locations of known bedrock outcrops from the 2004 USGS geology map to create an approximate depth to bedrock surface. Figure 7 shows a colored raster and contours of the depth to bedrock surface. The bedrock surface map shows that sediments throughout most of the Bedford Subbasin are between 100 and 200 feet thick. Bedrock outcrops in the northern and south-central potion of the subbasin result in relatively thin and discontinuous pockets of alluvial sediments. However, there is an area in the western central portion of the subbasin where alluvial thickness is between 300 and 400 feet.

2.3. Subbasin Aquifers

The primary aquifer within the Bedford Subbasin is unconfined consisting of alluvial fan gravels prograding across valley fill sediments and interfingering with channel deposits associated with Temescal Wash. Although the alluvial aquifer is composed of material from multiple depositional environments, it is considered to be one continuous aquifer due to its high permeability and the prograding / interfingering nature of the deposits.

The bedrock in the subbasin does have some limited aquifer capacity, and there are some domestic wells that are completed in these bedrock aquifers. Bedrock aquifers in the area are primarily recharged from the alluvial aquifers. For the purpose of this study, the bedrock aquifers were not considered to be targets for recycled water recharge due to their limited capacity to store and transmit water.

2.3.1. Aquifer Geometry

The Bedford Subbasin alluvial aquifer is controlled by surface topography and the underlying erosional bedrock surface. The resulting aquifer is an elongated northwest southeast structure that is deepest in the middle, shallows to the north and east, is bounded by faults on the west, and is dotted by areas of no thickness where bedrock crops out. The aquifer generally slopes down to the northwest where it thins dramatically and is virtually nonexistent at the northern end of the subbasin.

The approximate latitudinal geometry of the alluvial fan deposits in the Coldwater and Bedford subbasins are shown on Figure 8. The cross section shows generalized subbasin geometry from west to east across the Coldwater/Bedford subbasin boundary at the North Glen Ivy fault. Rather than representative of a specific location, the cross section is a schematic profile illustrating the nature and maximum thickness of the alluvial fan aquifers and the relationship with the Temescal Wash deposits. Alluvial sediments are more than 800 feet thick in the Coldwater Subbasin and up to 500 feet thick in the Bedford Subbasin, with the thickest section occurring near the subbasin boundary and fault zone (Figure 8).

Water levels are lower in the western Coldwater Subbasin as a result of pumping by the City of Corona and others in the subbasin (Figure 8). The discontinuity indicated by water levels across the Glen Ivy fault reflects the commonly held view that groundwater is impeded by low permeability clay along the fault zone. This discontinuity has been observed in water levels on opposite sides of the fault by others (MWH, 2004)These and other data indicate that outflow from the Coldwater Subbasin into the Bedford Subbasin only occurs during times of high water levels (MWH, 2004).

2.3.2. Aquifer Parameters

Aquifer parameters for the alluvial aquifer in the Bedford Subbasin are not available throughout most of the subbasin. However, a 72-hour constant rate pumping test was performed

on a District well, Well 1A, in February 2003 by Foothill Engine & Pump Company. Groundwater levels in Well 1A, and nearby Wells 3 and 4, were monitored during the test and recorded on field forms by the pumping contractor. The locations of the District wells are shown on Figure 6. No aquifer parameter analysis appears to have been conducted for these data. Therefore, data from this test were made available for analysis by the District as part of this project. Test data from the three wells were plotted on a semi-log graph of drawdown versus time. The graph of these data and the resulting straight line portions are shown on Figure 9. Straight line portions of the data were identified on this graph in order to apply the Cooper-Jacobs straight line approximation for the calculation of transmissivity (T) and storage coefficient (S) as shown by the following equations:

$$T = \frac{264Q}{\Delta s} \quad \text{and} \quad S = \frac{0.3Tt_0}{r^2}$$

Where T = transmissivity
S = storage coefficient
Q = pumping rate
Δs = drawdown for one log cycle
t_0 = time when drawdown equals zero
r = radius of observation point from pumping well

Data from Well 3 appeared to be the most representative of stabilized aquifer conditions and were less affected by the sporadic breaks in drawdown that were present in the data from Well 1A. Using these data, the calculated aquifer transmissivity is 144,000 gallons per day per foot (gpd/ft), equivalent to 19,250 square feet per day (ft^2/day). Storage coefficients were calculated for the straight lines from Wells 3 and 4 at 0.10 and 0.15, respectively. These values represent an effective porosity of the alluvial aquifer of 10 percent from Well 3 and 15 percent from Well 4. Well logs for District Wells 1A, 3, and 4 were not available for this analysis. However, nearby domestic well logs indicate a total saturated aquifer thickness of about 77 feet. Using this value for the saturated aquifer thickness (b), a hydraulic conductivity (K) of 250 feet per day (ft/day) was calculated for the aquifer using $K = T/b$. Because this represents the only K value available in the basin, it is unknown whether the data are representative. As such, a slightly lower K value of 200 ft/day is used for further analysis of the alluvial aquifer.

2.4. Groundwater Use and Wells

Groundwater has been used as an irrigation water supply in the Bedford Subbasin for at least 80 years. Published data on wells in the Temescal Valley indicate that at least eleven wells had been drilled for irrigation supply in the Bedford Subbasin (or just downgradient of the boundary) by 1957 (DWR, 1959). One shallow well was reported to have been in place since

1912. Driller reports obtained from DWR indicate that more than 100 wells have been drilled in the subbasin.

2.4.1. Subbasin Production

Groundwater pumping data are available from a private firm, Watermaster Support Services (WMSS), which compiles well and pumping data for the Temescal Valley subbasins and other basins in the Santa Ana River watershed. Data from 1947 through 2006 were obtained from WMSS and reviewed for this project. During this period, approximately 22 wells have extracted groundwater in the subbasin. These data include three irrigation wells that pump just outside of the subbasin at the mouth of Bedford Canyon (referred to as the EVWMD Flagler wells). Production from the Flagler wells is included in this analysis because they pump immediately downgradient of the subbasin and extract groundwater, in part, migrating out of the subbasin.

Annual groundwater production is shown on the top graph on Figure 10. As shown on the graph, Bedford Subbasin production has generally decreased over the last 60 years. From 1947 through 1965, annual production averaged 2,900 AFY. Groundwater pumping increased from 1966 through 1971, averaging about 4,000 AFY with a peak in 1966 of 4,658 AFY. Through the 1970s and into the early 1990s, average production declined to about 2,500 AFY. Since 2000, production has declined to about 1,000 AFY and averaged only 245 AFY in 2005-2006.

Several water companies were formed in the subbasin before 1950 to provide irrigation water for subbasin agriculture (DWR, 1959). These companies secured surface and groundwater supplies and operated several groundwater wells in the subbasin. When the District was formed in 1965, two existing production wells were acquired to supplement the District's imported water supply. Production from these two wells by the District and previous well owners are summarized on the graph on the bottom of Figure 10. As shown on the graph, production from the District wells has also declined over time. From 1947 through 1970, production averaged about 676 AFY, accounting for about 20 percent of the documented subbasin pumping. From 1972 through 1995, average production declined by more than one half to 274 AFY (about 10 percent of subbasin production). Over the last 10 years, production has declined to less than 20 AFY and the wells are not currently used for potable water supply.

2.4.2. Domestic Wells

Although there is very little documented domestic groundwater extraction from the subbasin, private wells used for domestic water supply likely exist in the basin. DWR driller's logs indicate that some wells were previously permitted for domestic supply as well as irrigation. The number of active wells is not known. The drilling of domestic wells (and other wells) requires a permit to be filed with Riverside County Division of Environmental Health (DEH). The County maintains these well permits in their records and compiles information into a database as internal resources allow. Communication with the County revealed that their databases does not currently allow for geographic filtering of well information and therefore

accessing the data for Bedford Subbasin wells would require considerable effort on the part of County staff. Unfortunately, due to current staffing levels, the County cannot accommodate this type of search in a timely manner. As such, permit data were not reviewed for this project.

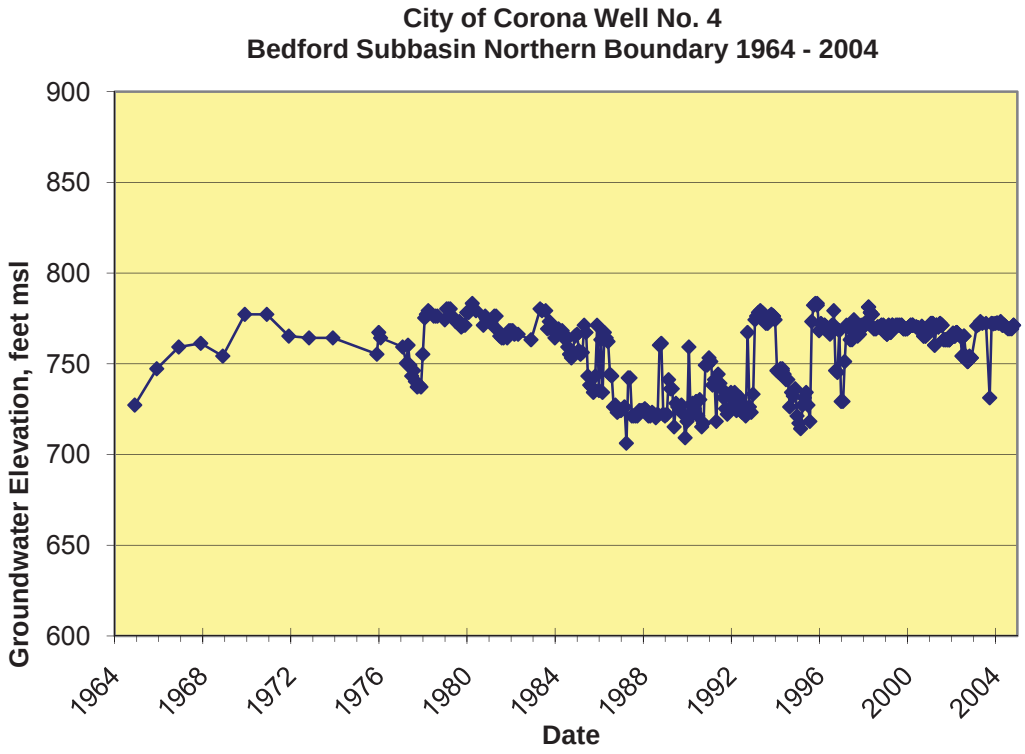
2.5. Groundwater Occurrence and Flow

Groundwater occurrence in the unconfined aquifer of the Bedford Subbasin is controlled by recharge and outflow. The primary source of recharge to the alluvial aquifer is runoff from the watershed to the east and percolation of precipitation. Additional runoff enters the basin and the aquifer from the west, but this must first travel through the Coldwater Subbasin, where most of the water infiltrates. Some additional recharge also occurs as a result of subsurface inflow from the alluvial aquifer in the Coldwater Subbasin. However, this recharge source is limited by groundwater pumping in Coldwater Subbasin and impedance across the Glen Ivy fault. Very little, if any, groundwater enters the subbasin from Lake Elsinore due to its limited releases. Groundwater flow in the subbasin is generally easterly toward Temescal Wash and then northwesterly following surface water drainage.

2.5.1. Water Levels and Depth to Water

Very few wells in the Bedford Subbasin provide a sufficient water level record to analyze long term trends. However, there are scattered wells throughout the subbasin with original static water levels from water well driller's logs. These water levels were recorded at the time of installation of the wells shown on Figure 6. Since these wells have been constructed over a period of approximately 50 years spanning various hydrologic conditions, it can be reasonably assumed that they collectively approximate average static water levels. Contours of the depth to groundwater, as shown on Figure 11, were created using these data. In addition, there are a number of wells near the northeast outflow of the subbasin that allow for an analysis of water levels at that location (Figure 6). As shown on Figure 11, groundwater is deepest in the western portion of the subbasin (up to about 100 feet deep). Shallower groundwater occurs in the eastern subbasin near Temescal Wash. The exact groundwater-surface water interaction along the wash has not been documented, but groundwater likely provides baseflow to the creek in shallow bedrock areas and the creek likely recharges groundwater where water levels are deeper. As Temescal Wash exits the subbasin in the northeast, groundwater discharge likely occurs.

One former well, operated by the City of Corona (Well 4), is located about 950 feet north of the northeast corner of Bedford Subbasin at the mouth of Bedford Canyon. Wells pumping in this area receive recharge from runoff in adjacent Bedford Canyon (Temescal Subbasin) as well as surface and subsurface outflow from Bedford Subbasin (Figure 1). As such, water levels in this area are indicative of the total groundwater and surface water discharge where Temescal Wash temporarily leaves the subbasins. A hydrograph from this Bedford Canyon well is shown below.



The ground surface elevation at this well is reported to be about 791 feet msl indicating that water levels are within 10 feet of the ground surface during times of high water levels. This is to be expected given the downgradient location of the well and its position near rising groundwater that enters Temescal Canyon as surface water in the wash. Downstream ground surface elevations are around 780 feet, similar to water levels in the well. It appears that this elevation is acting similar to a drain, and likely indicates the level at which the groundwater basin is discharging to Temescal Wash. Given the shallow groundwater, this location would not be applicable to a District recharge project; nonetheless the hydrograph provides a record for long-term water levels at the downgradient extent of the subbasin.

As shown on the hydrograph, water levels have fluctuated only about 60 feet over the last 40 years. Water levels have been recorded as high as 782 feet, but have remained above about 770 feet for most of the period of record. Water levels dropped to around 720 feet during the relatively dry cycle from 1987 to 1995. According to a DWR study (1980), groundwater levels in the Bedford Subbasin fluctuate considerably during the year as a result of seasonal pumping and considerable recovery of water levels during the rainy season. This observation indicates that infiltration of recycled water at the surface can readily recharge the alluvial aquifers.

2.5.2. Groundwater Flow

Most of the subsurface flow in the Bedford Subbasin parallels surface water flow to the northwest along Temescal Wash. However, flow is easterly in the western portion of the subbasin, generally following surface topography. In the northern portion of the subbasin, groundwater

flow becomes more complex as a result of refraction around low permeability bedrock. Throughout the subbasin, groundwater flow is generally controlled by surface topography.

2.5.3. Groundwater Quality

Groundwater quality data for the Bedford Subbasin alluvial aquifer at this time are limited to samples collected from District Well 1A in February 2003 and in Well 4 in August 2007. A complete list of analytical parameters and the concentrations at which they were detected is presented in the following table.

Table 2-2
Groundwater Quality Data
District Wells 1A & 4

Well		Well 1A	Well 4
Sample Date		2/5/2003	8/20/2007
pH	mg/L	--	7.1
Calcium	mg/L	--	110
Magnesium	mg/L	--	23
Nitrate as N	mg/L	--	1.2
Nitrite as N	mg/L	--	< 0.1
Ammonia	mg/L	--	0.43
Sulfide	mg/L	< 0.10	--
Total Hardness	mg/L	--	370
Total Dissolved Solids	mg/L	--	690
Total Suspended Solids	mg/L	< 5	--
Chlorine Residual	mg/L	< 0.10	--
Oil & Grease	mg/L	< 5	--

As shown by the values for total dissolved solids (TDS), groundwater contains a relatively high mineral content in the subbasin. The TDS value of 690 mg/L exceeds the secondary maximum contaminant level (MCL) of 500 mg/L. This MCL is not based on health

risk, but rather aesthetic values such as odor or taste. The value of total hardness of 370 mg/L indicates a water classified as *very hard* (Todd and Mays, 2005), which can result in scale deposition in pipes and other inconveniences. Preliminary review of these data indicates that recycled water may be of higher quality for some constituents than ambient groundwater. Recycled water quality data are reviewed in the following section.

3. Considerations for Groundwater Recharge

The District's recharge project was evaluated in the context of the hydrogeologic setting of the subbasin and District objectives. Based on this analysis, potential recharge locations and methods were selected. This section describes the evaluation and provides project parameters, methods of analysis, assumptions, regulatory considerations, and results.

3.1. Recharge Water Parameters

Based on communication with the District and a review of current permit requirements and data, the following parameters and data have been incorporated into the analysis.

3.1.1. Quantity Available for Recharge

In compliance with the current NPDES permit, the District can discharge up to 1,570,000 gpd of recycled water to Temescal Creek. The District is currently discharging about 700,000 gpd during non-irrigation months. The recycled water demand is much larger in summer months and discharge to the creek is significantly reduced during that time. The WRF is capable of reclaiming up to about 1,570,000 gpd, but demand for recycled water is also expected to rise (LLWD, 2008). For the purposes of this preliminary analysis, we assume that a current continuous flow of 700,000 gpd is available for recharge on a six-month basis. This amount is equivalent to a continuous recharge rate of 486 gpm. The recharge method and location selected for the District's project needs to accommodate this rate and amount. Additional recycled water will likely be available in the future although the exact amount is unknown. Even though the analysis is based on 700,000 gpd, the potential for increasing this amount is also considered.

3.1.2. Recycled Water Quality

The WRF produces tertiary-treated wastewater derived from imported SWP water. This water source is considered to be higher quality than local groundwater for many parameters. According to a 2006 report to consumers, the imported water contains an average TDS of 200 mg/L (LLWD, 2006) compared to a groundwater supply of about 690 mg/L. Although mineral content is concentrated in the wastewater, elevating the TDS, the recycled water is expected to be equal to or better than ambient groundwater quality.

Water quality data from the WRF are available in connection with the District's monitoring program. These data were provided by the District and reviewed for application to the recharge project. Table 3-1 presents a summary of recycled water data with a focus on the parameters relevant to recycled water recharge regulations (Section 60320.030 in DPH, 2007). The table is presented on the following pages and described in the text following the table.

Table 3-1
Recycled Water Analytical Results Average Concentrations 2002 - 2007

ANALYTE (*Italics* - required for recharge project by DPH)	Average Result (**bold underline** - exceeds MCL or Secondary MCL)	Number of Detections	Number of Non-Detect Results (ND)	Maximum Contaminant Level (MCL)	Secondary MCL	Units
Aluminum	Not Analyzed	--	--	1	0.2	mg/L
Antimony	ND	0	1	0.006		mg/L
Arsenic	0.011	1	6	0.05		mg/L
Asbestos	Not Analyzed	--	--	7		MFL
Barium	ND	0	7	1		mg/L
Beryllium	ND	0	1	0.004		mg/L
Cadmium	ND	0	7	0.005		mg/L
Calcium	29	62	1	--		mg/L
Chloride	149	63	1	--	250	mg/L
Chromium (Total)	ND	0	7	0.05		mg/L
Chromium (Hexavalent)	ND	0	13	0.05		mg/L
Copper	0.0305	4	62	1.3	1	mg/L
Cyanide	ND	0	7	0.15		mg/L
Fluoride	Not Analyzed	--	--	2		mg/L
Iron	0.09	2	5	--	0.3	mg/L
Lead	ND	0	7	0.015		mg/L
Magnesium	12	62	1	--		mg/L
Manganese	0.019	6	1	--	0.05	mg/L
Mercury	ND	0	18	0.002		mg/L
Nickel	ND	0	1	0.1		mg/L
Nitrate as N	3.5	249	10	10		mg/L
Nitrite as N	0.96	84	176	1		mg/L
Nitrogen (as Ammonia)	4.5	148	114	--	1.5	mg/L
Total Nitrogen (ammonia, nitrate, & nitrite)	9.0	Calculation	Calculation	*		mg/L
Inorganic Nitrogen	6.4	252	8	--		mg/L
Biochemical Oxygen Demand	10	49	213	--		mg/L
Perchlorate	Not Analyzed	--	--	0.006		mg/L
Selenium	0.0043	46	21	0.05		mg/L
Silver	ND	0	17	--	0.1	mg/L
Sodium	128	63	1	--		mg/L
Sulfate	96	62	2	--	250	mg/L
Thallium	ND	0	1	0.002		mg/L
Bicarbonate	Not Analyzed	--	--	--		mg/L
Carbonate	Not Analyzed	--	--	--		mg/L
Alkalinity	Not Analyzed	--	--	--		mg/L
Total Hardness	122	63	1	--		mg/L
Zinc	0.054	7	0	--	5.0	mg/L
pH	7.3	59	0	--		Standard Units
Foaming Agents (MBAS)	Not Analyzed	--	--	--	0.5	mg/L
Turbidity	Not Analyzed	--	--	--	5.0	NTU
Total Dissolved Solids	**554**	66	0	--	500**	mg/L
Total Suspended Solids	14	14	248	--		mg/L
Total Coliform	2.8	5	20	--		MPN/100mL
Total Organic Carbon	Not Analyzed			16***		mg/L

Table 3-1
Recycled Water Analytical Results Average Concentrations 2002 - 2007

ANALYTE (*Italics* - required for recharge project by DPH)	Average Result (**bold underline** - exceeds MCL or Secondary MCL)	Number of Detections	Number of Non-Detect Results (ND)	Maximum Contaminant Level (MCL)	Secondary MCL	Units
Radium-226	Not Analyzed	--	--	5 (combined)		pCi/L
Radium-228	Not Analyzed	--	--			pCi/L
Gross Alpha	Not Analyzed	--	--	15		pCi/L
Uranium	Not Analyzed	--	--	20		pCi/L
Beta / photon emitters	Not Analyzed	--	--	4		millirem/year
Strontium-90	Not Analyzed	--	--	8		pCi/L
Tritium	Not Analyzed	--	--	20,000		pCi/L
1,1,1-Trichloroethane	ND	0	3	0.200		mg/L
1,1,2,2-Tetrachloroethane	ND	0	3	0.001		mg/L
1,1,2-Trichloro-1,2,2-Trifluoroethane	Not Analyzed	--	--	1.2		mg/L
1,1,2-Trichloroethane	ND	0	3	0.005		mg/L
1,1-Dichloroethane	ND	0	3	0.005		mg/L
1,1-Dichloroethylene	ND	0	3	0.006		mg/L
1,2,4-Trichlorobenzene	ND	0	3	0.005		mg/L
1,2-Dichlorobenzene	ND	0	6	0.6		mg/L
1,2-Dichloroethane	ND	0	3	0.0005		mg/L
1,2-Dichloropropane	ND	0	3	0.005		mg/L
1,3-Dichloropropene	Not Analyzed	--	--	0.0005		mg/L
cis-1,3-Dichloropropene	ND	0	3	--		mg/L
trans-1,3-Dichloropropene	ND	0	3	--		mg/L
1,4-Dichlorobenzene	ND	0	6	0.005		mg/L
2,3,7,8-TCDD	Not Analyzed	--	--	0.00000003		mg/L
2,4,5-TP	Not Analyzed	--	--	0.05		mg/L
2,4-D	Not Analyzed	--	--	0.07		mg/L
Alachlor	Not Analyzed	--	--	0.002		mg/L
Atrazine	Not Analyzed	--	--	0.001		mg/L
Bentazon	Not Analyzed	--	--	0.018		mg/L
Benzene	ND	0	3	0.001		mg/L
Benzo(a)pyrene	ND	0	3	0.0002		mg/L
Bromodichloromethane	0.03	0	3	0.08		mg/L
Carbofuran	Not Analyzed	--	--	0.018		mg/L
Carbon Tetrachloride	ND	0	3	0.0005		mg/L
Chlordane	ND	0	3	0.0001		mg/L
Chloroform	0.009	0	3	0.08		mg/L
cis-1,2-Dichloroethylene	Not Analyzed	--	--	0.006		mg/L
Dalapon	Not Analyzed	--	--	0.2		mg/L
Di(2-ethylhexyl)adipate	Not Analyzed	--	--	0.4		mg/L
Di(2-ethylhexyl)phthalate	ND	0	3	0.004		mg/L
Dibromochloropropane	Not Analyzed	--	--	0.0002		mg/L
Dichloromethane	ND	0	3	0.005		mg/L
Dinoseb	Not Analyzed	--	--	0.007		mg/L
Diquat	Not Analyzed	--	--	0.02		mg/L
Endothal	Not Analyzed	--	--	0.1		mg/L
Endrin	ND	0	6	0.002		mg/L
Ethylbenzene	ND	0	3	0.3		mg/L
Ethylene Dibromide	Not Analyzed	--	--	0.00005		mg/L
Glyphosate	Not Analyzed	--	--	0.7		mg/L
Heptachlor	ND	0	6	0.00001		mg/L
Heptachlor Epoxide	ND	0	6	0.00001		mg/L
Hexachlorobenzene	ND	0	3	0.001		mg/L
Hexachlorocylopentadiene	ND	0	3	0.05		mg/L

Table 3-1
Recycled Water Analytical Results Average Concentrations 2002 - 2007

ANALYTE (*Italics* - required for recharge project by DPH)	Average Result (**bold underline** - exceeds MCL or Secondary MCL)	Number of Detections	Number of Non-Detect Results (ND)	Maximum Contaminant Level (MCL)	Secondary MCL	Units
Lindane	ND	0	6	0.0002		mg/L
Methoxychlor	ND	0	3	0.03		mg/L
Methyl-tert-butyl ether (MTBE)	ND	0	3	0.013	0.005	mg/L
Molinate	Not Analyzed	--	--	0.02		mg/L
Monochlorobenzene	ND	0	3	0.07		mg/L
Oxamyl	Not Analyzed	--	--	0.05		mg/L
Pentachlorophenol	ND	0	3	0.001		mg/L
Picloram	Not Analyzed	--	--	0.5		mg/L
Polychlorinated Biphenyls	Not Analyzed	--	--	0.0005		mg/L
Simazine	Not Analyzed	--	--	0.004		mg/L
Styrene	Not Analyzed	--	--	0.1		mg/L
Tetrachloroethylene	ND	0	3	0.005		mg/L
Thiobencarb	Not Analyzed	--	--	0.07	0.001	mg/L
Toluene	0.007	1	2	0.15		mg/L
Toxaphene	ND	0	6	0.003		mg/L
trans-1,2-Dichloroethylene	ND	0	3	0.01		mg/L
Trichloroethene	ND	0	3	0.005		mg/L
Trichlorofluoromethane	ND	0	3	0.5		mg/L
Vinyl Chloride	ND	0	3	0.0005		mg/L
Xylenes	ND	0	3	1.750		mg/L

*See recycled water regulations for limits on total nitrogen and disinfection byproducts
**For TDS, regulations allow upper exceedances of 1,000 mg/L and short-term exceedances of 1,500 mg/L
*** Regulatory requirements for TOC may be lower than MCL

Table 3-1 presents concentrations of metals and other inorganic constituents and physical parameters in the first grouping of analytes. These data are followed by radionuclides that are required for monitoring of recycled water recharge. The last group of analytes contains organic chemicals. Also included on the table are primary and secondary maximum contaminant levels (MCLs) pertinent to regulations for recharge of recycled water (DPH, 2007). Concentrations listed in the column of *Average Result* are average concentrations of detections from 2002 through 2007 and do not consider samples when the concentration was not detected above reporting detection limits (Table 3-1).

As shown on Table 3-1, the District's recycled water appears to meet regulatory requirements for constituents analyzed to date. The average TDS is about 555 mg/L, slightly larger than the secondary MCL of 500 mg/L. However, this is lower than the TDS concentration detected in the limited groundwater data presented above. As noted at the bottom of the table, TDS concentrations above 500 mg/L may be recharged and short-term concentrations of up to 1,500 mg/L may be allowed.

Regulations require control of total nitrogen compounds in recharge water. Total nitrogen as defined by the regulations is the sum of nitrogen in ammonia, nitrite, nitrate and other organic nitrogen-containing compounds. Total nitrogen is calculated on Table 3-1 and averages 8.8 mg/L. Total nitrogen may be limited to as low as 5 mg/L for a recharge project. If the 5 mg/L objective is exceeded, additional groundwater monitoring and/ or blending will likely be required to demonstrate that groundwater quality has not been adversely impacted. Regulations allow for alternative concentration limits to be proposed for a recycled water recharge permit (DPH, 2007). Nitrate, one of the nitrogen compounds of particular concern, meets primary standards as shown on Table 3-1. Concentrations of nitrate (as N) in recycled water average 3.4 mg/L from more than 261 samples analyzed. This value is well below the MCL of 10 mg/L.

Radionuclide data are currently unavailable for the WRF water. The seven parameters listed on Table 3-1 summarize the regulated analytes.

Organic chemicals regulated for recycled water recharge are listed on Table 3-1 beginning on the second page of the table. Almost all of these chemical have been analyzed in recycled water in at least one sampling event since 2002. Most of the data were developed during two sampling events in 2005 (winter and summer) and one event in January 2007. For those sampling events, there have been no detections of any organic chemical that did not meet water quality standards for regulated compounds. Two organic chemicals detected are classified as trihalomethanes (THMs), a group of chemicals formed when chlorine is used to control microbial contaminants in water (referred to collectively as disinfection byproducts). Analyses of THMs include chloroform, bromodichloromethane, dibromochloromethane, and bromoform. Of these chemicals, chloroform and bromodichloromethane have been detected in recycled water samples. Chloroform has been detected in three samples at 0.0026 mg/L, 0.008 mg/L, and 0.015 mg/L. All detections meet water quality standards and were significantly lower than the MCL of 0.080

mg/L. Bromodichloromethane has also been detected in three samples at concentrations of 0.009 mg/L, 0.002 mg/L, and 0.0063 mg/L, all at least one order of magnitude below the MCL of 0.080 mg/L. Only one other organic contaminant, toluene, has been detected in effluent samples. The concentration of that detection (0.007 mg/L) was about two orders of magnitude lower than the MCL of 0.15 mg/L.

As shown on the table, radionuclides and several inorganic and organic constituents have not yet been analyzed in District recycled water because they are not required for current monitoring. The table contains a more complete list of constituents to allow the District to review additional constituents to be analyzed for the recharge project if implemented. In addition to the constituents and parameters provided on Table 3-1, total organic carbon must meet stringent regulatory requirements. DPH will also require initial testing and monitoring for specific non-regulated compounds.

3.2. Hydrogeologic Considerations

Hydrogeologic conditions within the groundwater subbasin are important to the performance of a successful recharge project. The vadose zone above the water table must be sufficiently permeable to percolate the recharge water and there must be sufficient storage to accommodate the water during the recharge period. Aquifers must be sufficiently permeable to transmit the recharge water downgradient toward the basin discharge point or extraction wells. During an evaluation of recharge sites in the Lucerne Valley, USGS developed a general list of criteria for site selection. Although the list is specific to large spreading basins, the criteria are applicable to many recharge sites and methods. These criteria are listed below:

1. The infiltration rate of the spreading grounds must be high enough to accept the anticipated rate of recharge.
2. The storage capacity of the groundwater basin must be adequate to accommodate the anticipated volume of recharge.
3. The transmissivity of the water-bearing material must be sufficient to transmit the water at an acceptable rate away from the recharge site toward the area of extraction.
4. An adequate supply of water must be available for recharge, and it must be close enough to the area of need to meet economic criteria.
5. The spreading grounds should be upgradient of the withdrawal areas or be so situated with respect to withdrawal areas that water moves as directly as possible from one area to the other.
6. Faults and other hydrogeologic barriers should not impede the movement of recharge water.
7. The recharge water should be compared geochemically with ambient groundwater to minimize mineral precipitation and clogging of the aquifer with consequent reduction in rates of recharge.

For application to the District's recharge project, criteria 1-3 above are considered the most critical for project success. Data relevant to the infiltration potential, storage capacity, and transmissivity were discussed in the hydrogeologic setting. Although site-specific tests have not

yet been conducted to determine infiltration rates, surface alluvial sediments are judged generally adequate for sufficient infiltration. Soil mapping conducted by the U.S. Natural Resources Conservation Service (NRCS) indicates permeable soils over the entire subbasin except in areas where bedrock crops out (NRCS, 2006). The transmissivity of the aquifers, as indicated by the aquifer test at District Well 1A, indicates sufficient permeability for downgradient transport of recharge water away from the recharge site and toward extraction wells. The exact storage capacity of the groundwater basin is currently unknown. Most of the storage is in the alluvial sediments that have infilled the basin around areas of shallow bedrock. The surface area of the subbasin is approximately 4,133 acres, but includes areas of bedrock and negligible groundwater storage. Using reasonable assumptions of two-thirds of the surface area (2,769 acres), an average depth to water of 50 feet, and an S value of 0.15, available subbasin storage is estimated to be about 20,000 AF. Storage estimates are judged adequate for the relatively small volume of recharge considered for this project, approximately 400 AFY of current discharge and 900 AFY at full permitted plant capacity assuming six months of continuous recharge. In addition, both the District and others have indicated an interest in additional extraction in the subbasin, making enhanced recharge a critical component of groundwater management.

Criterion 4 addresses the availability of source water for the project. WRF capacity and water quality data indicate that a reasonable amount of recycled water of sufficient quality is available. In addition, the current and planned conveyance system for recycled water anticipates increased demand throughout most of the subbasin. As such, sites within the central and northern Bedford Subbasin are considered sufficiently close to the recycled water conveyance system for the purposes of this feasibility study. If the project moves forward, final site selection will consider distance to conveyance and costs.

With regard to criterion 5, the upgradient (southern) portion of the subbasin was considered to be higher priority and was targeted for site selection. This criterion was balanced with the need for more favorable aquifer conditions than exist in the most upgradient portion of the subbasin where bedrock crops out, aquifers are thin, and the water table is shallow.

Criterion 6 notes the need to understand subbasin hydrogeology and potential barriers to groundwater flow. Geologic faults, such as the Glen Ivy fault on the western subbasin boundary, have been observed to impede groundwater flow in the area. Additional faults impacting groundwater flow have not been identified within the central and northeastern portions of the Bedford Subbasin. As such, specific faults are not considered to limit project site selection. Bedrock outcrops of the Bedford Subbasin are also considered to be hydrogeologic barriers, where low permeability rock impedes and diverts groundwater flow. Recent mapping in the area by USGS provided guidance on more favorable areas based on surface geology. For this project, Todd Engineers also constructed a detailed map on the depth to bedrock across the subbasin based on existing data (Figure 7). This map was used to identify more favorable areas away from shallow bedrock.

The final criterion in the previous list, criterion 7, addresses the compatibility of the recharge water and ambient groundwater to ensure long-term infiltration can be sustained without well or aquifer damage. This compatibility issue is typically evaluated using geochemical models, such as the USGS-developed model PHREEQC (Parkhurst and Appelo, 1999). Data are currently insufficient to conduct geochemical modeling. Site-specific data will need to be collected for this evaluation after a project site is selected.

3.2.1. Potential Recharge Methods

To replenish the unconfined alluvial aquifer, recycled water can be applied in one of several ways: at the surface using infiltration basins, directly into the aquifer using injection wells, or into the subsurface above the water table using vadose zone wells. Each of these recharge methods are illustrated by the schematic diagram on Figure 12. For surface basins, water infiltrates the basin floor and percolates through the vadose zone to the underlying water table (Figure 12). If clay layers are present in the vadose zone, or if sufficient land for recharge basins is unavailable, vadose zone wells can provide a space-efficient pathway for project water to reach the water table. If clay layers are prevalent, especially if they represent confining layers in the aquifer system, injection wells can be used to access aquifers more directly for recharge. Either of these methods, or a combination of methods, could potentially be applied to the District's recharge project. The applicability of each method to the District's project is discussed below.

3.2.1.1. Surface Basins

The use of surface recharge basins involves conveyance of recycled water to a shallow excavated basin or series of basins where water would pond and infiltrate to underlying groundwater. Recharge basins have been used for conjunctive use and enhanced recharge projects for almost a century in areas of Riverside and San Bernardino counties. Since the alluvial aquifers of the Bedford Subbasin are considered to be unconfined, surface recharge would likely be capable of replenishment of subbasin aquifers. The size of the basin depends on the amount of water to be recharged and infiltration rates.

The infiltration rate varies with vadose zone permeability, depth to water, water quality, and other factors. Infiltration rates tend to decrease over time due to physical and/or biological clogging of the basin floor. Maintenance often involves drying and re-working the shallow subsurface. Physical clogging is anticipated to be less with recycled water, given the low amount of suspended solids. To maximize infiltration rates, relatively shallow basins are preferred (Bouwer, 2002).

Using a typical infiltration rate of about two feet per day (ft/day), a one-acre area is calculated to be capable of recharging about 450 gpm, a rate similar to that required for the District project. However, to allow for basin edge effects, maintenance, and other project needs, a minimum area of two acres should be considered.

Surface recharge basins provide the following project benefits:

- Relatively simple to construct and maintain
- Ability to spread recharge water over a large area, minimizing water levels impacts
- Water quality benefits by filtration through the vadose zone
- Ability to rehabilitate shallow clogging problems

Several disadvantages are associated with surface recharge basins compared to other recharge methods including:

- Larger land requirements
- Relatively large environmental footprint
- Potential security and liability issues

3.2.1.2. Vadose Zone Wells

If sufficient land is unavailable for the construction of relatively large surface basins, vadose zone wells can be used. These wells, also referred to as dry wells, consist of an engineered casing/screen/gravel pack assembly installed in a shallow boring above the water table. Vadose zone wells can also be used to by-pass shallow clay layers that may impede or divert percolating recharge water (Figure 12). The amount of clay in the vadose zone throughout the Bedford Subbasin is unknown, but is predicted to be relatively low. Thus, this may not be an important advantage for the District's project. Nonetheless, wells are relatively inexpensive to construct and use, especially for the amounts of water to be recharged in this project. Vadose zone wells can be constructed in a developed area and need relatively small areas for installation and operation. In addition, they can be constructed on several separate parcels, if needed, allowing for a series of smaller projects rather than one larger recharge project. If infiltration rates are relatively high, only a few vadose zone wells would likely be needed to accommodate the District's project.

One major disadvantage is the inability to rehabilitate wells should they become clogged or ineffective. The entrainment of air is often cited for problems with decreasing infiltration rates. However, it is relatively easy to abandon and replace wells as needed.

3.2.1.3. Injection Wells

For more direct recharge into the aquifer, injection wells can be used. These wells are constructed similar to production wells, but are configured for injection. Wells are effective in areas of relatively shallow water tables or for confined aquifers. Because well clogging typically decreases injection rates over time, wells need to be pumped periodically for maintenance, a process referred to as backflushing. The frequency of required backflushing varies from project to project, but is assumed to be required on a bi-weekly or monthly basis. Pumping for

backflushing is typically conducted at twice the injection rate. As such, a dedicated pump is usually installed in the injection well with a flow control valve that allows for both injection and pumping to occur in the same wellbore.

Injection wells cost more to install than vadose zone wells and are often associated with significant maintenance costs. Land requirements are typically smaller than for surface recharge basins, but larger than for vadose zone wells since pumping and backflushing operations must be accommodated. However, they can serve as an effective method of recharge.

3.2.1.4. Recharge Methods for District Project

As discussed above, any of the three methods could be applicable for recycled water recharge in the Bedford Subbasin. For a conceptual cost comparison, a recharge basin may be the less expensive alternative if land costs are not considered. The process of constructing a shallow basin is relatively straightforward and fewer inaccessible project components are developed. However, because of the larger land requirement, this method could also easily be the most expensive method depending on land costs. Injection wells would be relatively shallow for this project and would not likely be cost prohibitive. However, the clogging issues and backflushing requirements add significantly to project risk. Existing wells would not be good candidates for use as injection wells, given the lack of construction information, well seals, and the desire by the District to pump wells for water supply in the future. Recharge regulations require a minimum distance from drinking water wells. Vadose zone wells are likely the least expensive recharge option when land costs are considered. Since injection capacity is relatively low for vadose zone wells compared to recharge basins, numerous wells are often required to support a recharge project. However, for the small volume of recharge water associated with this project, this alternative seems slightly more favorable. Because all methods appear feasible, none are eliminated for the purposes of this study. Detailed costs can be generated when a specific site and data are available, and a method can be selected at that time.

3.2.2. Selection of Favorable Areas

For the purpose of this feasibility study, three favorable areas were chosen as potential recharge sites. A variety of factors were analyzed in order to select these favorable areas including:

- Depth to bedrock / alluvial thickness
- Depth to groundwater
- Land Use
- Soil / vadose zone lithology and permeability
- Distance to aquifer boundaries
- Ease of obtaining land

As a result of this analysis, the basin was subdivided into five priority zones, with Priority 1 being the most favorable and Priority 5 the least. The distribution of the zones is presented on Figure 13. The areas indicated as Priority 1 were chosen as the most suitable locations for potential recharge facilities. Areas at and near outcrops of bedrock are rated the lowest priority as shown by the gray areas of the subbasin on Figure 13. The southern segment of the subbasin is rated relatively low (Priority 4), even though alluvial deposits and depth to groundwater may present favorable conditions. This low rating is due to the concern that recharge water would be discharged to Temescal Wash as the creek crosses an area of very thin sediments to the north, removing the project water from the groundwater basin without adding to subbasin yield. Areas designated Priority 3 were judged too close to the creek and areas of shallow groundwater and land use considerations. Priority areas 2 were so-designated based on land use and, to some extent, less certainty in hydrogeology. Priority areas 1 were carried forward for further evaluation.

The District currently produces up to 700,000 gallons per day (gpd) of recycled water for potential recharge, an amount equivalent to 2.15 AF/day. The District is permitted to produce 1,570,000 gpd (4.82 AF/day) of recycled water at full build-out. Assuming a conservative recharge rate of 2 ft/day (only one percent of the measured hydraulic conductivity of the aquifer), a recharge basin with a minimum of 1.07 acre infiltration area (wetted area within a recharge basin) would be sufficient to recharge the current quantity of WFR water. For full build-out, a recharge basin with a minimum of 2.41 acres of infiltration area would be required. These parameters are used to evaluate project impacts to subbasin water levels as described below.

3.2.3. Groundwater Mounding Estimates

Potential recharge basins were plotted in each of the Priority 1 areas as shown on Figure 14. The depth to bedrock and depth to groundwater were interpolated for each of these three locations from the bedrock and groundwater surfaces on Figures 7 and 11. At Site 1 the interpolated depth to bedrock is 165 feet and the depth to groundwater is 40 feet, giving an approximate aquifer thickness of 120 feet. At Sites 2 and 3 the interpolated depth to bedrock is 370 feet and the depth to groundwater is 75 feet, giving an approximate aquifer thickness of 295 feet. The red area shown on the figure at Sites 1 and 3 covers approximately five acres, which is about the size necessary for the berms and other structures associated with a recharge basin with a one- to two-acre infiltration area. The blue area in the center of each of the three basins is just over one acre and represents the potential minimum size of the necessary infiltration area.

For a surface recharge project, water levels rise beneath the recharge area creating a groundwater mound. The height and extent of this mound varies over time with hydraulic properties of the aquifer and the amount of water being recharged. The development of a groundwater mound beneath the Study Area was evaluated using an analytical equation developed by Hantush (1967). The Hantush equation estimates the height of the groundwater

recharge mound as a function of time and distance from the recharge area. The Hantush equation assumes that the underlying aquifer is unconfined, homogeneous, isotropic, and effectively infinite in areal extent. The analysis does not account for travel time and lateral flow of recharge water through the unsaturated zone, a sloping groundwater table, aquifer boundaries such as surface water bodies, bedrock, or faults, or aquifer stresses, such as pumping.

The Hantush equation was solved using the mounding function for a circular recharge area in Aqtesolv Pro 4.0 (Hydrosolve, Inc., 2006), the equation for which follows:

$$Z(r,t) = h_m^2 - h_i^2 = (V/2\pi K)\left(w(u_0) + \left(1 - e^{(-u_0)}\right)/u_0\right)$$

where,

$Z(r,t)$ = Height of the mound above initial height of water table with respect to distance from center of recharge area over time
h_m = Height of mound above aquifer base
h_i = Initial height of water table above aquifer base
V = Volume of recharge water expressed as $w\pi R^2$, where w is the vertical infiltration rate from a circular recharge area of radius, R
K = Horizontal hydraulic conductivity of the aquifer
$w(u)$ = Theis well function for nonleaky aquifers
u_0 = $R^2/4ntR$, where $n = Kb/Sn$ and $b = 0.5(h_i(0) + h(t)$, where S = Storativity, or specific yield of the unsaturated zone, t = time since start of recharge, and b = constant of linearization

The decay of the recharge mound can also be estimated in Aqtesolv Pro using the law of superposition: $h_m^2 - h_i^2 = Z(r,t) - Z(r,t-t_o)$, where t_o is the time elapsed since recharge stops. Recharge mound contours generated by Aqtesolv Pro were exported as shapefiles and projected in the project GIS.

As shown in the Hantush equation, the development of the recharge mound is largely dependent on the vertical infiltration rate (w), storativity (S) of the unsaturated zone, and the horizontal hydraulic conductivity (K_H) and thickness of the saturated zone. Based on pumping test data, a K_H of 200 feet/day, and S of 0.10 and a conservative K_V of 2 feet/day were applied in the Hantush equation and analyzed for a continuous recharge of six months.

Based on these site-specific input data and the current recycled water production rate of 2.15 AF/day, the calculated maximum height of the recharge mound is estimated to be 2.9 feet at Site 1 and 1.7 feet at Sites 2 and 3 after six months of recharge. At Site 1 the mound dissipates to 0.5 feet high within 4,700 feet of the infiltration basin, while at Sites 2 and 3 the mound is 0.5 feet high at 3,200 feet from the respective infiltration basins. Calculated groundwater recharge mound contours are presented for each of the three sites in Figure 14. The recharge mounds shown on Figure 14 were calculated for recharge basins with approximately 1 acre of infiltration area. However, these recharge mounds would also be representative for appropriately designed vadose zone wells.

For the full build-out recycled water production rate of 4.82 AF/day and recharge basins with approximately 2.5 acres of infiltration area, the calculated maximum height of the recharge mound is estimated to be 6.0 feet at Site 1 and 3.3 feet at Sites 2 and 3 after six months of recharge. At Site 1 the mound dissipates to 0.5 feet high within 8,400 feet (1.6 miles) of the basin, while at Sites 2 and 3 the mound is 0.5 feet high at 7,400 feet (1.4 miles) from the infiltration basin.

The Hantush equation method used to estimate groundwater mounding in response to recharge does not account for changes in the geometry of the mound as a result of boundary effects from faults, surface water bodies, or bedrock. However, it appears that the relative size of the mounds at the sites evaluated is small enough that recharge could be accommodated at any of the three locations evaluated above. Further, a larger amount of recycled water could also be accommodated for recharge if additional water is available in the future.

3.3. Regulatory Requirements

The California Department of Public Health (DPH), formerly referred to as the Department of Health Services (DHS), has developed draft regulations for the use of recycled water for groundwater recharge (DPH, 2007). Draft regulations are provided in Title 22, California Code of Regulations, Division 4 Environmental Health, Chapter 3, Recycling Criteria, Articles 1-7, Sections 60301-60323, and endnotes. These regulations provide guidance for siting, operating, and monitoring a recharge project using recycled water. Application of key regulations to the District's proposed recharge project is summarized below. This discussion is not a comprehensive review of all regulations, but rather identifies preliminary requirements that could impact how the project is implemented.

3.3.1. Distance from Extraction Wells

To ensure the control of potential pathogenic microorganisms, regulations require a specific residence time in the aquifer prior to the extraction of recharged water. Required residence times are six months for a surface recharge project (i.e., spreading basin) and twelve months for a direct injection project (i.e., injection wells). To accomplish this residence time, DPH has considered vadose zone transport and conservative groundwater flow rates to establish a minimum distance between recharge and any drinking water well. Current required distances are 500 feet and 2,000 feet for surface recharge and direct injection, respectively (DPH, 2007). This requirement has been recently reviewed by DPH and will likely be modified to a required distance of 500 feet from a drinking water well for both surface recharge and injection. Although there is no documented current extraction of groundwater for municipal supply in the Bedford Subbasin, there may be active domestic wells with undocumented extractions as indicated by DWR driller's logs and communications with the District. Riverside County requires well permits for domestic wells and maintains records on those wells. However, due to limited resources, data have not been organized and are not accessible at this time. If the project moves forward, a

canvas of active domestic wells will be required within 500 feet and possibly up to 2,000 feet of the selected recharge area.

3.3.2. Diluent Water

As a redundant safety measure for public protection, DPH requires that recycled water recharge projects secure an alternative water source to mix with recycled water for dilution of any undocumented occurrence of constituents of concern. This additional water source, referred to in the regulations as diluent water, must also meet all water quality requirements stipulated for recycled recharge water and must be capable of being monitored to demonstrate water quality. The mix of diluent water and recycled water varies depending, in part, on the recharge method. For example, recycled water can account for up to 50 percent of the total recharge water for injection wells but only 20 percent of the total recharge water for surface recharge. This difference reflects the assumed higher level of recycled water treatment for an injection project. If recycled water quality meets regulatory objectives, the same proportion of recycled water can be used for either surface recharge or injection.

The diluent water does not have to be mixed with the recycled water prior to recharge and can be accounted for on a three or five-year average, depending on project operation. Diluent water sources can include stormwater (if collected for recharge and monitored), groundwater, or other surface water source. Recharge of diluent water does not have to be accomplished at the same recharge site, but must be shown to mix with recycled water in the aquifer prior to reaching extraction wells. Diluent water requirements can be reduced or eliminated after a period of monitoring has demonstrated the performance of the project. A meeting with DPH regulators will assist with the determination of diluent water requirements for the District's recharge project.

3.3.3. Water Quality Requirements

The recharge water must meet numerous numerical and qualitative water quality objectives to be approved for recharge into a groundwater basin that has been designated a source of drinking water supply. At a minimum, the recharge water must be treated to meet the definition of *disinfected tertiary recycled water*, as defined in Sections 60301.23.

In general, recharge water must meet Title 22 drinking water standards and other requirements for unregulated compounds. Most of the required levels are provided in regulatory tables in Title 22, Chapter 15 including Tables 64431-A (inorganic chemicals), Table 64442/64443 (radionuclides) and Table 64444-A (organic chemicals) (DPH, 2008). Action levels (AL) for lead (0.015 mg/L) and copper (1.3 mg/L) and secondary maximum contaminant levels (MCLs) for certain constituents and characteristics must also be met. Specific requirements for nitrogen compounds vary depending on the location of compliance monitoring. If levels in the recharge water average 5 mg/L with a maximum of 10 mg/L, then concentrations are considered sufficiently low to protect water quality without additional mixing with diluent water or sampling in the vadose zone.

Recycled water data were provided by the District for a preliminary review of water quality as described previously and presented on Table 3-1. A preliminary review of available data does not indicate non-compliance with recharge regulations. For several constituents, including TDS and total hardness, recycled water quality is better quality than ambient groundwater. For constituents listed on Table 3-1 that have not yet been analyzed, additional laboratory analyses will be required to ensure sufficient water quality for recharge. In addition, regulatory agencies may identify additional water quality constituents that will be considered in a recharge permit, including unregulated compounds.

3.3.4. Monitoring

Compliance monitoring consists of analyses of recharge water, water in the vadose zone or groundwater mound, and/or downgradient groundwater, depending on the constituent being analyzed and the quality of the source water. For example, if certain stringent requirements can be met in the source water prior to recharge, the need to monitor water quality in the vadose zone can be eliminated. In general, upgradient and downgradient monitoring wells will be required to demonstrate the performance of the project.

3.3.5. Other Requirements

There are a number of other requirements that the wastewater management agency (i.e., the District) must meet for a groundwater recharge reuse project including a pollutant source control program, identification of alternative water supplies, a public notification program, and compliance with the details in a project-specific permit. The District should involve early communication with regulators to ensure that the application of regulations to the District's project is well understood.

4. Benefits for Groundwater Management

In order to manage the shared groundwater resource of the Bedford Subbasin and provide for planned growth associated with build out, management strategies will be required. The District is cooperating with neighboring agencies including the City of Corona and EVMWD in management of the Bedford Subbasin. Recharge of recycled water appears to be a viable strategy to increase subbasin yield without adverse impacts to groundwater quality.

4.1. Subbasin Yield

In the current draft of the City of Corona's GWMP, the City plans to increase production immediately downgradient of the Bedford Subbasin. The District also has the option to use additional groundwater for augmentation of water supplies through existing or new Bedford Subbasin wells. The nearby Coldwater and Temescal subbasins have experienced declining water levels. Enhanced recharge through the District's proposed project could raise groundwater levels and provide additional yield for increased groundwater extraction. As shown on Figure 10, the addition of 400 AFY to basin resources is not insignificant given historical levels of subbasin production. This amount represents about 15 percent of the average groundwater production total in the subbasin over time. If additional recycled water is available in the future, basin pumping above historical levels may be supported.

4.2. Groundwater Quality

Because the source of the recycled water contains significantly less dissolved minerals than ambient groundwater, the quality of the recycled water has the potential to improve local groundwater quality for certain constituents. As previously mentioned, TDS and total hardness are lower in recycled water. Mixing in the aquifer would dilute recycled water with groundwater and potential long-term benefits would require additional analysis. Also, additional water quality analyses are required for a full evaluation of impacts to groundwater quality. Nonetheless, based on existing data, the District's recharge project is not expected to adversely impact groundwater quality and could improve local quality in some areas.

4.3. Surface Water

Removing the current discharge of recycled water from Temescal Wash will reduce surface water flows in the short term. However, most of the discharge occurs during the wet season when runoff contributes significantly to flows and additional flows are not likely needed to support beneficial uses. By allowing the recycled water to migrate in the subsurface toward surface water discharge at the subbasin boundary, more surface water discharge could potentially be available during dry conditions.

In addition, several of the constituents in recycled water including selenium have been problematic on occasion for creek discharge. Moving the recycled water to groundwater recharge would eliminate this condition. By allowing the recycled water to receive filtration benefits from aquifer materials, water quality of the recharge water would potentially improve in the subsurface and contribute higher quality water when rising to baseflow at the edge of the subbasin.

The analysis suggests that the basin could accommodate additional recharge from recycled water than amounts analyzed in this memorandum. If more recycled water is recharged than is extracted from production wells, surface water flows would be increased as groundwater rises into Temescal Canyon and exits the subbasin.

These benefits will require further analysis and will be reviewed in the environmental analysis for the City's GWMP. However, at a minimum, no adverse impacts to surface water are expected.

5. Conclusions and Recommendations

Based on the Feasibility Study presented in this document, the following conclusions can be made about the District's proposed recharge project:

- Bedford Subbasin hydrogeology is complicated by complex geology with relatively thin alluvial aquifers interrupted by bedrock outcrops.
- Alluvial aquifers are sufficiently thick in some areas to support an enhanced recharge project based on bedrock mapping.
- Aquifer testing in one District well indicates that subbasin aquifers have sufficient permeability and storage to support the District's project.
- Groundwater occurs at depths ranging from 100 feet to about 10 feet across the subbasin and is deepest in the west and shallowest near Temescal Wash.
- Groundwater is sufficiently deep in several areas to provide available storage for the District's recharge project.
- Groundwater quality data are limited, but one analysis indicates very hard water (total hardness of 370 mg/L) with a relatively high mineral content (TDS of 690 mg/L).
- Assuming a conservative infiltration rate of 2 ft/day, WRF recharge would require a minimum infiltration area of 1 acre for the current maximum discharge and 2.5 acres for full build-out.
- An analysis of groundwater mounding indicates that the anticipated water level rise in the vicinity of the proposed recharge sites is estimated to be between 1.7 and 2.9 feet (dependant on the location) for the current maximum WRF output of 2.15 AF/day. It appears that there is adequate unsaturated area in the proposed recharge locations to accommodate this quantity of groundwater.
- Further analysis of groundwater mounding for the increased capacity at full build-out (4.82 AF/day) indicates that the water level rise in the vicinity of the proposed recharge sites is estimated to be between 3.3 and 6.0 feet (dependant on the location). It appears that there is adequate unsaturated area in the proposed recharge locations to accommodate this quantity of groundwater.
- A comparison of recycled water quality data with regulatory requirements did not identify any significant water quality issues for the District's project. Additional water quality analyses will be required to demonstrate regulatory compliance if the project is implemented.

- The District's project provides management benefits to subbasin yield and, potentially, groundwater and surface water quality.
- Based on the results in this study, the District's proposed recharge project appears feasible and could involve a variety of recharge methods, depending on final project location.
- The analysis was based on limited data and significant data gaps exist. Recommendations to address these data gaps are provided below.

For continued assessment and implementation of the District's project, the following recommendations are provided:

- Include the recycled recharge project in the City of Corona's GWMP and support GWMP adoption.
- Participate in the environmental review process planned for the City's GWMP.
- Explore options for securing land in the areas designated most favorable for recharge and consider additional infrastructure required for conveyance of recycled water.
- Conduct an exploratory meeting with regulatory agencies regarding project objectives and permit requirements.
- Conduct site-specific evaluations and investigations to determine potential injection rates and aquifer response to recharge.
- Continue and expand recycled water quality testing to include constituents identified on Table 3-1 as well as additional constituents indicated by regulators in preliminary meetings.

6. References

Bouwer, H. (2002) *Artificial Recharge of Groundwater: Hydrogeology and Engineering.* Hydrogeology Journal, v.10, pp.121-42.

California Department of Public Health (DPH), California Regulations Related to Drinking Water, Title 22, California Code of Regulations, California Safe Drinking Water Act and Related Laws and Regulations, last updated February 7, 2008.

California Department of Public Health (DPH), Groundwater Recharge Reuse Draft Regulation, January 4, 2007.

California Department of Water Resources (DWR), Elsinore Groundwater Basin No. 8-4, Hydrologic Region South Coast, California's Groundwater Bulletin 118, last update February 27, 2004.

California Department of Water Resources (DWR), California's Groundwater, Bulletin 118, Update 2003.

California Department of Water Resources (DWR), Groundwater Basins in California, electronic file in .pdf format, http://www.water.ca.gov, latest update June 27, 2003.

California Department of Water Resources (DWR), Ground Water Basin Objectives for Upper Temescal Subarea, Memorandum Report, June 1980.

California Department of Water Resources (DWR), Ground Water Quality Study, Temescal Hydrologic Subarea, A Report to Santa Ana River Basin Regional Water Pollution Control Board (No. 8), Project Code No. 4110-024, February 1965.

California Department of Water Resources (DWR), Ground Water Quality Objectives, Temescal Valley, Project No. 58-8-1, A Report to Santa Ana Regional Water Pollution Control Board (No. 8), September 1959.

California Regional Water Quality Control Board (CRWQCB), Santa Ana Region, Order No. R8-2002-0001, NPDES No. CA8000100, Water Discharge and Producer/User Recycling Requirements for the Lee Lake Water District Wastewater Reclamation Facility, Riverside County, September 6, 2002.

Environmental Solutions, Water Resources Technical Report, El Sobrante Landfill, Prepared for Western Waste Industries, April 1994.

Hantush, M.S. (1967) *Growth and Decay of Groundwater Mounds in Response to Uniform Percolation.* Water Resources Research, v.3(1), pp. 227-34.

Hydrosolve, Inc. (2006) *Aqtesolv Pro 4.0 – Aquifer Analysis Software*.

Mark Roberts, Consulting Hydrogeologist, City of Corona DWP, Hydrogeologic Analysis of a Portion of Temescal Canyon, December 2005.

Lee Lake Water District (LLWD), The Pipeline, v. 20, Issue 17, newsletter produced by LLWD, Winter 2008.

Lee Lake Water District (LLWD), Unpublished water quality laboratory data sheets, Well 4 and Well 1A, Bedford Subbasin, August 20, 2007.

Lee Lake Water District (LLWD), Your 2006 Water Quality Report, Consumer confidence report on water quality, 2006.

Montgomery Watson Harza (MWH), Coldwater Basin Recharge Feasibility Study, Elsinore Valley Municipal Water District, January 2004.

Montgomery Watson Harza (MWH), Elsinore Valley Municipal Water District, Elsinore Basin Groundwater Management Plan, Final Draft Report, June 2003.

Norris, Robert M. and Webb, Robert W., Geology of California, Second Edition, John Wiley & Sons, 1990.

Oregon Climate Service (OCS), PRISM Group, Oregon State University, California Average Monthly or Annual Precipitation 1961-1990, http://www.ocs.orst.edu/prism/prism_new.html, updated January 8, 2007.

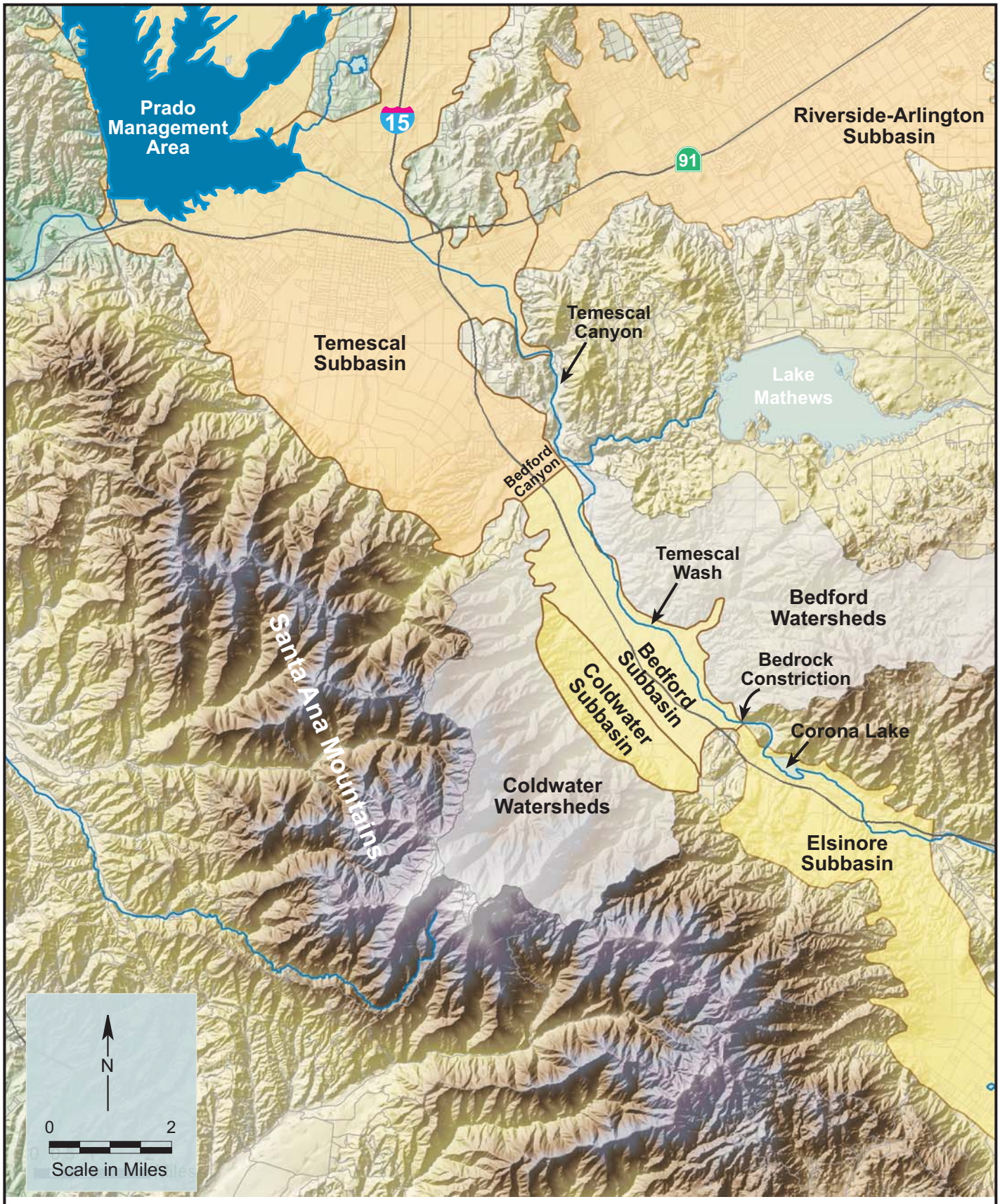
Parkhurst, D.L., and Appelo, C.A.J., User's Guide to PHREEQC (version 2) – A Computer Program for Speciation, Batch-reaction, One-Dimensional Transport, and Inverse Geochemical Calculations, USGS Water-Resources Investigations Report, 99-4259, 1999.

Todd, David K. and Mays, Larry W., Groundwater Hydrology, 3rd edition, John Wiley and Sons, 2004.

U. S. Geological Survey (USGS), Preliminary Digital Geologic Map of the Santa Ana 30' x 60' Quadrangle, Southern California, Version 2.0, USGS Open File Report 99-172, Southern California Areal Mapping Project, compiled by D.M. Morton, digital preparation by Kelly R. Bovard and Rachel M. Alvarez, prepared in cooperation with the California Geological Survey, 2004.

U.S. Natural Resource Conservation Service (NRCS) Soil Map, http://soildatamart.nrcs.usda.gov/, date accessed July 2006.

Figures



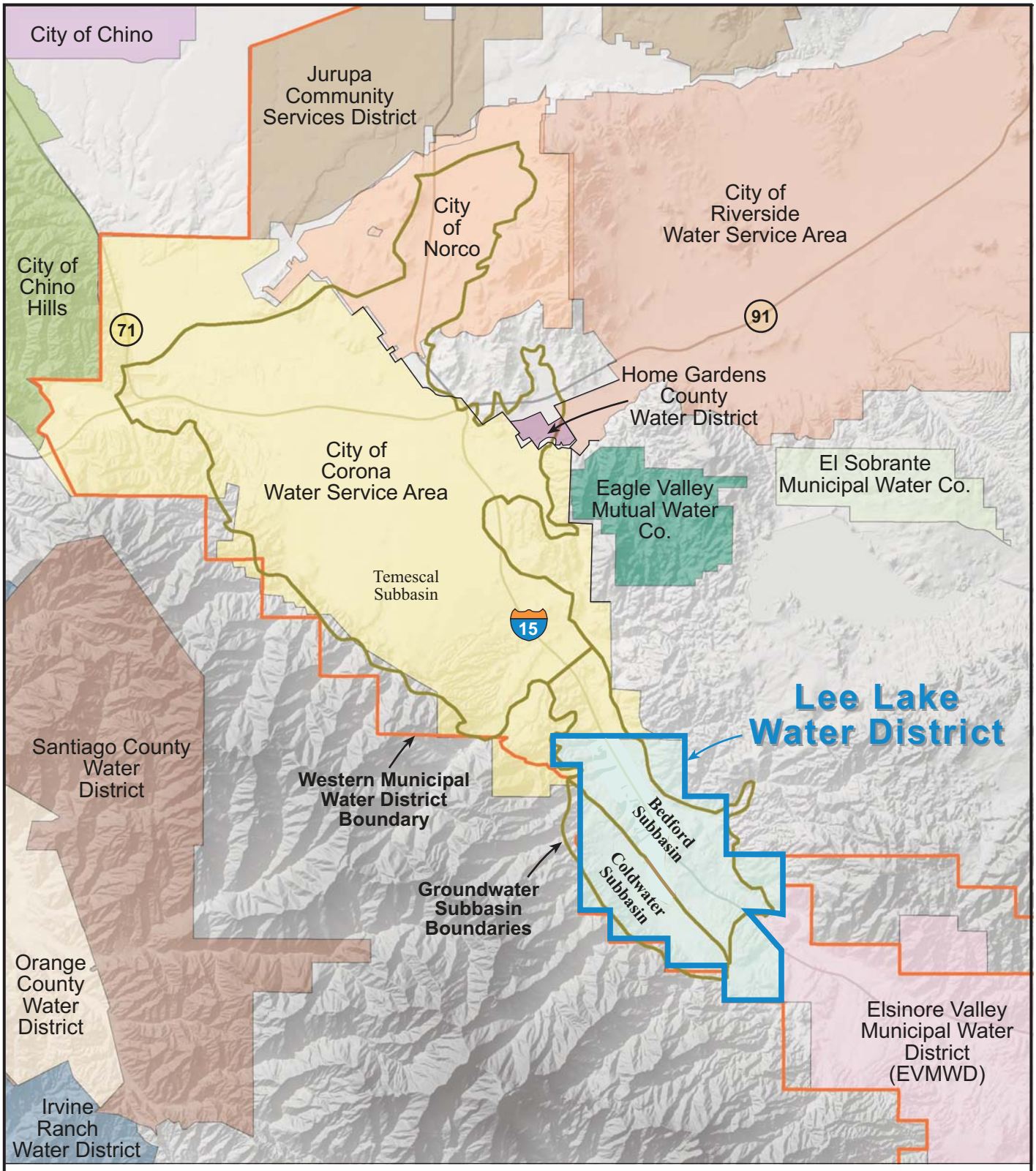
LEGEND

- Upper Santa Ana Valley Groundwater Basin
- Elsinore Groundwater Basin

May 2008

TODD ENGINEERS
Alameda, California

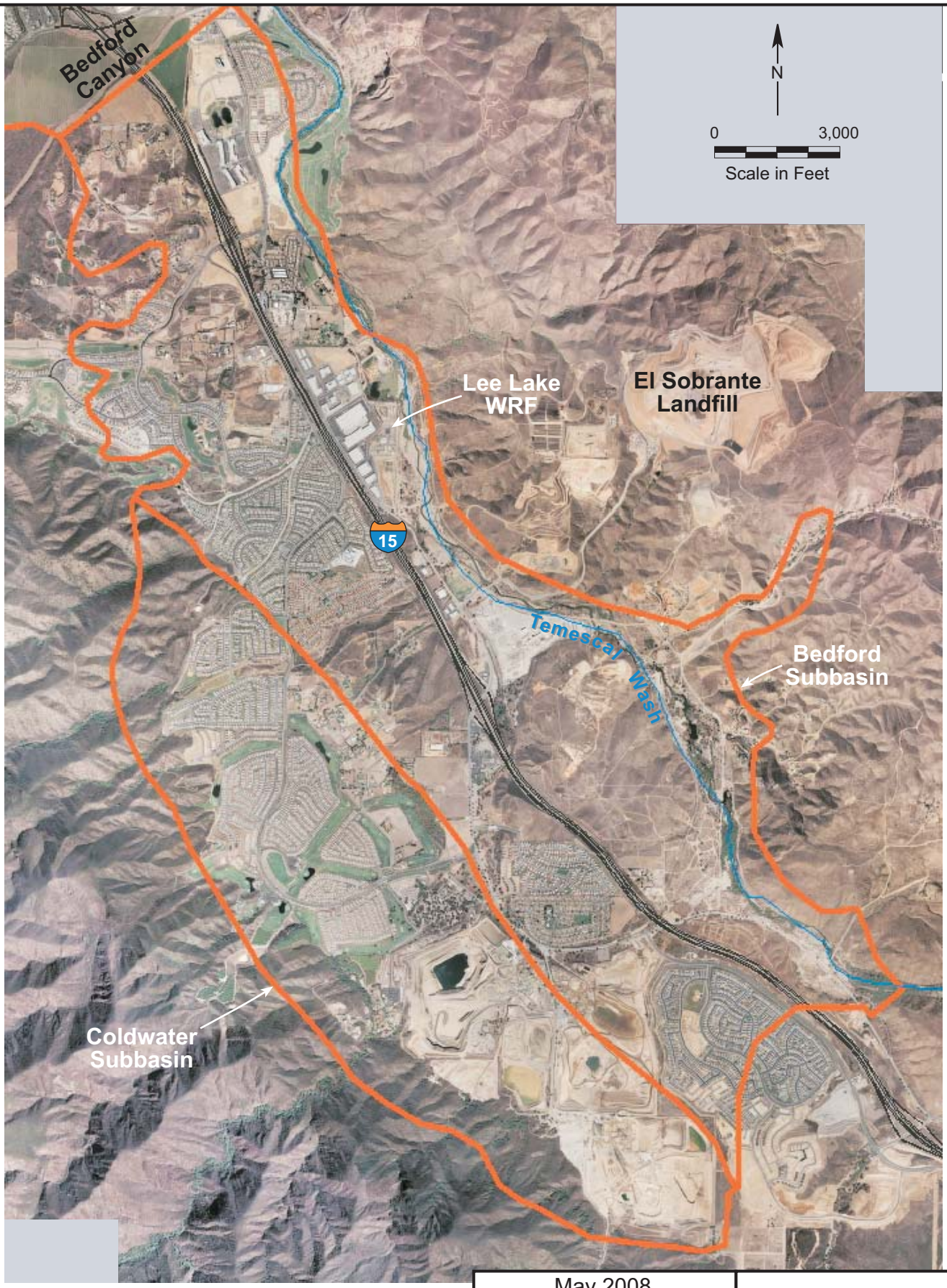
Figure 1
Groundwater Basins and Study Area



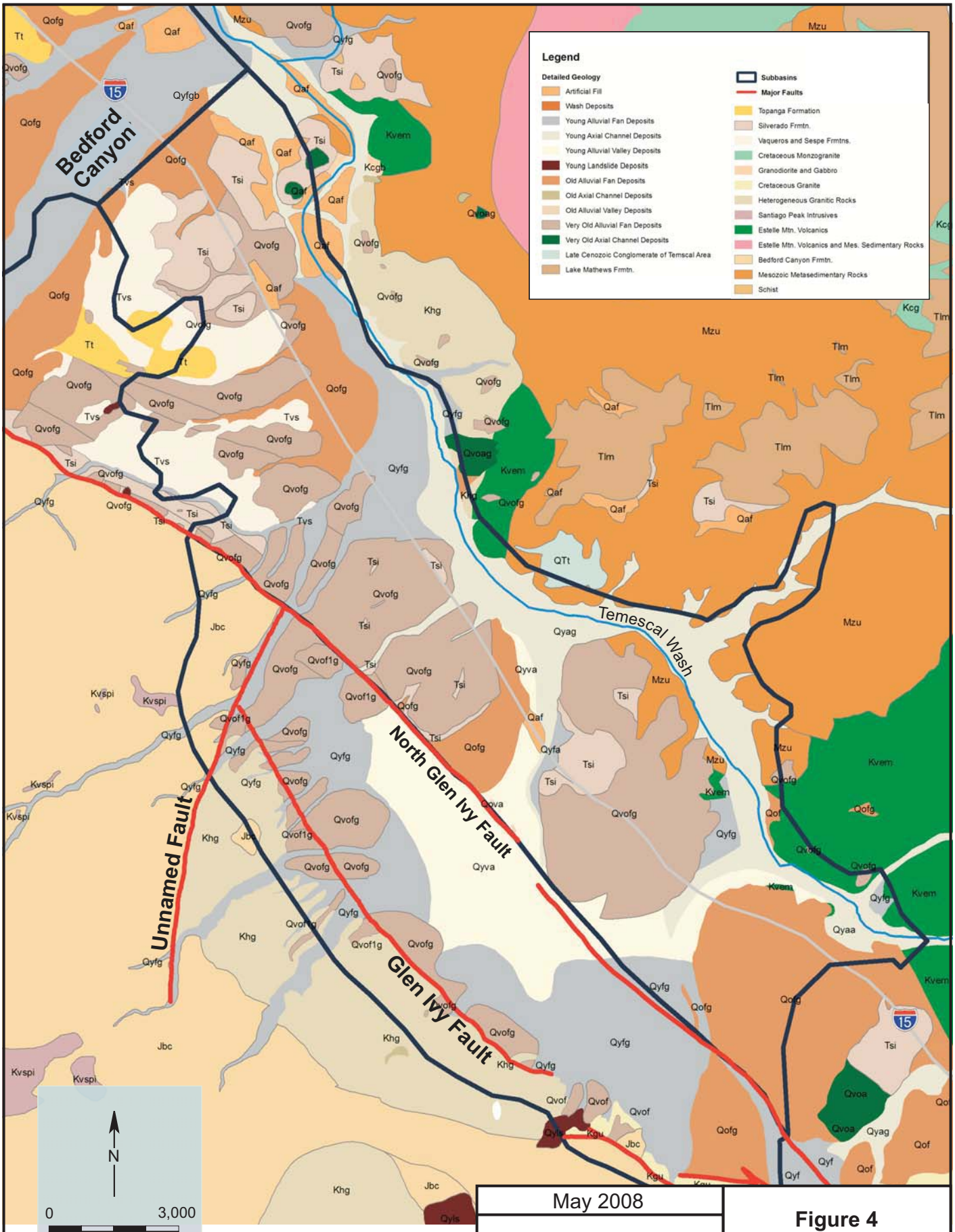
May 2008

TODD ENGINEERS
Alameda, California

Figure 2
Lee Lake Water District and Local Water Agencies



May 2008	**Figure 3** **Aerial Photograph** **Bedford Subbasin**
TODD ENGINEERS Alameda, California	

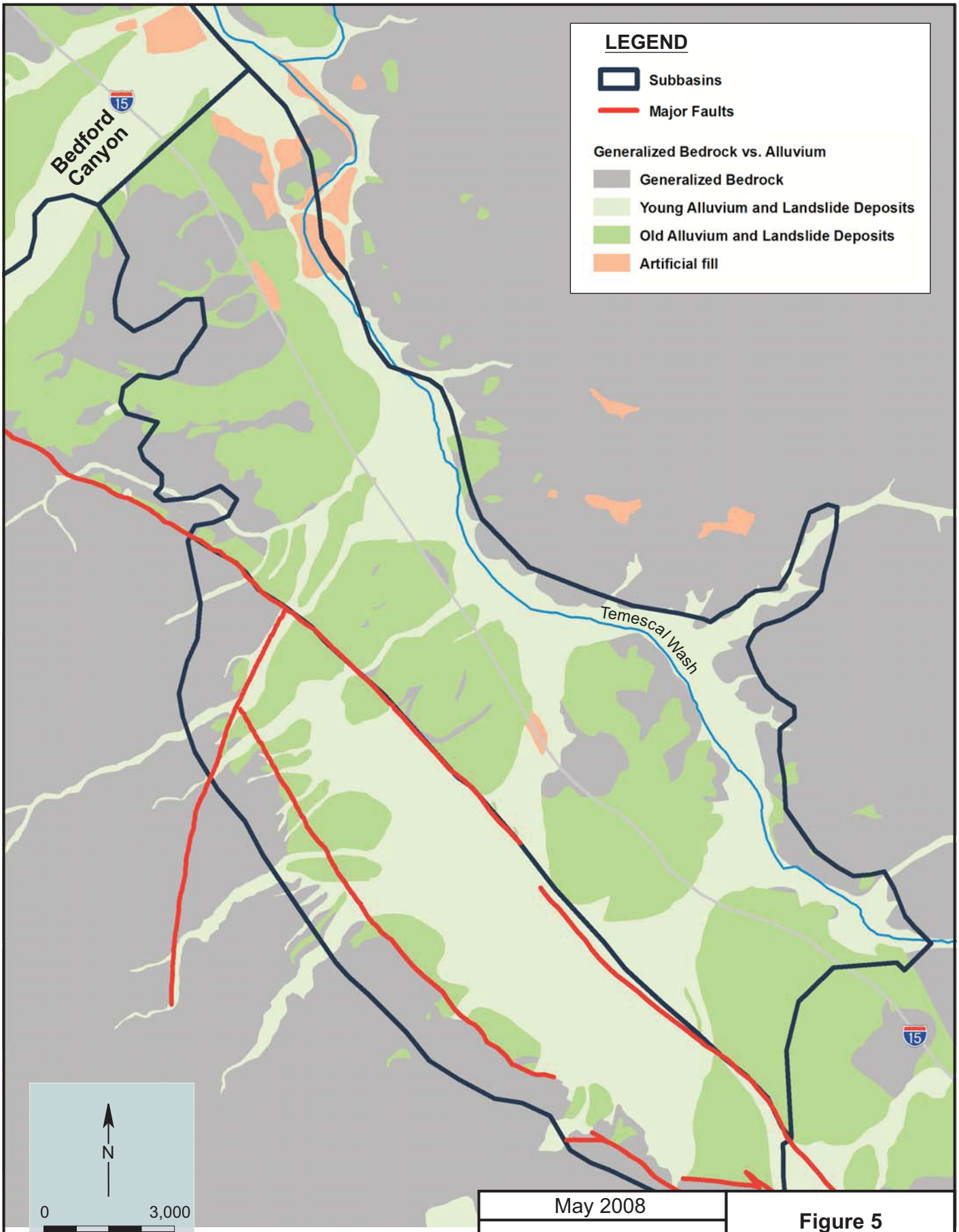


Source: USGS, 2004

May 2008

TODD ENGINEERS
Alameda, California

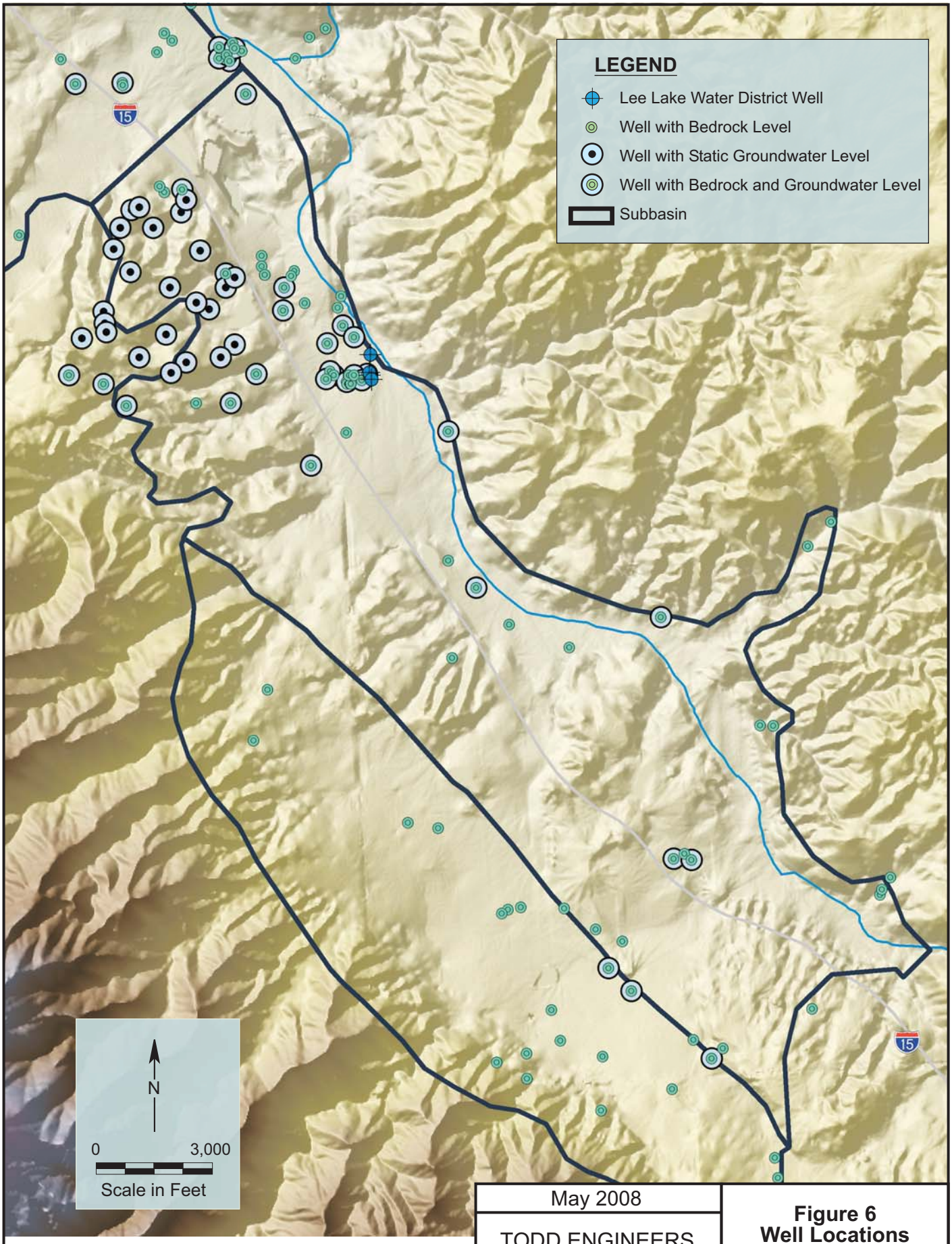
Figure 4
Detailed Geologic Map



May 2008

TODD ENGINEERS
Alameda, California

Figure 5
Generalized Bedrock and Alluvial Deposits

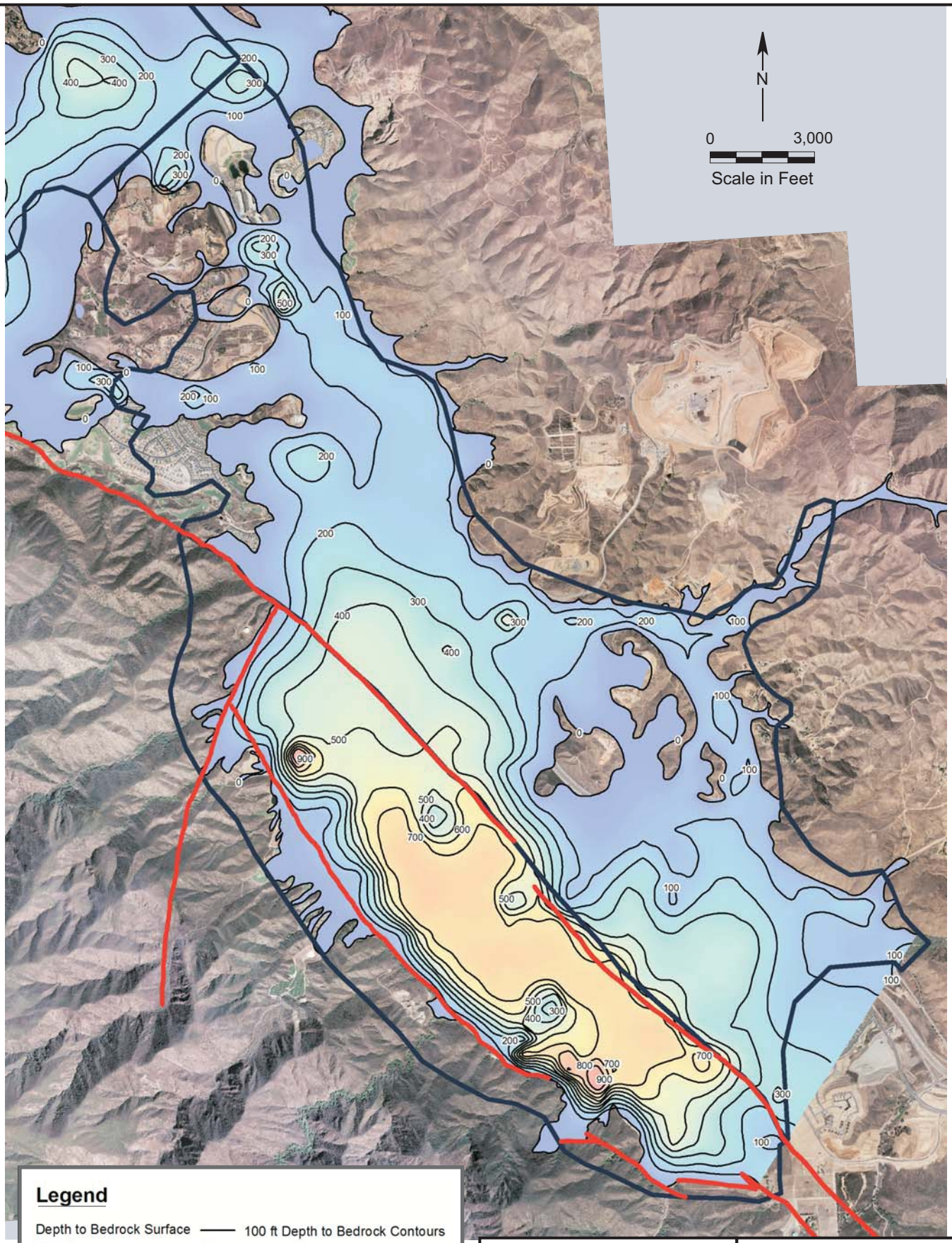


Well Locations approximated from DWR Driller's logs.
Lee Lake Water District well locations provided by District.

May 2008

TODD ENGINEERS
Alameda, California

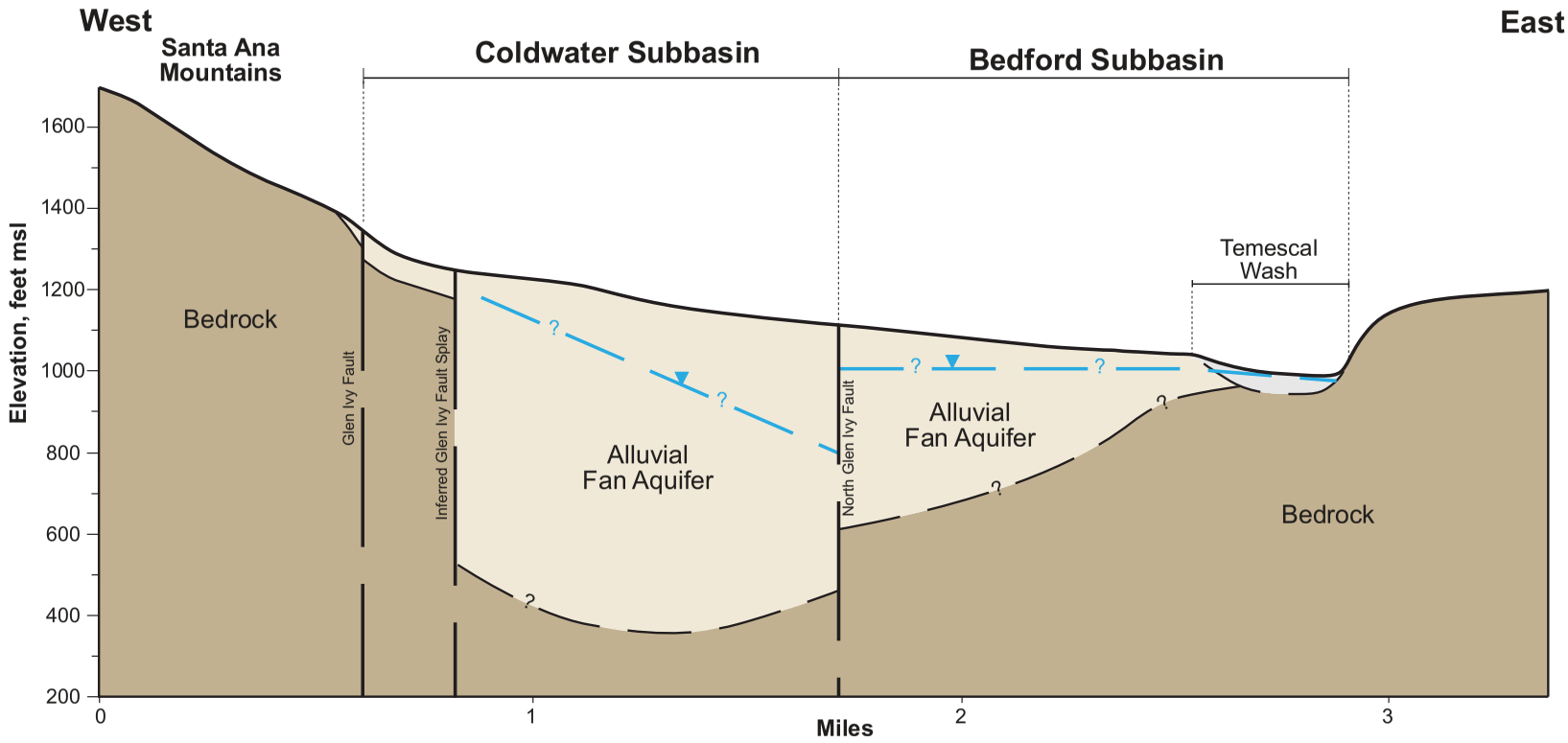
Figure 6
Well Locations



May 2008

TODD ENGINEERS
Alameda, California

Figure 7
Depth to Bedrock



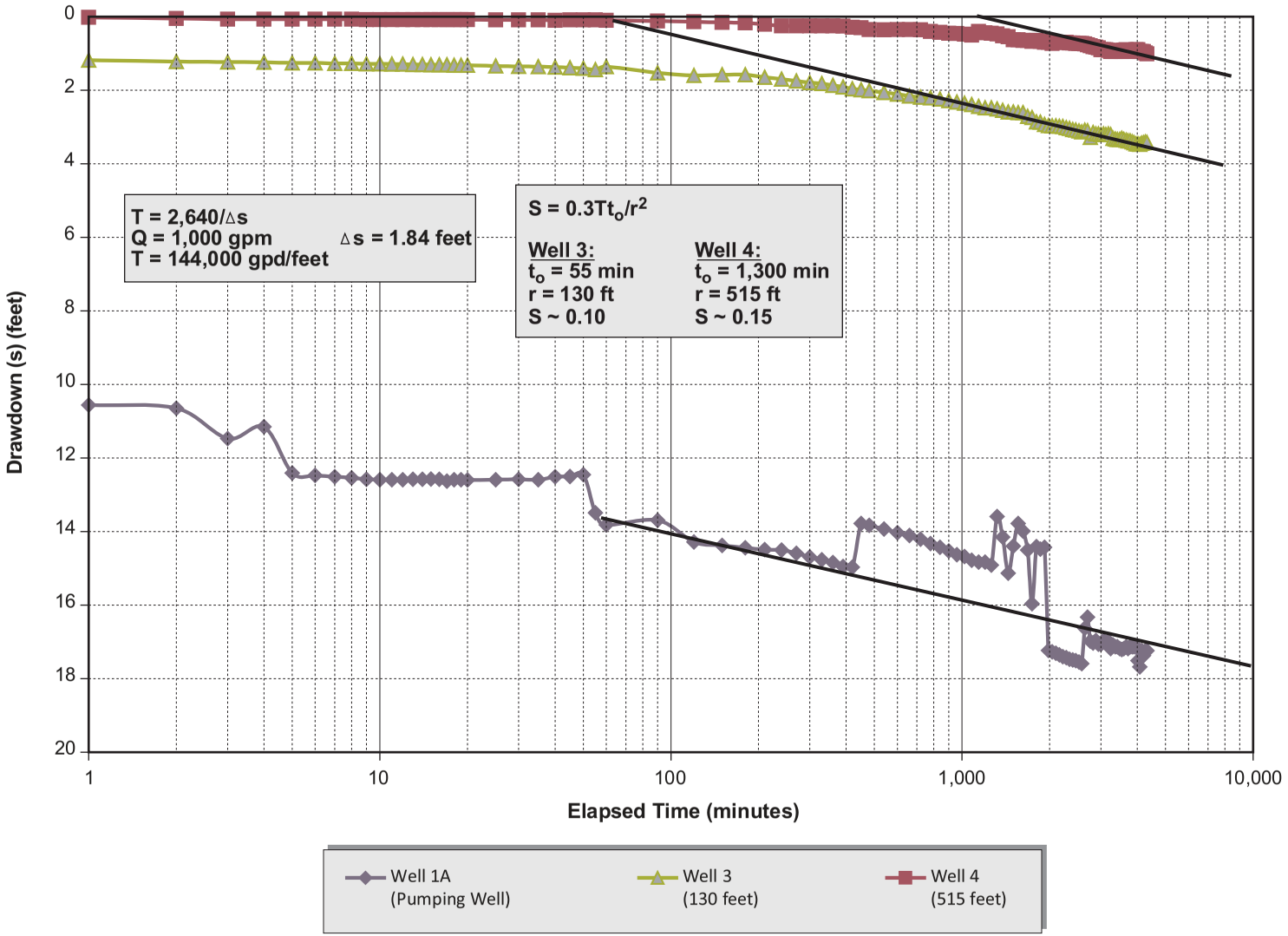
LEGEND

Groundwater Elevation (approximate)

Figure 8
Generalized Cross Section

May 2008

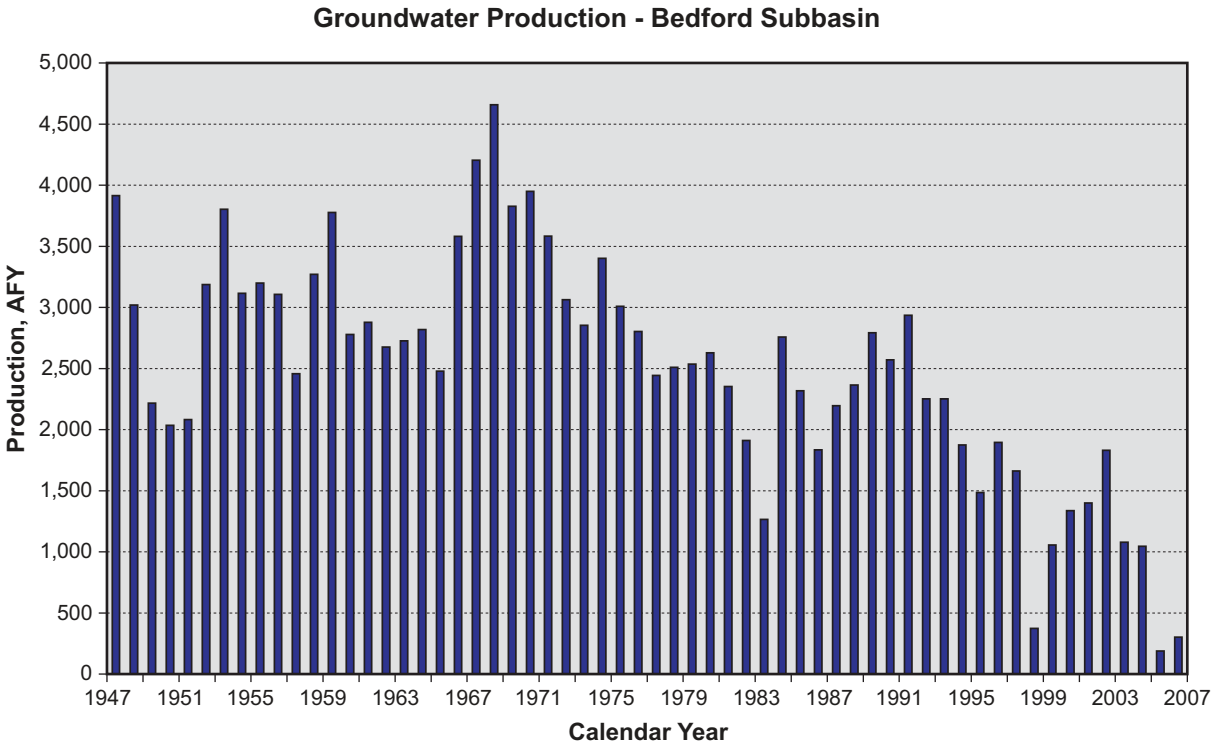
TODD ENGINEERS
Alameda, California

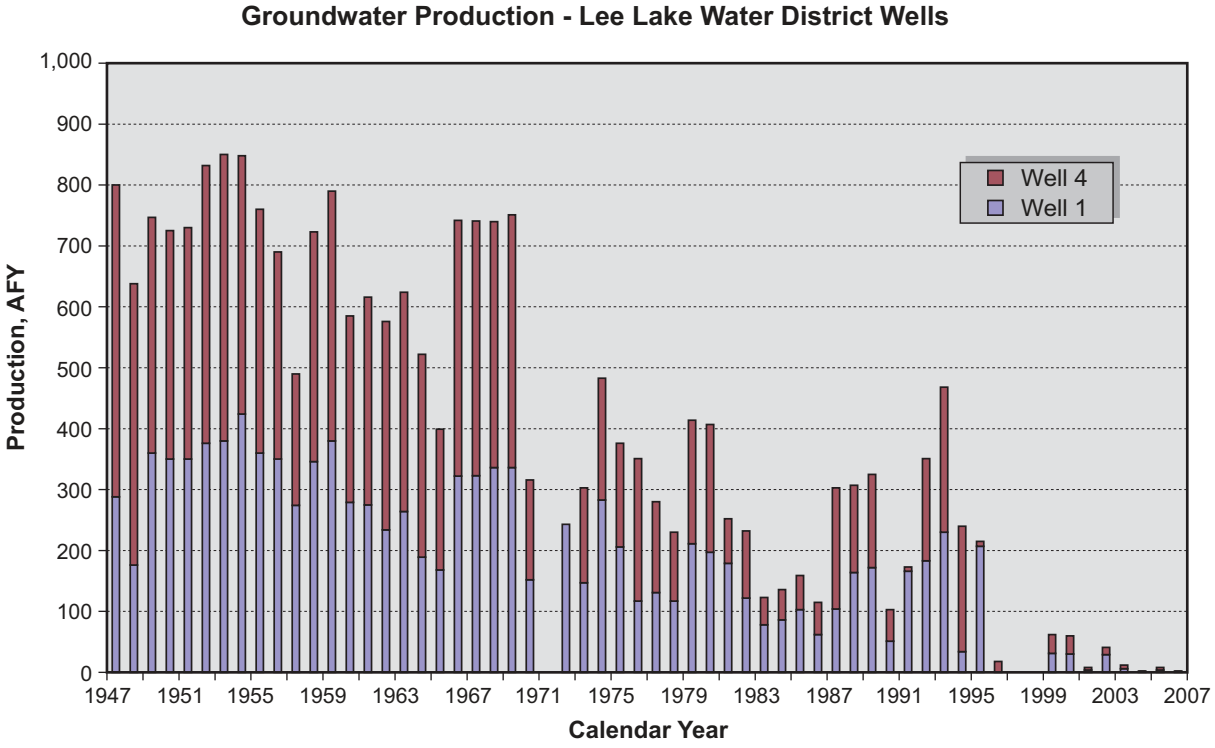


May 2008

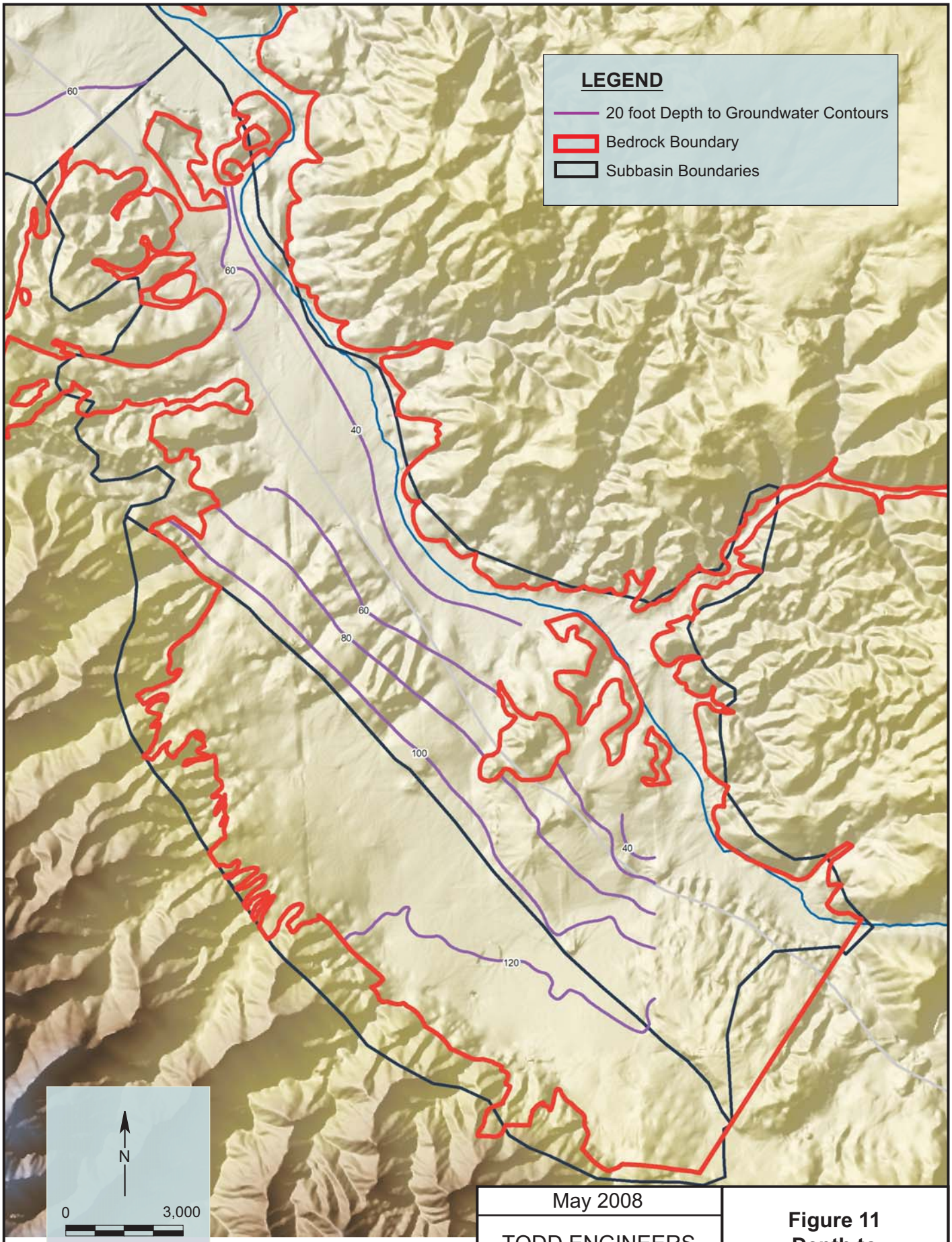
TODD ENGINEERS
Alameda, California

Figure 9
Pumping Test
Analysis Well 1A
February 2003





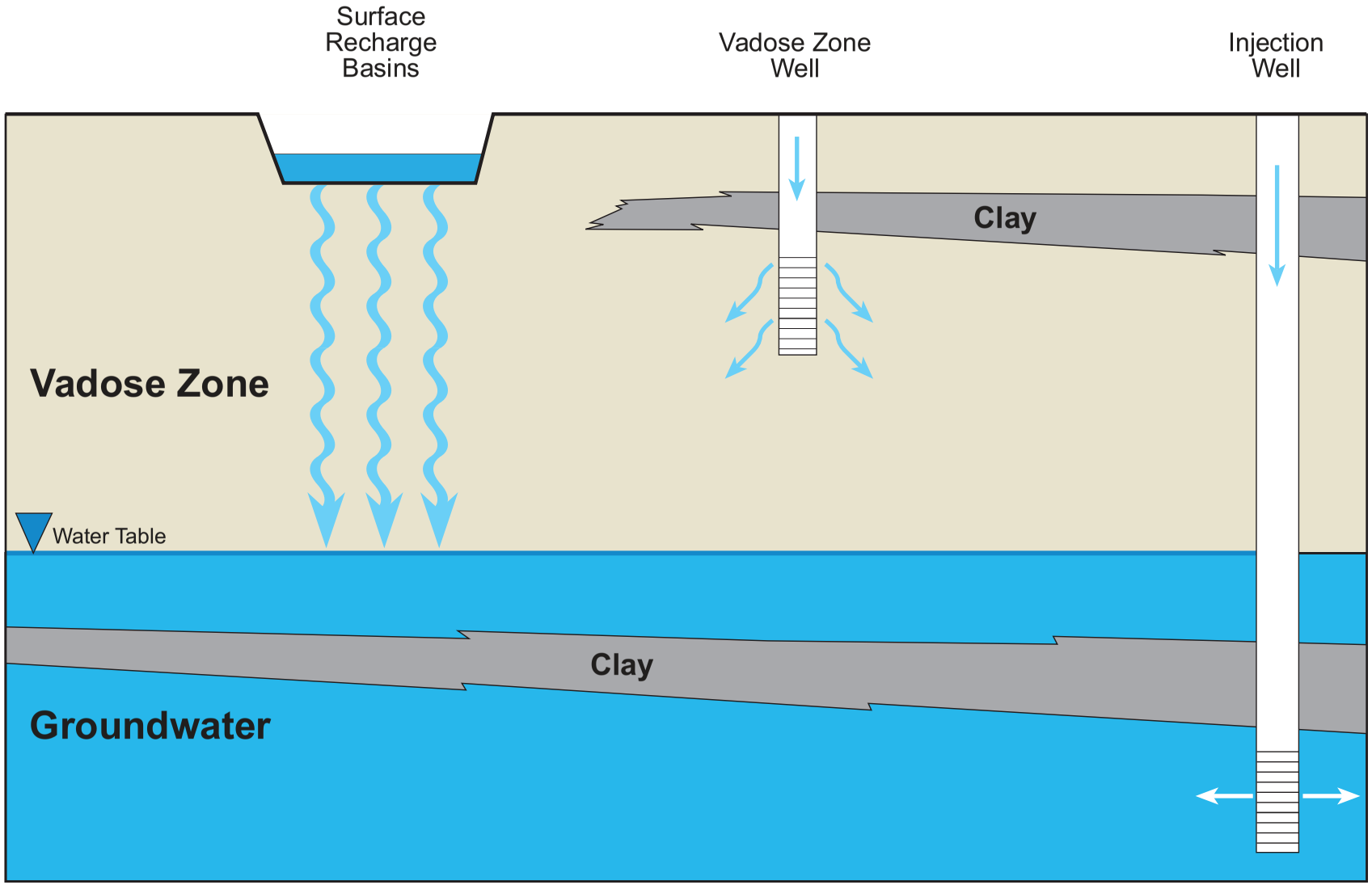
May 2008	**Figure 10** **Bedford Subbasin Groundwater Production**
TODD ENGINEERS Alameda, California	



May 2008

TODD ENGINEERS
Alameda, California

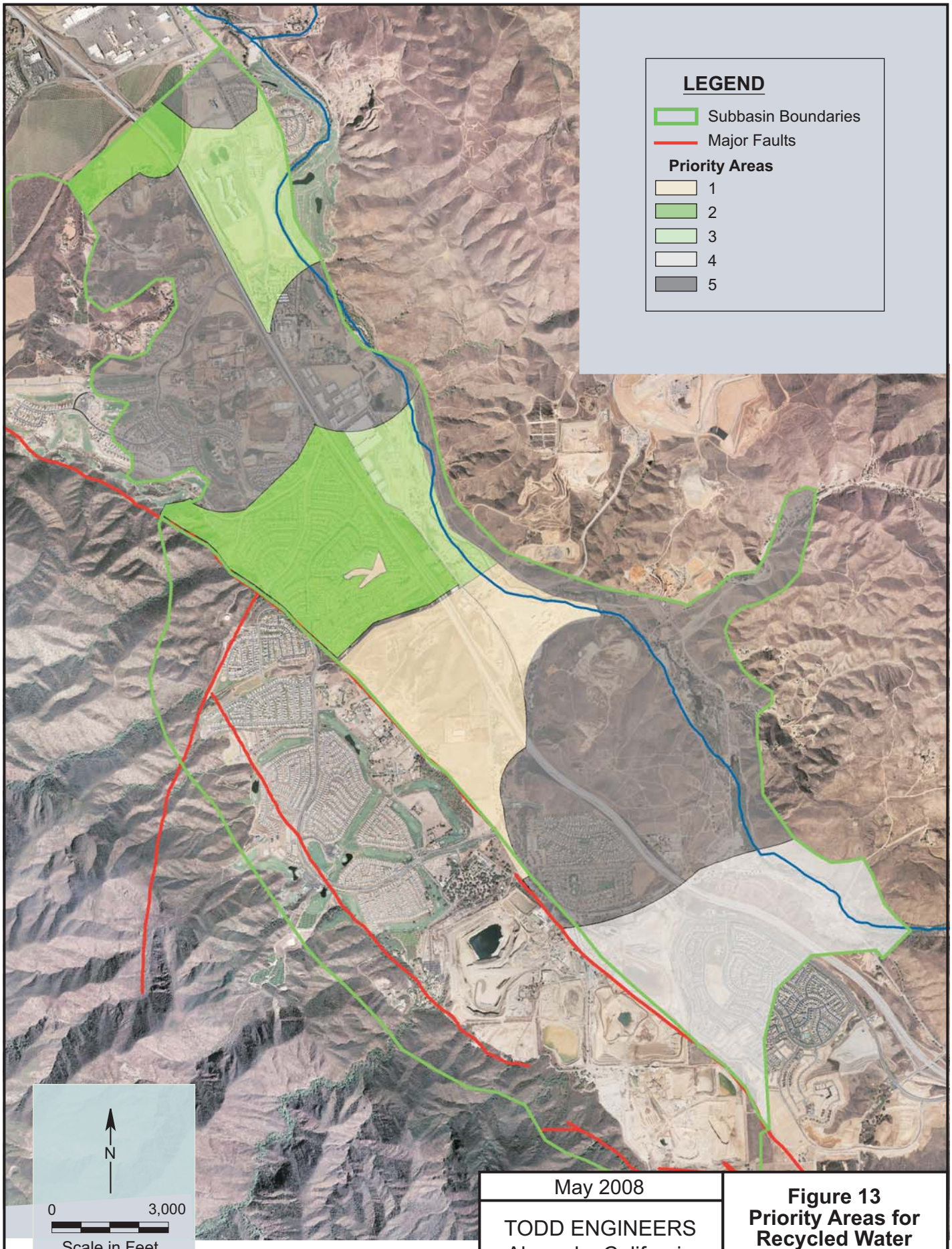
Figure 11
Depth to Groundwater



May 2008

TODD ENGINEERS
Alameda, California

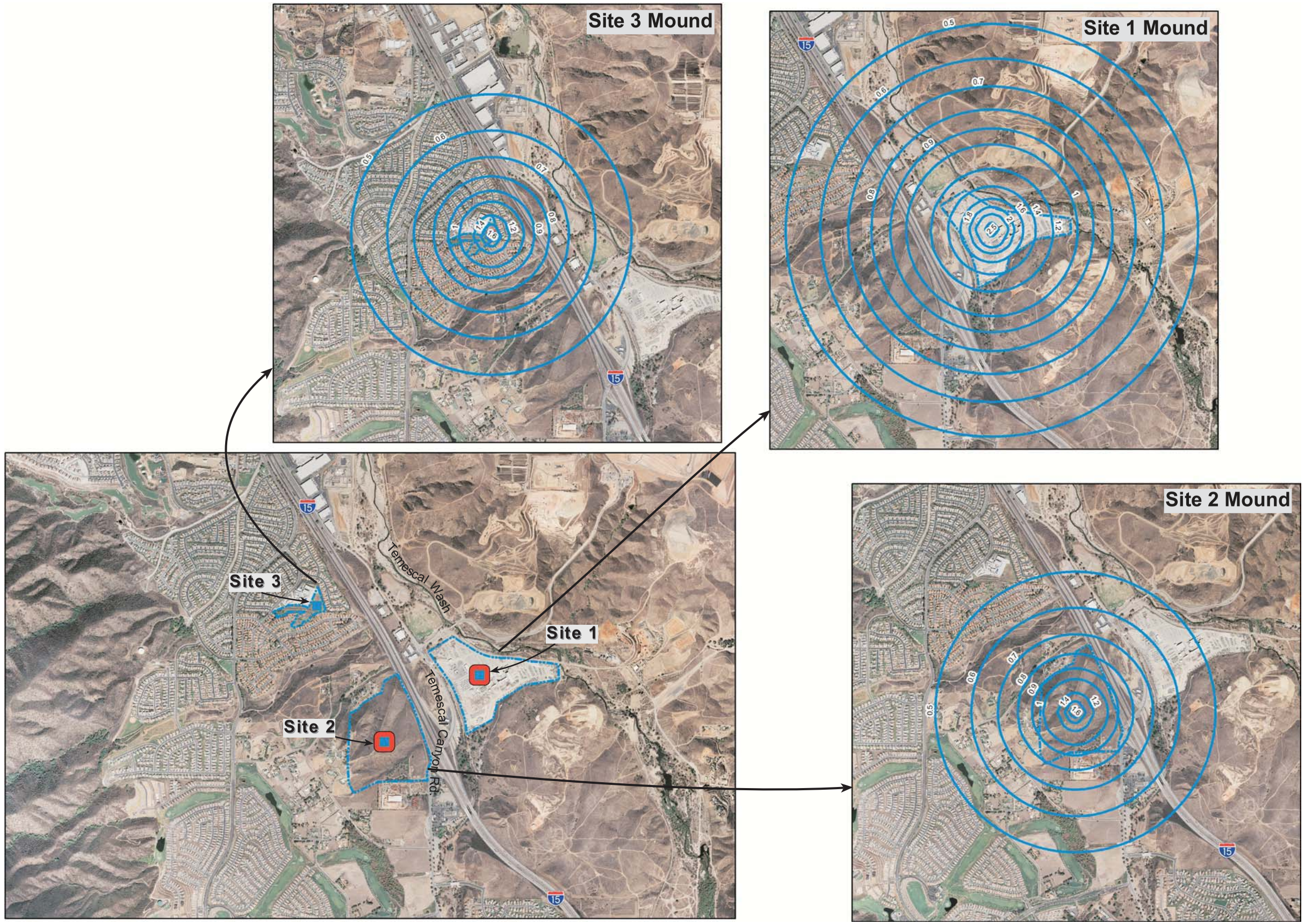
Figure 12
Recharge Methods
Schematic Diagram



May 2008

TODD ENGINEERS
Alameda, California

Figure 13
Priority Areas for Recycled Water Recharge



May 2008 TODD ENGINEERS Alameda, California	**Figure 14** **Potential Recharge Areas and Approximate Recharge Mounds After Six Months**

Appendix K – Joint Powers Agreement

JOINT POWERS AGREEMENT

by and among

THE CITY OF CORONA,
a California general law city,

ELSINORE VALLEY MUNICIPAL
WATER DISTRICT,
a municipal water district

and

TEMESCAL VALLEY WATER DISTRICT,
a California water district

for the formation of a joint powers authority and management of

THE BEDFORD-COLDWATER SUB-BASIN
OF THE ELSINORE BASIN

TABLE OF CONTENTS

		Page
1.	RECITALS	2
2.	DEFINITIONS	2
3.	CERTIFICATION	3
4.	CREATION OF SEPARATE AGENCY	3
5.	PURPOSES AND MEMBER RESPONSIBILITIES	4
6.	POWERS	4
7.	OBLIGATIONS OR LIABILITIES OF AUTHORITY	6
8.	DESIGNATION OF ADMINISTERING MEMBER/ADMINISTRATOR	6
9.	ORGANIZATION	6
10.	SPECIAL PROJECTS AND PROJECT COMMITTEES	8
11.	FISCAL AGENT, DEPOSITORY AND ACCOUNTING	9
12.	ACCOUNTABILITY, REPORTS AND AUDITS	9
13.	OPERATING BUDGET AND EXPENDITURES	9
14.	CONTRIBUTIONS/BUDGETS	9
15.	ASSESSMENTS FOR EXTRAORDINARY COSTS	12
16.	STAFFING	13
17.	DISPUTE RESOLUTION	13
18.	WITHDRAWAL	14
19.	TERM AND TERMINATION	15
20.	INDEMNIFICATION/CONTRIBUTION	15
21.	INSURANCE	16
22.	CLAIMS	16
23.	ENTIRE AGREEMENT REPRESENTED	16
24.	HEADINGS	16

Page

25. NOTICES 16

26. CONSTRUCTION 17

27. NO THIRD PARTY BENEFICIARIES INTENDED 17

28. WAIVERS 17

29. CONFLICT WITH LAWS OR REGULATIONS/SEVERABILITY 17

30. FURTHER ASSURANCES AND OBLIGATION OF GOOD FAITH DEALING 17

31. COUNTERPARTS 18

32. AMENDMENT 18

33. CUA ASSIGNMENT 18

JOINT POWERS AGREEMENT BY AND AMONG THE CITY OF CORONA, ELSINORE VALLEY MUNICIPAL WATER DISTRICT, AND TEMESCAL VALLEY WATER DISTRICT FOR THE FORMATION OF A JOINT POWERS AUTHORITY AND MANAGEMENT OF THE BEDFORD-COLDWATER SUB-BASIN OF THE ELSINORE BASIN

THIS JOINT POWERS AGREEMENT ("Agreement") is entered into as of March 29, 2017, by and between the CITY OF CORONA ("Corona"), a California General Law City organized and existing under the laws of the State of California, ELSINORE VALLEY MUNICIPAL WATER DISTRICT ("EVMWD"), a Municipal Water District organized under Water Code §§ 71000 et seq., and the TEMESCAL VALLEY WATER DISTRICT ("TVWD"), a California Water District organized under California Water Code §§ 34000 et seq., hereinafter collectively referred to as "Members", with reference to the following:

A. WHEREAS, in September 2014, the Governor signed three bills (SB 1168, SB 1319, and AB 1739) into law creating the Sustainable Groundwater Management Act of 2014 ("SGMA"); and

B. WHEREAS, SGMA generally requires the formation of one or more Groundwater Sustainability Agencies ("GSA" or "GSAs") responsible for implementing sustainable groundwater management and preventing "undesirable results" in groundwater basins and sub-basins designated as a medium or high priority basin by the California Department of Water Resources ("DWR") in its Bulletin 118 inventory of California groundwater basins; and

C. WHEREAS, DWR has designated the Bedford-Coldwater Sub-Basin (the "Sub-Basin"), as a medium priority groundwater basin under Bulletin 118; and

D. WHEREAS, each of the Members overlies a portion of the Sub-Basin and exercises water management, water supply or land use authority within a portion of the Sub-Basin; and

E. WHEREAS, the Members are local agencies that can exercise powers related to groundwater management within their jurisdictional boundaries and qualify individually to serve as a GSA within portions of the Sub-Basin per Water Code Section 10723; and

F. WHEREAS, under SGMA, a combination of local agencies may elect to form a joint powers authority ("JPA") to serve as the GSA for all or portions of the Sub-Basin through a joint powers agreement; and

G. WHEREAS, the Members intend by this Agreement to create a JPA to implement SGMA in the entire Sub-Basin, and are authorized to enter into this Agreement pursuant to the Joint Exercise of Powers Act, Government Code §§ 6500 et seq., for the purpose of acting as a separate public agency that can carry out all obligations, and exercise all powers, of a GSA in all areas of the Sub-Basin; and

H. WHEREAS, under SGMA, a GSA, including a JPA composed of one or more SGMA-eligible local agencies, must file a notice of intent with DWR by June 30, 2017 indicating the GSA's intent to undertake sustainable groundwater management within all or portions of a groundwater basin; and

I. WHEREAS, the governing boards of each of the three Members have formally agreed to: (1) enter into this Agreement; (2) form a JPA that can jointly exercise the powers common to the Members and fulfill all legal obligations imposed by SGMA; and (3) authorize the JPA to promptly file all necessary documentation with DWR so as to permit the JPA to become the exclusive GSA for the entire Sub-Basin; and

J. WHEREAS, the Members further intend by this Agreement to provide for the management and funding commitments reasonably anticipated to be necessary for the above purposes and for the purpose of ensuring that the Sub-Basin is sustainably managed in accordance with the timelines established by SGMA; and

K. WHEREAS, the Members understand that Corona has entered into a Water Enterprise Management Agreement and a Wastewater Enterprise Management Agreement, both dated as of February 6, 2002, with the Corona Utility Authority ("CUA") for the maintenance, management and operation of those utility systems (collectively "the CUA Management Agreements"). To the extent that this Agreement is deemed to be a "material contract" under either of the CUA Management Agreements, Corona enters into this Agreement on behalf of the CUA and subject to the terms of the applicable CUA Management Agreements.

ACCORDINGLY, IT IS AGREED BY ALL MEMBERS:

1. RECITALS: The foregoing recitals are incorporated as terms of this Agreement.

2. DEFINITIONS: Unless otherwise required by the context, the following terms shall have the following meanings:

a. "Administering Member" shall mean the Member designated by the Authority Board to provide administration, operation and staffing of the Authority so as to ensure the Authority complies with this Agreement and all legal requirements. The Board is not required to designate an Administering Member, and a Member so designated is not required to accept the designation.

b. "Administrator" shall mean the individual selected to act as the chief executive of the Authority, and the person responsible for its day to day operations. The Administrator may, but it is not required to be, an employee of one of the Members.

c. "Authority" and "JPA" as used herein shall, unless otherwise noted, mean the "Bedford-Coldwater Groundwater Sustainability Authority," the separate public agency created by this Agreement and Government Code Sections 6507 and 6508, and the entity charged by this Agreement with becoming the exclusive GSA for the Sub-Basin.

d. "Board" or "Board of Directors," shall, unless otherwise indicated, mean the Board of Directors of the Authority.

e. "DWR" shall mean the California Department of Water Resources.

f. "Effective Date" shall mean the date on which all Members have signed this Agreement.

g. "Fiscal Year" shall run from July 1 through June 30.

h. "Groundwater Sustainability Agency" or "GSA" shall mean a groundwater sustainability agency as defined in SGMA, Water Code § 10721.

i. "Groundwater Sustainability Plan," "Plan," or "GSP" shall have the same meaning as provided in SGMA, Water Code § 10721.

j. "Member" shall mean any of the individual signatories to this Agreement, and "Members" shall collectively mean two or more of the signatories to this Agreement.

k. "SGMA" shall mean the Sustainable Groundwater Management Act of 2014, as amended, and any regulations of DWR or the State Water Resources Control Board that implement SGMA.

l. "Special Projects" shall mean projects that are consistent with, and within the scope of activities, authorized by this Agreement, but which are undertaken by fewer than all the Members in the name of the Authority in accordance with the procedures outlined in Sections 10 and 14.

m. "Sub-Basin" shall mean the Bedford-Coldwater Sub-Basin of the Elsinore Groundwater Basin, Sub-Basin No. 8-004.2, as identified in the most recent modifications of Bulletin 118 by DWR.

n. "SWRCB" shall mean the California State Water Resources Control Board.

3. CERTIFICATION: Each Member, as a signatory to this Agreement, certifies and declares that it is a public agency, as defined by Government Code § 6500, that is authorized to enter into a joint powers agreement to contract with each other for the joint exercise of any common power under Article 1, Chapter 5, Division 7, Title 1 of the Government Code or any power otherwise granted to one or more of the Members by SGMA.

4. CREATION OF SEPARATE AGENCY: There is hereby created, per Government Code §§ 6507 and 6508, an agency separate from the parties to the Agreement, and which is responsible for the administration of this Agreement, to be known as the "**BEDFORD-COLDWATER GROUNDWATER SUSTAINABILITY AUTHORITY**." Within thirty (30) days of the Effective Date of this Agreement, the Members, and/or the Authority shall: (a) cause a notice of this Agreement to be prepared and filed with the office of the California Secretary of State as required by Government Code § 6503.5; (b) file a copy of this Agreement with the State Controller per Government Code § 6503.6; and (c) file a copy of this Agreement with the Local Agency Formation Commission ("LAFCO") for Riverside County per Government Code § 6503.6.

5. PURPOSES AND MEMBER RESPONSIBILITIES: The Authority is formed with the purpose and intent of jointly creating a separate legal entity to fulfill the role and legal obligations of a GSA required by SGMA, to include complying with SGMA and ensuring sustainable groundwater management throughout the Sub-Basin, so that the Members may collaboratively and cost effectively develop, adopt, and implement a GSP for the Sub-Basin in

accordance with pertinent regulatory timelines. The geographic boundaries of the GSA that will be formed by the Authority, which will encompass the entire Sub-Basin, are as depicted in the map attached hereto as Exhibit "A," which is incorporated herein by reference. The Authority may also represent the Members, as appropriate, in discussions and transactions with other local agencies, to include (but not limited to) the development of inter-basin coordination agreements with other GSAs in Riverside County, and agreements with other local agencies or groundwater sustainability agencies as may be required to ensure compliance with SGMA for the Sub-Basin.

6. POWERS: The Members intend that the Authority provide for the joint exercise of powers common to the Members as such powers relate to the management of the Sub-Basin, and for the exercise of such additional powers as are conferred by law in order to meet the requirements of SGMA. The Members are each SGMA-eligible local agencies empowered by the laws of the State of California to exercise the powers specified in this Agreement, and such other powers as are granted to GSAs by SGMA. These common powers shall be exercised for the benefit of any one or more of the Members or otherwise in the manner set forth in this Agreement. Subject to the limitations set forth in this Agreement, the Authority shall have the powers to perform all acts necessary to accomplish its purposes as stated in this Agreement, as authorized by law, including but not limited to the following:

a. To make and/or assume contracts and to employ agents, employees, consultants and such other persons or firms as the Board may deem necessary, to the full extent of the Authority's power, including, but not limited to, engineering, hydrogeological, and other consultants, and with attorneys and accountants and financial advisors, for the purpose of providing any service required by the Authority to accomplish its purposes, or to otherwise take such actions as are necessary to ensure the Sub-Basin is managed in accordance with the requirements of SGMA;

b. To conduct all necessary research and investigations, and to compile appropriate reports and collect data from all available sources to assist in preparation and implementation of a GSP, and to support the development of such other agreements as may be necessary to ensure the Sub-Basin can be sustainably managed;

c. To cooperate, act in conjunction with, and contract with the United States, the State of California, or any agency thereof, the County of Riverside, or such other entities or persons as the Board may deem necessary to ensure that the Authority fulfills its obligations under SGMA;

d. To apply for, accept and receive licenses, permits, water rights, approvals, agreements, grants, loans, gifts, contributions, donations or other aid from any agency of the United States, the State of California or other public or private person or entity necessary for fulfilling the purposes of SGMA in the Sub-Basin;

e. To acquire by grant, purchase, lease, gift, devise, contract, construction, eminent domain or otherwise, and hold, use, enjoy, sell, let, and dispose of, real and personal property of every kind, including lands, water rights, structures, buildings, rights-of-way, easements, and privileges, and construct, maintain, alter, and operate any and all works or

improvements, within or outside the agency, necessary or proper to carry out any of the purposes of the Authority as specified in this Agreement and/or the requirements of SGMA;

f. To enforce the requirements of SGMA within the Sub-Basin to the extent authorized by law including, but not limited to, the imposition and collection of civil penalties as authorized by SGMA;

g. To sue and be sued in its own name;

h. To provide for the prosecution of, defense of, or other participation in actions or proceedings at law or in public meetings in which the Members, pursuant to this Agreement or otherwise pertaining to management of the Sub-Basin, may have an interest, and to employ counsel or other expert assistance for that purpose;

i. To adopt an initial operating budget and initial Member contributions within ninety (90) days of the execution of this Agreement, and an annual budget and Member contributions, by March 31 of each subsequent Fiscal Year;

j. To incur debts, liabilities or obligations, subject to the limitations provided in this Agreement;

k. To impose fees authorized by SGMA (Water Code §§ 10730-10731), without any limitation on a Member's separate ability to impose fees within its jurisdiction, to fund the cost of furthering the purposes of this Agreement, complying with SGMA, and sustainably managing groundwater within the Sub-Basin;

l. To adopt rules, regulations, policies and procedures for governing the operation of the GSA and adoption and implementation of the GSP consistent with the powers and purposes of the Authority and as authorized by SGMA;

m. To investigate legislation and proposed legislation affecting SGMA and the Sub-Basin and make appearances regarding such matters;

n. Subject to the limitations imposed by this Agreement, to take such actions as are deemed necessary by the Board to achieve the purposes stated above and to provide for the sustainable management of the Sub-Basin; and

o. To adopt and revise bylaws, rules, ordinances, and resolutions in a manner authorized by law and not inconsistent with the terms of this Agreement.

Any power necessary or incidental to the foregoing powers shall be exercised by the Authority in the manner provided for under the legal authority applicable to the City of Corona except as otherwise provided by law or in this Agreement.

7. OBLIGATIONS OR LIABILITIES OF AUTHORITY: No debt, liability or obligation of the Authority shall constitute a debt, liability or obligation of any of the Members, except as otherwise provided in this Agreement or unless otherwise required by law.

8. DESIGNATION OF ADMINISTERING MEMBER/ADMINISTRATOR: The powers of the Authority provided in this Agreement shall be exercised in the manner provided by this Agreement. The Board may designate an Administering Member and/or an Administrator to provide all or a portion of the administrative (or other) services required by this Agreement, SGMA, or other legal authority. However, whether or not the Board decides to designate an Administering Member, each Member shall nevertheless be responsible, when requested by the Board, for designating staff from their agency to coordinate with the Board and other Members, and for otherwise ensuring the Authority has sufficient staffing and administrative support to comply with this Agreement and other legal obligations.

9. ORGANIZATION:

a. Additional Members: The Board may allow additional members to join the Authority. Additional Members must be local agencies capable of being designated as a GSA under SGMA. The Board may set whatever conditions it deems necessary as a precondition to addition of the new Member, to include requiring the additional Members to reimburse the other Members for a proportionate share of the costs already incurred by the existing Members.

b. Bylaws: The Board shall adopt bylaws governing the management of the Authority within 180 days of the Effective Date. The bylaws shall require the Board to develop a conflict of interest code for the Authority compliant with California law, and to otherwise ensure that the Board operates in a manner that is fully compliant with the Brown Act, the Joint Exercise of Powers Act, Government Code §§ 6500 et seq., SGMA, and all other applicable legal requirements.

c. Committees: The Board may create committees as authorized by law.

d. Governing Board: The Authority shall be governed by a Board of Directors which shall be composed of one (1) elected representative of each Member, appointed by each Member. The governing body of each Member shall determine in its sole discretion the person it will appoint to the Authority Board of Directors. The Board of Directors shall receive no compensation from the JPA for serving on the Board of the JPA.

e. Meetings: Regular meetings of the Board may be held quarterly, or as the Board determines necessary, on such dates and times and at such locations as the Board shall fix by resolution. Special meetings of the Board shall be called in accordance with Government Code § 54956. All meetings of the Board shall comply with the provisions of the Ralph M. Brown Act (Government Code §§ 54950 et seq.).

f. Officers: The officers of the Authority shall be a Chairperson, and Vice-Chairperson, and such other officers as the Board shall designate. The election of officers will take place at the first meeting of the JPA Board, and subsequently in the first Board meeting of each new Fiscal Year unless the time of election is otherwise designated in the Authority bylaws. The officers or persons who have charge of, handle or have access to any property of the Authority shall be designated in the bylaws, and such officers and persons shall comply with all applicable requirements of Government Code § 6505.1.

g. Quorum: Two-thirds (2/3) of the Board of Directors shall constitute a quorum in order to conduct business.

h. Rules: The Board may adopt such other rules, policies, and regulations as it deems proper consistent with all applicable laws, this Agreement, and the Authority's bylaws.

i. Term: The Authority Board Members shall serve without terms and at the pleasure of the legislative body which appointed them.

j. Treasurer: The Treasurer of the Board shall be formally designated by a resolution adopted by the Board of Directors stating the effective date of the appointment and the term of the appointment.

k. Voting: Each Director shall have one vote. A simple majority of the quorum shall be required for the adoption of a motion, resolution, contract authorization or other action of the Board, except that:

(1) A majority vote of less than a quorum may vote to adjourn;

(2) Any of the following actions shall require a unanimous vote of the entire Board:

(a) Adoption, modification or alteration of the GSP, or of the GSA boundaries;

(b) Adoption of assessments, charges or fees;

(c) Adoption or modification of ramp-downs or curtailments;

(d) Initiation/settlement of enforcement actions;

(e) Adoption of an initial budget;

(f) Adoption or modification of the annual budget, as further described in Section 14, below;

(g) Initiation/termination or settlement of any litigation or threatened litigation that involves the Authority;

(h) Admission of additional Members to the Authority;

(i) Appointment, employment, or dismissal of the Authority's Administrator and/or Legal Counsel;

(j) Designating an Administrator or Administering Member;

(k) Setting the amounts of any contributions or fees to be made or paid to the Authority by any Member, including extraordinary costs as defined in Section 15;

(l) Acquisition by grant, purchase, lease, gift, devise, contract, construction, or otherwise, and hold, use, enjoy, sell, let, and dispose of, real and personal property of every kind, including lands, water rights, structures, buildings, rights-of-way, easements, and privileges, and construct, maintain, alter, and operate any and all works or improvements, within or outside the agency, necessary or proper to carry out any of the purposes of the Authority;

(m) Replacement of the annual special audit required by Government Code § 6505(f) with an audit covering a two year period;

(n) Amendments or modifications of this Agreement;

(o) Adoption or modification of bylaws or other binding rules governing the operations of the JPA Board;

(p) Adoption of ordinances;

(q) Issuance of bonds or other indebtedness;

(r) Allocating funding received from grants, loans, or from other alternative sources, in a manner that does not result in equal sharing of alternative funding among the Members;

(s) To apply for, accept and receive licenses, permits, water rights, approvals, agreements, grants, loans, gifts, contributions, donations or other aid from any agency of the United States, the State of California or other public or private person or entity necessary for fulfilling the purposes of SGMA in the Sub-Basin.

10. SPECIAL PROJECTS AND PROJECT COMMITTEES:

a. With the prior approval of the entire Board, Members may undertake Special Projects in the name of the Authority, utilizing the legal powers granted to the Authority under SGMA, the Joint Exercise of Powers Act, or other applicable legal authorities. All Members shall be given the opportunity to participate in Special Projects, but shall not be required to participate.

b. A Member considering a new project, other than a groundwater extraction project, where the project is reasonably likely to affect groundwater management in the Sub-Basin shall consult with the other Members before individually undertaking the project to determine whether that individual project might otherwise be better accomplished as an Authority Special Project.

c. Members electing to participate in a Special Project shall enter into a Special Project Agreement in accordance with Section 14.a(4) of this Agreement. Such Special Project Agreement shall provide that: (a) no Special Project undertaken pursuant to such agreement shall conflict with the terms of this Agreement or the GSP; (b) the Members to the Special Project Agreement shall indemnify, defend and hold harmless the Authority, and Members

of the Authority who are not participating in the Special Project, against any costs liabilities, or expenses of any kind arising as a result of the Special Project; (c) all benefits and liabilities attributable to a Special Project shall solely be the benefits and liabilities of the Members that have entered into the Special Project Agreement, and non-participating Members shall have no rights, and incur no obligations or liabilities, in the Special Project.

11. FISCAL AGENT, DEPOSITORY AND ACCOUNTING: The "Treasurer" appointed by the Board is designated as the fiscal agent and depository for the Authority per Government Code §§ 6505.5 and 6505.6. The Treasurer of the Authority shall be the treasurer of one of the Authority's Members, or a certified public accountant designated by the Board, or an officer or employee designated per Government Code § 6505.6. The Treasurer shall be the depositary and have custody of all money of the Authority, from whatever source, subject to the applicable provisions of any indenture or resolution providing for a trustee or other fiscal agent. All funds of the Authority shall be held in the operating fund established by Section 14, or such other separate accounts as may be necessary, in the name of the Authority and not commingled with the funds of any Member or any other person or entity. Full books and accounts shall be maintained for the Authority in accordance with generally accepted accounting principles applicable to governmental entities per Government Code §§ 6505 et seq., and any other applicable laws of the State of California.

12. ACCOUNTABILITY, REPORTS AND AUDITS: There shall be strict accountability of all funds, and an auditor designated by the Board shall report any and all receipts and disbursements to the Board with such frequency as shall reasonably be required by the Board. The Authority will utilize the services of an outside independent certified public accountant to make an annual audit of the accounts and records of the Authority as required by Government Code § 6505, unless the Members, elect to conduct the audit for a two (2) year period. In each case, the minimum requirements of the audit shall be those prescribed by the State Controller for special districts pursuant to Government Code § 26909, and shall conform to generally accepted accounting principles. The outside independent certified public accountant selected by the Authority as auditor shall be formally designated by a resolution adopted by the Board of Directors stating the effective date of the appointment and the term of the appointment.

13. OPERATING BUDGET AND EXPENDITURES: The Board shall adopt a budget as specified in the bylaws and as set forth in Section 14, below. Unless otherwise required by this Agreement or applicable law, the Authority's Treasurer shall draw checks or warrants or make payments as specified in the bylaws of the Authority. The Authority may, consistent with the bylaws, invest any money in the treasury that is not needed for its immediate necessities.

14. CONTRIBUTIONS/BUDGETS: Unless otherwise provided in this Agreement, the Members shall equally share in the costs of the JPA. The Authority shall establish an operating fund. The fund shall be used to pay all administrative, operating and other expenses incurred by the Authority, and shall be funded by equal Member's contributions for payment of costs of the Authority. The Board may direct that any surplus funds be returned to the Members, per Government Code § 6512, in proportion to the contributions made by each Member.

a. Authority Budgets: Authority budgets shall be established as follows:

(1) General Operating Budget. No more than ninety (90) days following the first meeting of the Board, and annually thereafter in the month of March or other mutually agreed upon timeframe, a general operation budget (the "Operating Budget") shall be adopted by the Board. The Operating Budget shall be prepared in sufficient detail to constitute an operating outline for the purpose of establishing rates and/or contributions to be billed to and paid by the Members. The operating rates and/or contributions to be billed to and paid by each Member shall be based upon an equal contribution by each Member. The Operating Budget shall outline anticipated revenues and planned expenditures to be made during the ensuing Budget year by functional category such as operations and maintenance, administration, projects, programs, planning, study and any applicable contributions to operate related reserves. For the purpose of the Operating Budget, operating shall mean any financial activity related to exchange transactions, as defined by applicable generally accepted accounting principles ("GAAP") associated with the principal activity of the JPA. The Operating Budget shall be adopted by unanimous approval of the Board. The rates and contributions approved by the Board shall be paid by the Members pursuant to Section 14.c below.

(2) Non-Operating Budget. No more than ninety (90) days following the first meeting of the Board, and annually thereafter in the month of March or other mutually agreed upon timeframe, a non-operating budget (the "Non-Operating Budget") shall be adopted by the Board. The Non-Operating Budget shall be prepared in sufficient detail to constitute a non-operating outline for the purpose of establishing rates and/or contributions to be billed to and paid by the Members. These rates and/or contributions shall be based upon equal contributions by each Member. At a minimum, the Non-Operating Budget shall outline anticipated revenues and planned expenditures for non-operating financial activities for the ensuing Fiscal Year, inclusive of any amount necessary for servicing debt. For the purpose of the budget, Non-Operating shall mean any financial activity related to non-exchange transactions, as defined by applicable GAAP. Examples of non-exchange transactions include investment income, contributed capital from Members for capital debt service, interest expense, and return of capital to Members. The Non-Operating Budget shall be adopted by unanimous approval of the Board. The rates and contributions approved by the Board shall be paid by the Members pursuant to Section 14.c below.

(3) Capital Project Budget. No more than ninety (90) days following the first meeting of the Board, and annually thereafter in the month of March, or other mutually agreed upon timeframe, a capital project budget (the "Capital Project Budget") shall, if applicable, be adopted by the Board. The Capital Project Budget, if applicable, shall be prepared in sufficient detail to constitute a capital project outline to assess contributions to be paid by the Members and expenditures to be paid by the Members during the ensuing year for capital projects needed for major repair, replacement, expansion and efficiency of any capital improvements constructed or installed by or on behalf of the Authority. These contributions shall be based upon equal contribution by each Member, subject to unequal contribution amounts for Special Projects, as addressed in Sections 10 and 14.a.(4). The Capital Project Budget shall be adopted by unanimous approval of the Board. The contributions approved by the Board shall be paid by the Members pursuant to Section 14.c below.

(4) Special Project Budgets. In addition to the Operating Budgets, the Non-Operating Budgets, and the Capital Project Budget, the Board may budget at any time for the study, implementation or construction of any Special Project, program or study proposed to be undertaken by the Authority for matters not deemed to be of general benefit to all Members. A Special Project budget and written Special Project Agreement of the Members who consented to participation in the Special Project shall be established for each Special Project, which budget and agreement shall determine the respective obligations, functions, and rights of the Members involved and of the Authority. The directors of the Board representing the Members who will be involved in financing and implementing the Special Project shall be and constitute a "Special Project Committee," for purposes of administration and implementation of the Special Project. No Special Project shall be acquired or constructed by the Board without the consent of each of the governing boards of the participating Members. Ratification of the Special Project budget by each of the participating Members shall constitute consent for the acquisition and construction of the Special Project. Notwithstanding the foregoing, no debt shall be incurred by the Authority for a Special Project without the unanimous consent of the Board. Any rates and contributions approved by the Special Project Committee and approved by the participating Members shall be paid by the participating Members pursuant to Section 14.c below.

Where the Board has approved one or more Special Projects, annually thereafter in the month of March (or other mutually agreed upon timeframe), a Special Project budget shall be developed by each Special Project Committee if required by the applicable Special Project Agreement, Each Special Project budget shall include, without limitation, the following:

(i) Administrative expenses;

(ii) Studies and planning costs;

(iii) Engineering and construction costs;

(iv) The allocation of costs, including debt service costs, if any, among participating Members;

(v) Annual maintenance and operating expenses for the project; and

(vi) A formula for allocating annual maintenance and operating expenses, if any.

All actions by a Special Project Committee shall be deemed actions of the Authority and shall be taken in the name of the Authority, provided, only the participating Members shall have rights and obligations in the Special Project as herein provided.

b. Failure to Obtain Budget Approvals. In the event a budget acceptable to the Board is not approved prior to the start of a Fiscal Year the Authority shall continue to operate at the level of expenditure as authorized below:

(1) General Operating Budget. The Operating Budget shall be at the expenditure level authorized by the last approved Operating Budget increased by the Consumer Price Index ("CPI") with a minimum increase of no less than two percent (2%). The CPI shall mean the change in CPI for Urban Wage Earners and Clerical Workers for the Los Angeles County, Orange County, and Riverside County areas for the all items category for the 12-month period ending the February prior to the beginning of the Fiscal Year budgeted as determined by the U.S. Department of Labor, Bureau of Labor Statistics, or other mutually agreeable source if such a CPI is no longer available. This factor will be applied to the Operating Budget until such time as a new Operating Budget is approved by the Authority. Any shortfall in revenues will be made up from available reserves dedicated by the Board for such a purpose, and if insufficient to cover the shortfall, any available reserve funds not designated by the Board for other purposes or otherwise legally restricted for other purposes by external parties. Reserves shall mean any available cash or investments.

(2) Non-Operating Budget. The Non-Operating Budget shall automatically be established at the required level necessary to meet annual debt service requirements including any revenue coverage covenants. Each Member shall contribute to the Authority such amounts which will yield during each Fiscal Year net revenues payable to the Authority sufficient for the Authority to satisfy all covenants in any indentures, loan agreements or other documents entered into by the Authority and to enter into such other agreements as are necessary for the Authority to secure financing to pay the acquisition price for any facilities authorized by the Authority.

(3) Capital Project Budget. The Capital Project Budget shall automatically be established at the required level necessary to implement capital projects previously approved by the Authority.

c. Payments of Amounts Due. The payments owed for contributions from each Member to the Authority shall be due, payable, and delivered by the Members to the Authority within forty-five (45) days after receipt of a billing therefor from the Authority. To the extent permitted by state law, unpaid and past due contributions shall bear interest at ten percent (10%) per annum, calculated daily, from the date due to the date payment is received by the Authority.

15. ASSESSMENTS FOR EXTRAORDINARY COSTS: In the event the Authority should experience an unanticipated need to pay for extraordinary costs (e.g., those costs that are unanticipated and not otherwise funded through the budget), including, but not limited to the costs of litigation or indemnification as provided in this Agreement, and to the extent that such costs cannot otherwise be reasonably funded through use of reserves on hand or through the other revenue sources authorized by this Agreement, the Board may allocate the additional costs to the Members, whether such extraordinary costs are actually incurred or estimated to be necessary. Unless otherwise specifically allocated to one or more Members by the unanimous vote of the Board, all allocations of extraordinary costs shall be shared equally by each Member. The Members agree that they will then contribute their proportionate share of the extraordinary costs within a reasonable period of time as determined by the Board, or as otherwise specified in the Bylaws.

16. STAFFING: The Board shall provide for staffing of the Authority in accordance with procedures established in the bylaws. Such staffing shall ensure the Authority is able to accomplish all requirements imposed by SGMA, this Agreement, and/or any other requirements imposed by law. Legal counsel shall be appointed by the Board and shall serve at the pleasure of the Board. Legal counsel may be an attorney that also performs work for one of the Members, provided appropriate waivers suitable to the Board, and counsel for all of the Members, are first obtained.

17. DISPUTE RESOLUTION: The Members desire to informally resolve all disputes related to this Agreement and/or SGMA, whenever possible, at the lowest possible level, and triggering of the dispute resolution procedures described herein shall only occur where the Members and/or the Board have reached impasse and are unable to resolve matters without invoking formal dispute resolution procedures. Should informal resolution of any dispute prove unsuccessful, the Parties agree to neutral facilitation/mediation of the dispute as a next step prior to filing a lawsuit or otherwise seeking judicial intervention. The appointed facilitator/mediator, who need not be a licensed attorney, shall be a person who is not a current or former employee or agent of any Member, and someone who has knowledge of the rules governing public agencies, and who has experience with the management of groundwater resources in Southern California. The facilitator shall be compensated by the Authority.

The facilitator shall be a third party neutral assigned by the Center for Collaborative Policy ("CCP") of Sacramento State University, or such other neutral as is unanimously decided upon by the Members involved in the dispute. In the event that the Members involved in the dispute are unable to agree upon the facilitator or mediator, then each Member involved in the dispute shall provide the name of one recommended facilitator or mediator to the Authority's legal counsel. The facilitator/mediator shall then be selected by the Authority's legal counsel, based upon whichever recommended facilitator/mediator is the most qualified facilitator/mediator for the type of dispute involved. The selected facilitator/mediator shall diligently seek to achieve a consensus based solution to the dispute. Upon the request of one of the Members involved in the dispute, the facilitator shall render a recommended resolution of the dispute after five facilitated negotiation sessions between the Members involved in the dispute where an acceptable resolution has not yet been reached. The facilitator/mediator's recommended resolution shall not be admissible in any judicial proceedings. Where facilitation/mediation as described herein is unable to successfully resolve the dispute, then a Member involved in the dispute, upon providing 60 days-notice to the other Members and the Authority, may initiate judicial proceedings in the Superior Court for Riverside County.

This Section shall not bar a Member or Member(s) from initiating legal action in another appropriate forum with jurisdiction over the matter as necessary to comply with an applicable statute of limitation, provided such legal action, where authorized, is stayed pending completion of the dispute resolution process described herein. Members involved in a dispute governed by this Section are encouraged to enter a tolling agreement, if legally authorized, in order to allow sufficient time for completion of the process required by this Section.

18. WITHDRAWAL:

a. Notice to Members: Any Member may withdraw from the Authority by delivery of written notice to withdraw to each of the Members at least two years prior to the date of withdrawal ("Withdrawal Notice Period"), unless the Members unanimously agree to allow the withdrawing Member to withdraw sooner than two years, in which case the date of withdrawal shall be the date unanimously agreed upon by the Board. The withdrawing Member shall continue to be a full Member during the pendency of the Withdrawal Notice Period and shall retain all rights and obligations during such period unless otherwise agreed to by unanimous vote of the Board.

b. Effect of Withdrawal: Should a Member choose to withdraw from the Authority in accordance with the terms of this Agreement, that Member retains any legal right it has under SGMA to serve as the GSA for the groundwater basin underlying its jurisdictional boundaries, provided such withdrawal will not cause the Authority (or its remaining Members) to default on financial obligations or to otherwise fail to comply with the legal obligations imposed by SGMA. The Authority and the non-withdrawing Members shall retain whatever legal rights they have under SGMA, and the withdrawal of the Member shall have no effect on the continuance of this Agreement among the remaining Members. The withdrawing Member shall not take any action after withdrawal that would be reasonably anticipated to frustrate the ability of the Authority to comply with SGMA. After providing written notice of withdrawal, the withdrawing Member shall act at all times in good faith in the best interests of the Authority until such time as the withdrawal process is complete.

c. Continuing Fiscal Obligations: Any Member that withdraws as provided herein shall remain proportionately liable during the Withdrawal Notice Period for its proportionate share of the budget. If the Members elect to incur extraordinary costs in accordance with Section 15, the withdrawing Member shall be proportionately liable during the Withdrawal Notice Period for the obligations or debts approved and incurred by the Authority for those extraordinary costs, unless the Members agree otherwise. Any Member that withdraws shall remain proportionately liable for any unfunded capital expenditures or debt service obligations incurred or approved by the Board prior to the date of written notice of withdrawal of such Member until such time as the obligation is fully satisfied.

d. Continuing Claims Obligations: Members will remain obligated to contribute their proportionate share (based upon the membership roll as of the date of the claim), including without limitation legal defense costs, for any occurrences incurred during the Member's membership, but not presented as a claim against the Authority until after the Member's withdrawal.

e. Divisions of Property Assets: The real and/or personal property assets contributed by the withdrawing Member or the value of the real and/or personal property assets at the date of withdrawal will be returned to the withdrawing Member to the extent such assets are not required for the Authority to meet its continuing obligations as a GSA under SGMA. If such real and/or personal property assets are needed to meet the continuing obligations of the Authority to comply with SGMA, then the remaining Members of the Authority and the withdrawing Member shall negotiate a purchase or lease of such assets for a price not to exceed the fair market value of those assets.

19. TERM AND TERMINATION: This Agreement shall become effective, and the Authority shall come into existence, on the Effective Date. The Agreement, and the Authority, shall thereafter continue in full force and effect until the governing bodies of the Members unanimously elect to terminate the Agreement. Upon unanimous election to terminate this Agreement, the Board shall continue to act as a board to wind up and settle the affairs of the Authority. The Board shall adequately provide for the known debts, liabilities and obligations of the Authority, and shall then distribute the assets of the Authority among the Members, as follows:

a. The assets contributed by each Member, or the value thereof as of the date of termination, shall be distributed to that Member.

b. The remaining assets shall then be distributed to each Member in equal proportions.

The distribution of assets shall be made in-kind to the extent possible by returning to each Member those assets contributed by such parties to the Authority; however, no party shall be required to accept transfer of an asset in kind.

Notwithstanding any other provision by the Board for payment of all known debts, liabilities and obligations of the Authority, each Member shall remain liable for any and all such debts, liabilities, and obligations in equal proportions, or in the proportion specified by unanimous action of the Board if alternative proportions are so specified for particular actions or activities that give rise to such debts, liabilities, and obligations.

Termination of this Agreement shall not occur, and the Members shall continue to fund the operations of the Authority as a GSA for the Sub-Basin, until the Authority determines by a unanimous vote of the Board that: (a) a GSA is no longer required for the Sub-Basin; or (b) one or more of the individual Members will undertake the legal obligations of a GSA previously performed by the Authority, and such termination of the Authority will not result in the Sub-Basin being placed in a probationary status by the SWRCB.

20. INDEMNIFICATION/CONTRIBUTION: Members, directors, officers, agents and employees of the Authority shall use ordinary care and reasonable diligence in the exercise of their powers, and in the performance of their duties pursuant to this Agreement. The Authority shall hold harmless, defend and indemnify the Members, the Authority Board, and the Members' directors, agents, officers and employees from and against any liability, claims, actions, costs, damages or losses of any kind, including death or injury to any person and/or damage to property (including property owned by any Member), arising out of the activities or omissions of the Authority, or its agents, officers and employees related to this Agreement or SGMA ("Claims").

a. To the extent authorized by California law, no Member shall be liable for the actions or omissions of any other Member or the Authority related to this Agreement.

b. The indemnification obligations described herein shall continue beyond the term of this Agreement as to any acts or omissions occurring during this Agreement or any extension of this Agreement.

c. To the extent that the Authority is unable or unwilling (because of comparative fault of Member(s), or other good faith legal basis) to hold harmless, defend and/or indemnify any Member to this Agreement as provided in this Section, such Member shall be entitled to contribution from the other Members in equal proportion to the extent one Member pays more than its equal share of such obligation. Provided, however, that where one or more Members is determined by a court (or in a settlement approved by a court) to be responsible for a greater proportion for the Claims, each Member will only be responsible for contribution to the other Member (or Members) up to the extent of the contributing Member's proportional responsibility.

21. INSURANCE: The Authority shall obtain insurance for the Board members and general liability insurance containing liability in such amounts as the Board shall determine will be necessary to adequately insure against the risks of liability (including compliance with the indemnification provisions in Section 20 above) that may be incurred by the Authority. The Members, their officers, directors and employees, shall be named as additional insureds.

22. CLAIMS: All claims against the Authority, including, but not limited to, claims by public officers and employees for fees, salaries, wages, mileage, or any other expenses, shall be filed within the time and in the manner specified in Chapter 2 (commencing with Section 910) of Part 3, Division 3.6 of Title I of the Government Code, which describes the appropriate content of a claim.

23. ENTIRE AGREEMENT REPRESENTED: This Agreement represents the entire agreement among the parties as to its subject matter and no prior oral or written understanding shall be of any force or effect. No part of this Agreement may be modified without the written consent of all of the parties.

24. HEADINGS: Section headings are provided for organizational purposes only and do not in any manner affect the scope, meaning or intent of the provisions under the headings.

25. NOTICES: Except as may be otherwise required by law, any notice to be given shall be written and shall be either personally delivered sent by facsimile transmission, emailed or sent by first class mail, postage prepaid and addressed as follows:

MEMBERS:

City of Corona
Attn: General Manager,
Department of Water and Power
Address: 755 Public Safety Way
Corona, CA 92880

Elsinore Valley Municipal Water District
Attn: General Manager
Address: 31315 Chaney Street
Lake Elsinore, CA 92530

Temescal Valley Water District
Attn: General Manager
Address: 22646 Temescal Canyon Rd
Corona, CA 92883

Notice delivered personally is deemed to be received upon delivery. Notice sent by first class mail shall be deemed received on the fourth day after the date of mailing. Any party may change the above address by giving written notice pursuant to this Section.

26. CONSTRUCTION: This Agreement reflects the contributions of all parties and accordingly the provisions of Civil Code § 1654 shall not apply to address and interpret any uncertainty.

27. NO THIRD PARTY BENEFICIARIES INTENDED: Unless specifically set forth, the parties to this Agreement do not intend to provide any other party with any benefit or enforceable legal or equitable right or remedy.

28. WAIVERS: The failure of any party to insist on strict compliance with any provision of this Agreement shall not be considered a waiver of any right to do so, whether for that breach or any subsequent breach.

29. CONFLICT WITH LAWS OR REGULATIONS/SEVERABILITY: This Agreement is subject to all applicable laws and regulations. If any provision of this Agreement is found by any court or other legal authority, or is agreed by the parties, to be in conflict with any code or regulation governing its subject, the conflicting provision shall be considered null and void. If the effect of nullifying any conflicting provision is such that a material benefit of the Agreement to any party is lost, the Agreement may be terminated at the option of the affected party. In all other cases the remainder of the Agreement shall continue in full force and effect.

30. FURTHER ASSURANCES AND OBLIGATION OF GOOD FAITH DEALING: Each party agrees to execute any additional documents and to perform any further acts which may be reasonably required to affect the purposes of this Agreement. Moreover,

consent or approval, where reasonably requested in furtherance of the purposes of this Agreement or compliance with SGMA, shall not be unreasonably withheld by a Member.

31. COUNTERPARTS: This Agreement may be signed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

32. AMENDMENT: This document may only be amended with a vote by all of its Members.

33. CUA ASSIGNMENT: To the extent that this Agreement is deemed to be a "material contract" under either of the CUA Management Agreements, the Members have no right to terminate this Agreement, either or without cause, based upon the existence or non-existence of either or both of the CUA Management Agreements. Therefore, if an applicable CUA Management Agreement expires or terminates for any reason, the Members shall remain fully obligated to perform under this Agreement contracting directly with the CUA or another third party contracted by the CUA for the maintenance, management and operation of the applicable utility systems.

CITY OF CORONA SIGNATURE PAGE
FOR
JOINT POWERS AGREEMENT BY AND AMONG THE CITY OF CORONA, ELSINORE VALLEY MUNICIPAL WATER DISTRICT AND TEMESCAL VALLEY WATER DISTRICT FOR THE FORMATION OF A JOINT POWERS AUTHORITY AND MANAGEMENT OF THE BEDFORD-COLDWATER SUB-BASIN OF THE ELSINORE BASIN

EACH OF THE UNDERSIGNED, having read and considered the above provisions, indicate their agreement by their authorized signatures.

CITY OF CORONA,
a California General Law City organized and existing under the laws of the State of California

By: _____
Dick Haley
Mayor

Attest:

_____
Lisa Mobley
City Clerk

Approved as to Form:

_____
Dean Derleth
City Attorney

Consent:

_____
Darrell Talbert
Executive Director
Corona Utility Authority

ELSINORE VALLEY MUNICIPAL WATER DISTRICT SIGNATURE PAGE FOR JOINT POWERS AGREEMENT BY AND AMONG THE CITY OF CORONA, ELSINORE VALLEY MUNICIPAL WATER DISTRICT AND TEMESCAL VALLEY WATER DISTRICT FOR THE FORMATION OF A JOINT POWERS AUTHORITY AND MANAGEMENT OF THE BEDFORD-COLDWATER SUB-BASIN OF THE ELSINORE BASIN

EACH OF THE UNDERSIGNED, having read and considered the above provisions, indicate their agreement by their authorized signatures.

ELSINORE VALLEY MUNICIPAL WATER DISTRICT, a Municipal Water District organized under Water Code §§ 71000

By:_____
Harvey R. Ryan
President, Board of Directors

ATTEST

Terese Quintanar
Secretary to the Board

APPROVED AS TO FORM

John E. Brown
General Counsel

TEMESCAL VALLEY WATER DISTRICT SIGNATURE PAGE
FOR
JOINT POWERS AGREEMENT BY AND AMONG THE CITY OF CORONA, ELSINORE VALLEY MUNICIPAL WATER DISTRICT AND TEMESCAL VALLEY WATER DISTRICT FOR THE FORMATION OF A JOINT POWERS AUTHORITY AND MANAGEMENT OF THE BEDFORD-COLDWATER SUB-BASIN OF THE ELSINORE BASIN

EACH OF THE UNDERSIGNED, having read and considered the above provisions, indicate their agreement by their authorized signatures.

TEMESCAL VALLEY WATER DISTRICT,
a California Water District organized under
California Water Code §§ 34000 et seq.

By: _____
C.W. Colladay
President, Board of Directors

Attest:

_____
Paul Rodriguez
Board Secretary

Approved as to Form:

_____
Dave Saunders
General Counsel

Appendix L – Tiered Rate Structure

ORDINANCE NO. 3309

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF CORONA, CALIFORNIA, MODIFYING THE BUDGET BASED WATER STRUCTURE AND ESTABLISHING RATES FOR POTABLE AND RECLAIMED WATER SERVICE FEES AND CHARGES AND TEMPORARY REVENUE STABILITY CHARGES

WHEREAS, the City of Corona (the "City"), through its Department of Water and Power ("DWP"), is charged with providing a continuous and adequate supply of safe and potable water and with developing and encouraging the use of reclaimed or recycled water to supplement existing potable water supplies, which services are funded primarily by the revenue derived from potable and reclaimed water service fees; and

WHEREAS, Chapters 13.14 and 13.28 of the Corona Municipal Code ("CMC") require that the City Council establish the rates for providing potable and reclaimed water services; and

WHEREAS, DWP engaged the services of Raftelis Financial Consultants, Inc. ("Raftelis") to perform an independent rate study to evaluate the infrastructure needs, programs and operations and maintenance costs of the City's potable and reclaimed water systems and the rates necessary to recover the costs of providing for those services for the next five years; and

WHEREAS, based upon the analysis in the rate study, it has been determined that increases in the rates for the City's potable and reclaimed water service charges are necessary to enable the City to recover current and projected costs of operations and maintenance and capital infrastructure improvements needed to repair and update the City's aging water and reclaimed water systems, maintain the operational and financial stability of the utility, comply with State mandated regulatory requirements, meet and comply with annual debt service requirements, avoid operational deficits and further depletion of reserves, and provide an equitable allocation of the costs of providing service among the various customer classes; and

WHEREAS, Raftelis studied the impact that the multi-year statewide drought has had on water revenues and the consequential reduction in water use and developed rates for Temporary Revenue Stability Charges to ensure that there are stable revenues to fund utility

obligations going forward in the event that water use decreases during the current or future water shortages that may occur; and

WHEREAS, the proposed increases to the rates for the potable and reclaimed water service charges and the new Temporary Revenue Stability Charges ("TRSC") will allow the DWP to continue to provide safe, reliable drinking water to its customers; and

WHEREAS, DWP has experienced and anticipates additional inflationary increases to the costs to operate and maintain the City's potable water and reclaimed water systems (the "Systems") and to provide ongoing repairs, replacements, and upgrades to the Systems; and

WHEREAS, without the proposed rate increases and TRSC DWP would experience budget shortfalls for each year of the five-year forecast performed by Raftelis in the rate study; and

WHEREAS, California Constitution Article X, Section 2 and California Water Code Section 100 provide that because of conditions prevailing in the State of California, it is the declared policy of the State that the general welfare requires that the water resources of the State shall be put to beneficial use to the fullest extent of which they are capable, the waste or unreasonable use of water shall be prevented, and the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and the public welfare; and

WHEREAS, pursuant to California Water Code Section 106, it is the declared policy of the State that the use of water for domestic use is the highest use of water and that the next highest use is for irrigation; and

WHEREAS, pursuant to Ordinance No. 3025, the City Council previously adopted a Budget Based Water Rate Structure to implement a system of tiered water rates and charges based upon customer water budgets intended to (i) promote efficient water use and resource conservation; and (ii) proportionately allocate the cost of providing water service; and

WHEREAS, water budgets for residential customers, which have five tiers and includes a budget for indoor and outdoor use, are determined on the basis of individual household factors, such as the number of people per household, the size of the irrigated

landscaped area, the amount of water a typical household requires each month for indoor and outdoor use, actual daily water lost to the atmosphere by plants (evapotranspiration) and an evapotranspiration area factor ("ETAF"); and

WHEREAS, water budgets for commercial, industrial, institutional and governmental customers with non-dedicated irrigation meters are determined on the basis of each customer's average water use during the last three years and water budgets for commercial, industrial, institutional and governmental customers with dedicated irrigation meters are determined in the same manner as residential customers; and

WHEREAS, the rate structure for the City's monthly water service fees include the following components: (1) a Ready-to-Serve Charge imposed on residential, non-residential and reclaimed water customers that is based on the size of the water meter serving the property; (2) a variable potable water Commodity Charge that is determined on the basis of the number of units of water delivered to the property; and (3) a reclaimed water Commodity Charge that is determined on the basis of the number of units of reclaimed water delivered to the property. The rate increases adopted by this Ordinance would impact both the Ready-to-Serve Charge and the Commodity Charge components of the water service fees and the reclaimed water fees; and

WHEREAS, the rate structure for the fire protection customers, which includes customers who are required as a condition of extending or initiating water service to install a private fire suppression system on their property and customers who have requested the delivery of water to the property for the purpose of fire service protection, is comprised of two components: (1) a variable fire protection Commodity Charge that is determined on the basis of the number of units of water delivered to a fire protection customer through the City's potable water system; and (2) a fixed Fireline Charge that is determined on the basis of the size of the fireline (in inches) through which water is delivered; and

WHEREAS, based upon the rate study prepared by Raftelis, it has been determined that the water budget tiers should be modified: (1) to reduce the efficient indoor water use standard from 60 gallons per person per day to 55 gallons per person per day to reflect the State's water use efficiency goals; (2) to reduce the ETAF from 114% to 80% to reflect the water needs of the specific type of plant mixes and irrigation efficiency as established in recently

revised State water efficient landscape and irrigation guidelines; and (3) to revise the tier definitions as follows: inefficient use revised to 1%-50% over water budget (increased from 1%-20%), excessive use revised to 51%-100% over water budget (increased from 21%-40%), and wasteful use revised to greater than 100% over water budget (increased from 40%); and

WHEREAS, the rates adopted by this Ordinance have been calculated to meet the cost to the City of providing the services for which the rates and fees are imposed, without generating revenue that exceeds the funds required to provide the services, and without exceeding the proportional cost of service attributable to each customer; and

WHEREAS, the revenues derived from the rates adopted by this Ordinance will not exceed the funds required to provide the services for which the rates and charges are imposed and shall be used exclusively for maintenance and operation of the Systems and the provision of potable water and reclaimed water services; and

WHEREAS, the rates adopted by this Ordinance will not exceed the proportional cost of the services attributable to each parcel upon which they are imposed; and

WHEREAS, the rates adopted by this Ordinance will not be imposed on a parcel unless the services for which the rates and fees are imposed are actually used by, or immediately available to, the owner of the parcel; and

WHEREAS, the City, as the lead agency under the California Environmental Quality Act ("CEQA"), in consultation with the City's Legal Counsel, prepared a Preliminary Exemption Assessment for the adoption of this Ordinance in order to evaluate its potential impacts. The City determined that this Ordinance is exempt from CEQA review under Public Resources Code section 21080(b)(8) and State CEQA Guidelines section 15273 because the rates adopted by this Ordinance are necessary and reasonable to fund the administration, operation, maintenance, and improvements of the Systems and will not result in the expansion of the Systems; and

WHEREAS, pursuant to California Constitution article XIII D, section 6 ("Article XII D") at least 45 days prior to the public hearing on the proposed increase in the potable water service fees or the reclaimed water service fees, the City provided written notice (the "Notice") by mail to the record owner of each parcel upon which the rates and charges are

proposed for imposition and any tenant directly liable for payment of the rates and charges, which Notice included the following information: (1) the amount of the rates and charges proposed to be imposed on each parcel; (2) the basis upon which the rates and charges were calculated; (3) the reason for the rates and charges; and (4) the date, time and location of a public hearing on the proposed rates and charges; and

WHEREAS, on December 4, 2019, the City Council held a duly noticed public hearing at which all persons wishing to testify in connection with the proposed increase in the potable water service fees and the reclaimed water service fees were heard and all protests against the proposed rates and fees were considered; and

WHEREAS, at the close of the hearing, the City Council determined that the City did not receive written protests against the establishment and imposition of the proposed rate increases for the potable water service fees or the reclaimed water service fees from a majority of the affected property owners or tenants directly liable for the payment of such fees.

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF CORONA, CALIFORNIA, DOES ORDAIN AS FOLLOWS:

SECTION 1. The City Council finds and determines that the foregoing Recitals are true and correct and incorporates the Recitals herein.

SECTION 2. As the decision-making body for the City, the City Council has reviewed and considered the information contained in the Preliminary Exemption Assessment and administrative record. The City Council finds that the Preliminary Exemption Assessment contains a complete and accurate reporting of the environmental impacts associated with the adoption of this Ordinance and reflects the independent judgment of the City Council.

SECTION 3. The City Council hereby finds that the administration, operation, maintenance, and improvements of the Systems, which are to be funded by the potable water service fees and the reclaimed water service fees set forth herein, are necessary to maintain service within the City's existing service area. The City Council further finds that the administration, operation, maintenance, and improvements of the Systems, to be funded by the potable water service fees and the reclaimed water service fees set forth herein, will not expand the Systems. The City Council further finds that such potable water service fees and reclaimed

water service fees are necessary and reasonable to fund the administration, operation, maintenance, and improvements of the Systems. Based on these findings, the City Council hereby determines that this Ordinance is exempt from the requirements of CEQA pursuant to California Public Resources Code section 21080(b)(8) and State CEQA Guidelines section 15273(a).

SECTION 4. The documents and materials that constitute the record of proceedings on which these findings have been based are located at City of Corona, 400 S. Vicentia Avenue, Corona, California 92882. The custodian for these records is the City Clerk of the City.

SECTION 5. The City Council hereby authorizes and establishes, by not less than a two-thirds (2/3) vote, the rates and charges for the City's potable water service fees, including, without limitation, the fees imposed upon fire protection customers, the City's reclaimed water service fees, and the rates and charges for the TRSC, as set forth in Exhibit "A," attached hereto and incorporated herein by reference, which rates and charges will be effective on February 16, 2020, with scheduled annual rate increases effective on January 1, 2021, January 1, 2022, January 1, 2023 and January 1, 2024. The City Council further authorizes and approves the modifications to the Budget Based Water Rate Structure adopted pursuant to Ordinance No. 3025 as set forth in Exhibit "A". Such rates and charges and modifications to the Budget Based Water Rate Structure shall be in effect beginning February 16, 2020.

SECTION 6. The City Council hereby authorizes and directs the DWP General Manager to implement and take all actions necessary to effectuate the rates adopted by this Ordinance and to file a Notice of Exemption with the County Clerk for Riverside County within five (5) working days of the date of the adoption of this Ordinance.

SECTION 7. If any section, subsection, subdivision, sentence, clause, or phrase in this Ordinance or any part thereof is for any reason held to be unconstitutional or invalid, ineffective by any court of competent jurisdiction, such decision shall not affect the validity or effectiveness of the remaining portions of this Ordinance or any part thereof. The City Council hereby declares that it would have adopted each section irrespective of the fact that any one or

more subsections, subdivisions, sentences, clauses, or phrases be declared unconstitutional, invalid, or ineffective.

SECTION 8. This Ordinance shall supersede all other previous City Council resolutions and ordinances that may conflict with, or be contrary to, this Ordinance.

SECTION 9. In accordance with California Government Code section 36933(a), within fifteen days after its passage the City Clerk shall cause this Ordinance to be published at least once, with the names of those City Council members voting for or against it, in a newspaper of general circulation published and circulated within the City. If there is no such newspaper, the City Clerk shall cause the Ordinance to be posted in at least three public places in the City or published in a newspaper of general circulation printed and published in the county and circulated in the City.

SECTION 10. This Ordinance shall become effective thirty (30) days from and after its final passage.

PASSED, APPROVED AND ADOPTED this 15th day of January, 2020.

_____
Mayor of the City of Corona, California

ATTEST:

_____
City Clerk of the City of Corona, California

CERTIFICATION

I, Sylvia Edwards, City Clerk of the City of Corona, California, do hereby certify that the foregoing Ordinance was regularly introduced at a regular meeting of the City Council of the City of Corona, California, duly held the 4th day of December, 2019 and thereafter adopted at a regular meeting thereof held on the 15th day of January, 2020, by the following vote:

AYES:

NOES:

ABSTAINED:

ABSENT:

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the City of Corona, California, this 15th day of January, 2020.

_____

City Clerk of the City of Corona, California

(SEAL)

EXHIBIT "A"

RATES AND CHARGES FOR POTABLE WATER SERVICE FEES AND RECLAIMED WATER SERVICE FEES

Potable Water Budget Tier Modifications
Residential Customers

Water Budget Factors	Current	Proposed
Gallons per capita per day (GPCD)	60	55
Evapotranspiration Area Factor (ETAF)	114%	80%
Inefficient Use Definition	1%-20% over water budget	1%-50% over water budget
Excessive Use	21-40% over water budget	51-100% over water budget
Wasteful Use	Greater than 40% over water budget	Greater than 100% over water budget

Potable and Reclaimed Water Budget Tier Modifications
Non-Residential and Reclaimed Water Customers

Water Budget Factors	Current	Proposed
Evapotranspiration Area Factor (ETAF)	114%	80%
Inefficient Use Definition	1%-20% over water budget	1%-50% over water budget
Excessive Use	21-40% over water budget	51-100% over water budget
Wasteful Use	Greater than 40% over water budget	Greater than 100% over water budget

Current and Proposed Rates for Potable Water Commodity Charges ($/CCF)
Residential Customers

Tier	Tier Width Definition	Current	Feb. 16, 2020	Jan. 1, 2021	Jan. 1, 2022	Jan. 1, 2023	Jan. 1, 2024
1	Water use up to efficient indoor water budget	$2.10	$1.57	$1.65	$1.74	$1.83	$1.93
2	Water use up to efficient outdoor water budget	$2.33	$2.26	$2.38	$2.50	$2.63	$2.77
3	Water use 1%-50% over water budget (Indoor+Outdoor)	$3.17	$4.49	$4.72	$4.96	$5.21	$5.48
4	Water use 51%-100% over water budget (Indoor+Outdoor)	$6.35	$7.48	$7.86	$8.26	$8.68	$9.12
5	Water use greater than 100% over water budget (Indoor+Outdoor)	$11.64	$11.17	$11.73	$12.32	$12.94	$13.59

Current and Proposed Rates for Potable Water Commodity Charges ($/CCF)
Non-Residential Customers

Tier	Definition	Current	Feb. 16 2020	Jan. 1, 2021	Jan. 1, 2022	Jan. 1, 2023	Jan. 1, 2024
1	Water use up to efficient water budget	$2.33	$2.26	$2.38	$2.50	$2.63	$2.77
2	Water use 1%-50% over water budget	$3.17	$4.49	$4.72	$4.96	$5.21	$5.48
3	Water use 51%-100% over water budget	$6.35	$7.48	$7.86	$8.26	$8.68	$9.12
4	Water use greater than 100% over water budget	$11.64	$11.17	$11.73	$12.32	$12.94	$13.59

Current and Proposed Rates for Potable Water Commodity Charges ($/CCF)
Non-Residential Customers with Dedicated Irrigation Meters

Tier	Definition	Current	Feb. 16, 2020	Jan. 1, 2021	Jan. 1, 2022	Jan. 1, 2023	Jan. 1, 2024
1	Water use up to efficient outdoor water budget	$2.33	$2.26	$2.38	$2.50	$2.63	$2.77
2	Water use 1%-50% over water budget (Indoor+Outdoor)	$3.17	$4.49	$4.72	$4.96	$5.21	$5.48
3	Water use 51%-100% over water budget (Indoor+Outdoor)	$6.35	$7.48	$7.86	$8.26	$8.68	$9.12
4	Water use greater than 100% over water budget (Indoor+Outdoor)	$11.64	$11.17	$11.73	$12.32	$12.94	$13.59

Current and Proposed Rates for Potable Water Monthly Ready-to-Serve Charges ($/Meter Size in Inches)
Residential and Non-Residential

Meter Size	Current	Feb. 16, 2020	Jan. 1, 2021	Jan. 1, 2022	Jan. 1, 2023	Jan. 1, 2024
5/8”	$19.23	$22.28	$23.40	$24.57	$25.80	$27.09
3/4”	$25.23	$29.98	$31.48	$33.06	$34.72	$36.46
1”	$36.09	$45.38	$47.65	$50.04	$52.55	$55.18
1 1/2”	$62.90	$83.88	$88.08	$92.49	$97.12	$101.98
2”	$91.80	$130.08	$136.59	$143.42	$150.60	$158.13
3”	$156.91	$276.38	$290.20	$304.71	$319.95	$335.95
4”	$241.02	$491.98	$516.58	$542.41	$569.54	$598.02
6”	$442.64	$1,238.88	$1,300.83	$1,365.88	$1,434.18	$1,505.89
8”	$651.04	$2,162.88	$2,271.03	$2,384.59	$2,503.82	$2,629.02
10”	$651.04	$3,240.88	$3,402.93	$3,573.08	$3,751.74	$3,939.33

Current and Proposed Rates for Fire Protection Commodity Charges ($/CCF)
Fire Protection Customers

Current	Feb. 16, 2020	Jan. 1, 2021	Jan. 1, 2022	Jan. 1, 2023	Jan. 1, 2024
$3.17	$5.40	$5.67	$5.96	$6.26	$6.58

Current and Proposed Rates for Reclaimed Water Commodity Charges ($/CCF)
Reclaimed Water Customers

Tier	Definition	Current	Feb. 16, 2020	Jan. 1, 2021	Jan. 1, 2022	Jan. 1, 2023	Jan. 1, 2024
1	Water use up to efficient water budget	$1.51	$1.65	$1.79	$1.94	$2.03	$2.14
2	Water use up to 1%-50% over water budget	$2.27	$2.47	$2.70	$2.91	$3.06	$3.21
3	Water use up to 51%-100% over water budget	$3.02	$3.29	$3.59	$3.88	$4.07	$4.27
4	Water use greater than 100% over water budget	$4.53	$4.94	$5.38	$5.81	$6.10	$6.41

Current and Proposed Rates for Reclaimed Water Monthly Ready-to-Serve Charges ($/Meter Size in Inches)
Reclaimed Water Customers

Meter Size	Current	Feb. 16 2020	Jan. 1, 2021	Jan. 1, 2022	Jan. 1, 2023	Jan. 1, 2024
5/8”	$18.90	$18.12	$19.75	$21.33	$22.40	$23.52
3/4”	$24.79	$23.74	$25.88	$27.95	$29.34	$30.81
1”	$35.46	$34.97	$38.12	$41.17	$43.23	$45.39
1 1/2”	$61.79	$63.06	$68.74	$74.23	$77.95	$81.84
2”	$90.18	$96.77	$105.48	$113.92	$119.61	$125.59
3”	$154.12	$203.51	$221.83	$239.57	$251.55	$264.13
4”	$236.76	$360.81	$393.28	$424.75	$445.98	$468.28
6”	$434.82	$905.74	$987.26	$1,066.24	$1,119.55	$1,175.53
8”	$639.52	$1,579.89	$1,722.08	$1,859.85	$1,952.84	$2,050.48
10”	$639.52	$2,366.39	$2,579.37	$2,785.71	$2,925.00	$3,071.25

Current and Proposed Rates for Monthly Fireline Charges ($/Fireline Size in Inches) Fire Protection Customers

Fireline Size	Current	Feb. 16, 2020	Jan. 1, 2021	Jan. 1, 2022	Jan. 1, 2023	Jan. 1, 2024
5/8”	$16.25	$7.06	$7.42	$7.80	$8.19	$8.60
3/4”	$16.25	$7.06	$7.42	$7.80	$8.19	$8.60
1”	$16.25	$7.06	$7.42	$7.80	$8.19	$8.60
1 1/2”	$16.25	$7.06	$7.42	$7.80	$8.19	$8.60
2”	$16.25	$7.99	$8.40	$8.82	$9.27	$9.74
2 1/2”	$21.50	$8.88	$9.33	$9.80	$10.29	$10.81
4”	$42.75	$13.78	$14.47	$15.20	$15.96	$16.76
6”	$78.25	$26.92	$28.27	$29.69	$31.18	$32.74
8”	$115.25	$49.58	$52.06	$54.67	$57.41	$60.29
10”	$152.00	$83.66	$87.85	$92.25	$96.87	$101.72

Proposed Rates for Temporary Revenue Stability Charges (TRSC) ($/CCF)

Water Conservation Stages	Water Reduction Target	TRSC ($/CCF)
Stage 1	0%	N/A
Stage 2	10-15%	N/A
Stage 3	16-20%	$0.15
Stage 4	21-40%	$0.45
Stage 5	>40%	$0.84

CITY OF CORONA

Courtesy Reminder Rate Change Year 2



On January 15, 2020, the City Council adopted Ordinance No. 3309 approving the water rates and charges that went into effect on February 16, 2020, with scheduled annual rate increases effective on January 1, 2021, January 1, 2022, January 1, 2023 and January 1, 2024. As such, effective January 1, 2021, the Ready-To-Serve and commodity rates will change. For any questions, contact us at (951) 736-2321 or by e-mail at CustomerCare@CoronaCA.gov.

POTABLE

Ready-To-Serve Monthly Charges

Meter Size	Current	Effective Jan. 1, 2021
5/8"	$22.28	$23.40
3/4"	$29.98	$31.48
1"	$45.38	$47.65
1½"	$83.88	$88.08
2"	$130.08	$136.59
3"	$276.38	$290.20
4"	$491.98	$516.58
6"	$1,238.88	$1,300.83
8"	$2,162.88	$2,271.03
10"	$3,240.88	$3,402.93

Residential Per Unit Tiered Rates

Tier	Current	Effective Jan. 1, 2021
1	$1.57	$1.65
2	$2.26	$2.38
3	$4.49	$4.72
4	$7.48	$7.86
5	$11.17	$11.73

Non-residential Per Unit Tiered Rates

Tier	Current	Effective Jan. 1, 2021
1	$2.26	$2.38
2	$4.49	$4.72
3	$7.48	$7.86
4	$11.17	$11.73

RECLAIMED

Ready-To-Serve Monthly Charges

Meter Size	Current	Effective Jan. 1, 2021
5/8"	$18.12	$19.75
3/4"	$23.74	$25.88
1"	$34.97	$38.12
1½"	$63.06	$68.74
2"	$96.77	$105.48
3"	$203.51	$221.83
4"	$360.81	$393.28
6"	$905.74	$987.26
8"	$1,579.89	$1,722.08
10"	$2,366.39	$2,579.37

Per Unit Tiered Rates

Tier	Current	Effective Jan. 1, 2021
1	$1.65	$1.79
2	$2.47	$2.70
3	$3.29	$3.59
4	$4.94	$5.38

FIRELINE

Ready-To-Serve Monthly Charges

Meter Size	Current	Effective Jan. 1, 2021
5/8"	$7.06	$7.42
3/4"	$7.06	$7.42
1"	$7.06	$7.42
1½"	$7.06	$7.42
2"	$7.99	$8.40
2½"	$8.88	$9.33
4"	$13.78	$14.47
6"	$26.92	$28.27
8"	$49.58	$52.06
10"	$83.66	$87.85

Per Unit Rate

Current	Effective Jan. 1, 2021
$5.40	$5.67

CONTACT US

(951) 736-2321

CustomerCare@CoronaCA.gov

www.CoronaCA.gov/DWP

CITY OF CORONA
Recordatorio de Cortesía
Cambio de Tarifa Año 2



El 15 de enero de 2020, el Concejo Municipal adoptó la Ordenanza No. 3309 aprobando las tarifas y cargos de agua que entraron en vigencia el 16 de febrero de 2020, con aumentos de tarifas anuales programados efectivos el 1 de enero de 2021, 1 de enero de 2022, 1 de enero de 2023 y 1 de enero de 2024. Por lo tanto, a partir del 1 de enero de 2021, el cargo fijo de preparacion por el servicio (cargo RTS) y el cargo variable por el servicio basico de agua potable y reciclada cambiaran. Si tiene alguna pregunta, contáctenos al (951) 736-2321 o por correo electrónico a CustomerCare@CoronaCA.gov.

AGUA POTABLE

Cargos mensuales de preparacion para el servicio

Tamaño de Medidor	Actual	Efectivo el 1 de enero de 2021
5/8"	$22.28	$23.40
3/4"	$29.98	$31.48
1"	$45.38	$47.65
1½"	$83.88	$88.08
2"	$130.08	$136.59
3"	$276.38	$290.20
4"	$491.98	$516.58
6"	$1,238.88	$1,300.83
8"	$2,162.88	$2,271.03
10"	$3,240.88	$3,402.93

Tarifas para los cargos basicos de agua por unidad (residencial)

Nivel	Actual	Efectivo el 1 de enero de 2021
1	$1.57	$1.65
2	$2.26	$2.38
3	$4.49	$4.72
4	$7.48	$7.86
5	$11.17	$11.73

Tarifas para los cargos basicos de agua por unidad (no residencial)

Nivel	Actual	Efectivo el 1 de enero de 2021
1	$2.26	$2.38
2	$4.49	$4.72
3	$7.48	$7.86
4	$11.17	$11.73

AGUA RECICLADA

Cargos mensuales de preparacion para el servicio

Tamaño de Medidor	Actual	Efectivo el 1 de enero de 2021
5/8"	$18.12	$19.75
3/4"	$23.74	$25.88
1"	$34.97	$38.12
1½"	$63.06	$68.74
2"	$96.77	$105.48
3"	$203.51	$221.83
4"	$360.81	$393.28
6"	$905.74	$987.26
8"	$1,579.89	$1,722.08
10"	$2,366.39	$2,579.37

Tarifas para los cargos basicos de agua por unidad

Nivel	Actual	Efectivo el 1 de enero de 2021
1	$1.65	$1.79
2	$2.47	$2.70
3	$3.29	$3.59
4	$4.94	$5.38

LINEA DE PREVENCION DE INCENDIOS

Cargos mensuales de preparacion para el servicio

Tamaño de Medidor	Actual	Efectivo el 1 de enero de 2021
5/8"	$7.06	$7.42
3/4"	$7.06	$7.42
1"	$7.06	$7.42
1½"	$7.06	$7.42
2"	$7.99	$8.40
2½"	$8.88	$9.33
4"	$13.78	$14.47
6"	$26.92	$28.27
8"	$49.58	$52.06
10"	$83.66	$87.85

Tarifas para los cargos basicos de agua por unidad

Actual	Efectivo el 1 de enero de 2021
$5.40	$5.67

CONTACTANOS

(951) 736-2321
CustomerCare@CoronaCA.gov
www.CoronaCA.gov/DWP

Appendix M – Ordinance 3005

ORDINANCE NO. 3005

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF CORONA, CALIFORNIA, ESTABLISHING RATES FOR WATER SERVICE FEES

WHEREAS, The City of Corona (the "City") Department of Water and Power ("DWP") purchases wholesale water from Western Municipal Water District ("WMWD") to supplement City water supplies and provide reliable water service to its customers; and

WHEREAS, in 2008, DWP purchased 46% of its customers' domestic water needs from WMWD; and

WHEREAS, effective January 1, 2009, WMWD approved an increase to the rates for its wholesale water (the "January Pass Through") and, on June 17, 2009, approved additional increases to its wholesale water rates and a Delta Surcharge (the "June Pass Through"); and

WHEREAS, beginning on September 4, 2009, the City has determined to raise the rates for its water service fees and pass through to DWP water customers: (1) the January Pass Through; (2) the June Pass Through; (3) any new charges established by WMWD and imposed on DWP; and (4) any other future rate increases to any of WMWD's charges, including wholesale water charges, that are imposed on DWP (collectively referred to herein as the "WMWD Pass Throughs"); and

WHEREAS, the City has further determined to authorize future rate increases due to WMWD Pass Throughs through September 3, 2014; and

WHEREAS, DWP has experienced and anticipates additional inflationary increases in the costs to operate and maintain the City's Water system (the "System") and to provide ongoing repairs, replacements, and upgrades to the System; and

WHEREAS, in order to avoid operational deficits, depletion of reserves, an inability to address infrastructure and water quality improvements, and to continue to provide a safe and reliable water supply, the City has determined to impose annual cost of living increases to the rates for its water service fees beginning on January 1, 2010 and each January 1 thereafter through January 1, 2015; and

WHEREAS, the rate structure for the City's monthly water service fees are comprised of two components: (1) a Readiness to Serve Charge, and (2) a Commodity Charge. The rate increases to the water service fees due to the WMWD Pass Throughs would impact the Commodity Charge component of the water service fees and the annual cost of living rate increases would impact both the Readiness to Serve and Commodity Charge components of the water service fees; and

WHEREAS, the City's rates for water service fees are calculated to recover the costs of the City in providing water services and to proportionately allocate those costs among the water customers; and

WHEREAS, the revenues derived from the water service fees will not exceed the funds required to provide water services and shall be used exclusively for the System; and

WHEREAS, the water service fees will not exceed the proportional cost of the services attributable to each parcel upon which they are imposed; and

WHEREAS, the water service fees will not be imposed on a parcel unless the water services are actually used by, or immediately available to, the owner of the parcel; and

WHEREAS, the City, as the lead agency under the California Environmental Quality Act ("CEQA"), in consultation with the City's Legal Counsel, prepared a Preliminary Exemption Assessment for the adoption of this Ordinance in order to evaluate its potential impacts. The City determined that this Ordinance is exempt from CEQA review under Public Resources Code section

21080(b)(8) and State CEQA Guidelines section 15273 because the Water Service Charges are necessary and reasonable to fund the administration, operation, maintenance, and improvements of the System and will not result in the expansion of the System; and

WHEREAS, California Constitution article XIII D, section 6 ("Article XIII D") requires that prior to imposing any increase to the water service fees, the City shall provide written notice (the "Notice") by mail of: (1) the proposed increases to such rates and charges to the record owner of each parcel upon which the rates and charges are proposed for imposition and any tenant directly liable for payment of the rates and charges; (2) the amount of the rates and charges proposed to be imposed on each parcel; (3) the basis upon which the rates and charges were calculated; (4) the reason for the rates and charges; and (5) the date, time, and location of a public hearing (the "Hearing") on the proposed rates and charges; and

WHEREAS, pursuant to Article XIII D such Notice is required to be provided to the affected property owners and any tenant directly liable for the payment of the rates and charges not less than forty-five days prior to the Hearing on the proposed rates and charges; and

WHEREAS, the City did provide such Notice to the affected property owners and tenants of the proposed Water Service Charges in compliance with Article XIII D; and

WHEREAS, the Hearing was held on this day, July 15, 2009; and

WHEREAS, at the Hearing the City Council heard and considered all oral testimony, written materials, and written protests concerning the establishment and imposition of the proposed rate increases for the water service fees, and at the close of the Hearing the City did not receive written protests against the establishment and imposition of the proposed rate increases for the water service fees from a majority of the affected property owners and tenants directly liable for the payment of the water service fees; and

WHEREAS, the City Council of the City now desires to establish and impose the proposed rates for the water service fees.

NOW THEREFORE, THE CITY COUNCIL OF THE CITY OF CORONA, CALIFORNIA, DOES ORDAIN AS FOLLOWS:

SECTION 1. The City Council finds and determines that the foregoing Recitals are true and correct and incorporates the Recitals herein.

SECTION 2. As the decision-making body for the City, the City Council has reviewed and considered the information contained in the Preliminary Exemption Assessment and administrative record. The City Council finds that the Preliminary Exemption Assessment contains a complete and accurate reporting of the environmental impacts associated with the adoption of this Ordinance and reflects the independent judgment of the Board.

SECTION 3. The City Council hereby finds that the administration, operation, maintenance, and improvements of the System, which are to be funded by the water service fees set forth herein, are necessary to maintain service within the City's existing service area. The City Council further finds that the administration, operation, maintenance, and improvements of the System, to be funded by the water service fees set forth herein, will not expand the System. The City Council further finds that such water service fees are necessary and reasonable to fund the administration, operation, maintenance, and improvements of the System. Based on these findings, the City Council hereby determines that this Ordinance is exempt from the requirements of CEQA pursuant to California Public Resources Code section 21080(b)(8) and State CEQA Guidelines section 15273(a).

SECTION 4. The documents and materials that constitute the record of proceedings on which these findings have been based are located at City of Corona, 400 S. Vicentia Avenue,

Corona, California 92882. The custodian for these records is the City Clerk of the City.

SECTION 5. Effective September 4, 2009, the City Council hereby authorizes the Commodity Charge Component of the City's water services fees be established and imposed at the rate of two dollars and six cents ($2.06) per hundreds of cubic feet of water.

SECTION 6. The City Council hereby authorizes the imposition of future rate increases to the Commodity Charge component of its water service fees required as a result of WMWD Pass Throughs. Such WMWD Pass Through rate increases may be imposed for a five-year period, beginning on September 4, 2009, through September 3, 2014. Provided, however, any increases to the rates for the Commodity Charge component of the water service fees as a result of WMWD Pass Throughs authorized pursuant to this Ordinance may not exceed 20% per year. Provided, further that in no event shall such rates be increased in any year as a result of the WMWD Pass Throughs by more than the cost of providing water service. Prior to implementing any such future rate increases, the DWP General Manager shall provide written notice of any such rate increases to DWP customers not less than 30 days prior to the effective date of the rate increases. Any such notice may be provided in the regular billing statements of DWP water customers.

SECTION 7. The City Council hereby authorizes the imposition of annual inflationary adjustments to the rates for the Commodity Charge and Readiness to Serve components of its water service fees for a five-year period, beginning on January 1, 2010, and each January 1 thereafter through January 1, 2015, by an amount not to exceed the greater of: (1) the annual percentage increase, if any, in the Consumer Price Index, all Urban Consumers, for the Los Angeles-Orange-Riverside County Area, as determined by the United States Department of Labor Statistics, or its successor ("CPI Increase"); or (2) 15% (the "Max O&M Increase"). The CPI Increase and the Max O&M Increase are referred to in this Ordinance as the "Cost of Living Increase." Provided, however, in no event shall such rates increase as a result of the Cost of Living Increase by more than the cost of providing water service. Prior to implementing any future rate increases as a result of a

Cost of Living Increase, the DWP General Manager shall provide written notice of any such rate increases to DWP customers not less than 30 days prior to the effective date of the rate increases. Any such notice may be provided in the regular billing statements of DWP water customers.

SECTION 8. The City Council hereby authorizes and directs the DWP General Manager to implement and take all actions necessary to effectuate the rates for the water service fees set forth herein and to file a Notice of Exemption with the County Clerk for Riverside County within five (5) working days of the date of the adoption of this Ordinance.

SECTION 9. If any section, subsection, subdivision, sentence, clause, or phrase in this Ordinance or any part thereof is for any reason held to be unconstitutional or invalid, ineffective by any court of competent jurisdiction, such decision shall not affect the validity or effectiveness of the remaining portions of this Ordinance or any part thereof. The City Council hereby declares that it would have adopted each section irrespective of the fact that any one or more subsections, subdivisions, sentences, clauses, or phrases be declared unconstitutional, invalid, or ineffective.

SECTION 10. This Ordinance shall supersede all other previous City council resolutions and ordinances that may conflict with, or be contrary to, this Ordinance.

SECTION 11. In accordance with California Government Code section 36933(a), within fifteen days after its passage the City Clerk shall cause this Ordinance to be published at least once, with the names of those City Council members voting for or against it, in a newspaper of general circulation published and circulated within the City. If there is no such newspaper, the City Clerk shall cause the ordinance to be posted in at least three public places in the City or published in a newspaper of general circulation printed and published in the county and circulated in the City.

SECTION 12. This ordinance shall become effective thirty (30) days from and after its final passage.

PASSED, APPROVED AND ADOPTED this 5th day of August, 2009.

Mayor of the City of Corona, California

ATTEST:

City Clerk of the City ~~of~~ Corona, California

CERTIFICATION

I, VICTORIA J. WASKO, City Clerk of the City of Corona, California, do hereby certify that the foregoing Ordinance was regularly introduced at an adjourned regular meeting of the City Council of the City of Corona, California, duly held on the 15th day of July, 2009, and thereafter at a regular meeting held on the 5th day of August, 2009, it was duly passed and adopted by the following vote of the Council:

AYES:	**MONTANEZ, NOLAN, SCOTT, SPIEGEL**
NOES:	**SKIPWORTH**
ABSENT:	**NONE**
ABSTAINED:	**NONE**

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the City of Corona, California, this 5th day of August, 2009.

City Clerk of the City of Corona, California

[SEAL]

SUMMARY

On August 5, 2009, the Corona City Council will consider adopting an ordinance establishing rates for water service fees. A certified copy of the full text of this proposed ordinance is posted in the City Clerk's Office.

The City Council meets at 7:00 p.m. in the Council Chambers in the Corona City Hall, located at 400 South Vicentia Avenue. The City Clerk's office is located in City Hall near the Council Chambers.

Appendix N – Ordinance 2962

ORDINANCE NO. 2962

AN ORDINANCE OF THE CITY OF CORONA, CALIFORNIA, PRESCRIBING WATER CONSERVATION RULES AND REGULATIONS, AMENDING CHAPTER 13.26 (WATER CONSERVATION) AND SECTION 1.08.021 OF THE CORONA MUNICIPAL CODE

WHEREAS, California Constitution article X, section 2 and California Water Code section 100 provide that because of conditions prevailing in the state of California (the "State"), it is the declared policy of the State that the general welfare requires that the water resources of the State shall be put to beneficial use to the fullest extent of which they are capable, the waste or unreasonable use of water shall be prevented, and the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and the public welfare; and

WHEREAS, pursuant to California Water Code section 106, it is the declared policy of the State that the use of water for domestic use is the highest use of water and that the next highest use is for irrigation; and

WHEREAS, pursuant to California Water Code section 375, the City of Corona (the "City") is authorized to adopt and enforce a water conservation program to reduce the quantity of water used by persons within its jurisdiction for the purpose of conserving the water supplies of the City; and

WHEREAS, on June 4, 2008, the Governor of the State proclaimed a condition of statewide drought and strongly encouraged local agencies to take aggressive, immediate action to reduce water consumption locally and regionally for the remainder of 2008 and prepare for potentially worsening conditions in 2009; and

WHEREAS, because of the prevailing conditions in the State, the current statewide drought, and the declared policy of the State, the City hereby finds and determines that it is necessary and appropriate for the City to adopt, implement, and enforce a water conservation program to reduce the quantity of water used by consumers within the City to ensure that there is sufficient water for human consumption, sanitation, and fire protection; and

WHEREAS, pursuant to California Water Code section 350 the City Council is authorized to declare a water shortage emergency to prevail within its jurisdiction when it finds and determines that the City will not be able to or cannot satisfy the ordinary demands and requirements of water consumers without depleting the water supply of the City to the extent that there would be insufficient water for human consumption, sanitation, and fire protection, and as more fully set forth in this chapter; and

WHEREAS, in the event the City determines that it is necessary to declare that a water shortage emergency exists, the City will be authorized pursuant to this chapter to implement certain drought response measures and a water conservation and regulatory program to regulate water consumption activities within the City and ensure that the water delivered in the City is put to beneficial use for the greatest public benefit, with particular regard to domestic use, including human consumption, sanitation, and fire protection, and that the waste or unreasonable use of water is prevented; and

WHEREAS, the City is authorized to prescribe and define by ordinance restrictions, prohibitions, and exclusions for the use of water during a threatened or existing water shortage and adopt and enforce a water conservation and regulatory program to: (i) prohibit the wastage of City water or the use of City water during such period; (ii) prohibit use of water during such periods for specific uses which the City may from time to time find nonessential; and (iii) reduce and restrict the quantity of water used by those persons within the City for the purpose of conserving the water supplies of the City; and

WHEREAS, the City hereby finds and determines that pursuant to the provisions of title 13, chapter 13.26 of the City of Corona Municipal Code, as hereby amended, the City shall: (i) implement water conservation and drought response measures; (i) regulate the water consumption activities of persons within the City for the purposes of conserving and protecting the City's water supplies, reducing the quantity of water consumed, and deterring and preventing the waste or unreasonable use or unreasonable method of use of valuable water resources; and (ii) establish and collect regulatory fees and impose fines and penalties as set forth herein to accomplish these purposes and recover the costs of the City's water conservation and regulatory program; and

WHEREAS, the City Council hereby finds and determines that it is desirable to codify the rules and regulations governing its actions, and the actions of persons using and consuming water within the City, particularly during declared water shortages and water shortage emergencies, to protect the general welfare and the City's water supplies, and to reduce water consumption in accordance with the declared policies and laws of the State.

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF CORONA, CALIFORNIA, DOES ORDAIN AS FOLLOWS:

Section 1. The City hereby finds and determines that the above recitals are true and correct and incorporated herein.

Section 2. Chapter 13.26 of the Corona Municipal Code is hereby amended in its entirety to read as follows:

Section 13.26.010 Findings and intent.

(A) The City Council finds and determines that because of the prevailing conditions in the State, and the declared policy of the State, it is necessary and appropriate for the city to adopt, implement, and enforce a water conservation program to reduce the quantity of water used by persons within the city to ensure that there is sufficient water for human consumption, sanitation, and fire protection. The City Council further finds and determines that during periods of drought, water shortages, and water shortage emergencies the general welfare requires that the city maximize the beneficial use of its available water resources to the extent that it is capable, and that the waste or unreasonable use, or unreasonable method of use of water shall be prevented and the conservation of water is to be extended with the view to the reasonable and beneficial use thereof in the interests of the people of the city and for the public health, safety, and welfare.

(B) This chapter establishes water conservation and drought response measures and regulations to be implemented during declared water conservation stages.

(C) This chapter establishes five stages of water conservation and drought response measures to be implemented by the city, with increasing restrictions on water use in response to decreasing water supplies and worsening drought conditions.

Section 13.26.020 Purpose and scope.

(A) The purposes of the water conservation provisions of this chapter 13.26 are to:

(1) protect the health, safety, and welfare of the citizens and property owners of the city;

(2) assure the maximum beneficial use of city water supplies; and

(3) attempt to provide sufficient water supplies to meet the basic needs of human consumption, sanitation, and fire protection.

(B) This chapter 13.26 is not intended to repeal, abrogate, annul, impair or in any way interfere with the free use of property by covenant, deed, or other private agreement or with restrictive covenants running with the land to which the city provides water services.

(C) The provisions of this chapter 13.26 shall apply to all persons within the city and all property served by the city wherever situated.

(D) Nothing in this chapter 13.26 is intended to affect or limit the ability of the city to respond to an emergency, including an emergency that affects the ability of the city to supply water.

Section 13.26.030 Definitions. For the purposes of this chapter 13.26, the following words, terms, and phrases shall have the following meanings:

(A) “Appellant” means the person appealing a decision of the approving authority, General Manager, or other designated city official for relief from the requirements of this chapter 13.26.

(B) “Approving authority” means the General Manager or his or her designee, charged with approving or denying written applications for relief.

(C) “Base year consumption amount” means the total amount of water delivered to the property of each customer in the prior fiscal year, as determined by the city.

(D) “Conservation offset” means the implementation of proven conservation techniques which, when installed, will result in a reduction equal to demand of the proposed use.

(E) "Enforcement officer" means any individual employed or otherwise charged by the city to inspect or enforce codes, ordinances, mandates, regulations, resolutions, rules or other laws adopted by the City Council or other regulatory bodies.

(F) “General Manager” means the General Manager of the Department of Water & Power or his or her authorized designee.

(G) “Person” means any natural person, firm, joint venture, joint stock company, partnership, public or private association, club, company, corporation, business trust, organization, public or private agency, government agency or institution, school district, college, university, any other user of water provided by the city, or the manager, lessee, agent, servant, officer or employee of any of them or any other entity which is recognized by law as the subject of rights or duties.

(H) “Potable water” means water which conforms to federal, state, and local standards for human consumption.

(I) “Property owner” or “owner” means the record owner of real property as shown on the most recently issued equalized assessment roll.

(J) “Recycled water” means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource.

(K) “Recycled water distribution system” means a piping system intended for the delivery of recycled water exclusively and which is separate from any potable water distribution system.

(L) “Relief” means excuse from compliance with the regulations and restrictions on water use contained in this chapter 13.26.

(M) "Responsible person" shall mean a natural person or legal entity who causes, maintains or allows a violation(s) of the city code to occur or continue by action or failure to act. A responsible person includes, but is not limited to, the owner, tenant, co-tenant, lessee, sub-lessee or other person with any right to possession of the property where a city code violation that is related to the use or condition of property occurs, the on-site manager who normally works daily at the site when the business is open and is responsible for the activities at such premises, and the owner, majority stockholders, corporate officers, trustees and general partners of a legal entity. There may be more than one responsible person for a violation.

(N) “State” means the state of California.

(O) “Water customer” or “customer” means a person who, according to the city’s records, receives water service to a parcel of property.

(P) “Water shortage emergency” means a condition existing within the city in which the ordinary water demands and requirements of persons within the city cannot be satisfied without depleting the water supply of the city to the extent that there would be insufficient water for human consumption, sanitation, and fire protection. A water shortage emergency includes both an immediate emergency, in which the city is unable to meet current water needs of persons within the city, as well as a threatened water shortage, in which the city determines that its supply cannot meet an increased future demand.

(Q) “Watering Window” means a period of time established by the city within a particular water conservation stage regarding allowed water usage for outdoor irrigation.

Section 13.26.040 Water Conservation and unreasonable uses of water.

(A) It is unlawful at any time for any person to make, cause, or use or permit the use of water from the city for residential, commercial, industrial, agricultural, governmental, or any other purpose in a manner contrary to any provision of this chapter 13.26, or in an amount in excess of that use permitted by the water conservation stages which are in effect pursuant to this chapter 13.26 or by action taken by the City Council in accordance with this chapter 13.26. The water conservation and drought response measures set forth in this Section 13.26.040 shall be in effect at all times.

(B) It is unlawful at any time for any person to waste water or to use it unreasonably. Unreasonable uses of water shall include, but are not limited to, the following practices:

(1) allowing water to leave a person's property by drainage onto adjacent properties or public or private roadways or streets due to excessive irrigation and/or uncorrected leaks;

(2) failing to repair a water leak; and

(3) using water to wash down sidewalks, driveways, parking areas, tennis courts, patios or other paved areas, except to alleviate immediate safety or sanitation hazards.

(C) A water conservation stage shall be determined in accordance with the provisions of this chapter 13.26. A water conservation stage shall remain in full force and effect until otherwise determined or discontinued by resolution of the City Council declaring that existing water supply conditions and the supply of water available for distribution within the city's service area has been replenished or augmented.

(D) The city may declare a water shortage emergency during any water conservation stage.

(E) During Water Conservation Stage 1, the water conservation and drought response measures of Water Conservation Stage 2 are voluntary and will be enforced through local and regional public education and awareness measures by the city.

(F) During Water Conservation Stages 2 through 5, the water conservation and drought response measures are mandatory and violations are subject to criminal, civil, and administrative penalties and remedies as specified in this chapter 13.26 and State law.

Section 13.26.050 Water Conservation Stage 1. – Normal Water Supply.

Water Conservation Stage 1 is also referred to as a "Normal Water Supply" and applies during periods when the city is able to meet all of the water demands of its customers. Water Conservation Stage 1 is in effect at all times unless the City Council otherwise declares that another water conservation stage is in effect pursuant to this chapter 13.26. Water is a limited natural resource and must be used efficiently and economically to meet the health and safety needs of the community. All normal water efficiency programs and water conservation regulations of the city, including the city's landscape design guidelines for commercial and industrial developments as may be adopted from time to time, will be in full force and effect during Water Conservation Stage 1.

Section 13.26.060 Water Conservation Stage 2. – Minimum Water Shortage.

(A) Water Conservation Stage 2 is also referred to as a "Minimum Water Shortage" and applies during periods when a reasonable probability exists that the city will not be able to meet all of the water demands of its customers. Water Conservation Stage 2 may be caused by, but is not limited to, any or all of the following circumstances or events:

(1) a regional water supply shortage exists and a regional public outreach campaign is being implemented asking or requiring all persons to reduce water use;

(2) groundwater wells are inoperable or unusable (such as by power outages, mechanical failure, or contamination);

(3) alternative water supplies are limited or unavailable; and

(4) groundwater levels or groundwater quality is approaching levels which may require augmentation of the groundwater basin or other actions necessary to protect the groundwater basin as prescribed by the California Department of Water Resources, the Department of Public Health, the State or Regional Water Quality Control Board, Riverside County, or some other regulatory body.

(B) The objective of the measures undertaken in Water Conservation Stage 2 is to reduce water system consumption within the city by ten to fifteen percent as determined and recommended by the General Manager.

(C) Except as otherwise provided in this Section 13.26.060, all water conservation and drought response measures of Water Conservation Stage 1 shall be in full force and effect during Water Conservation Stage 2. Upon declaration of a Water Conservation Stage 2 by the City Council, implementation by the city and publication of notice, the following water conservation and drought response measures shall apply:

(1) The city shall determine the base year consumption amount. Water customers shall reduce their water consumption by ten to fifteen percent, as determined and recommended by the General Manager, from the base year consumption amount for the duration of Water Conservation Stage 2. Provided, however, the base year consumption amount for any subsequent fiscal year shall be determined by the city as appropriate in the event that the city is required to continue the Water Conservation Stage 2 for more than twelve months.

(2) Lawns and/or ground covers may be watered and landscaping may be irrigated, including construction meter irrigation, for a maximum of twenty minutes per day only during the following designated watering windows and designated days:

(a) lawns and/or ground cover may be watered and landscaping may be irrigated for properties with odd number street addresses, parks, and the public right-of-ways, only on Saturdays, Mondays, and Wednesdays between the hours of 8:00 p.m. and 10:00 a.m.;

(b) lawns and/or ground cover may be watered and landscaping may be irrigated for properties with even number street addresses only on Sundays, Tuesdays, and Thursdays between the hours of 8:00 p.m. and 10:00 a.m.; and

(c) watering lawns and/or ground cover and irrigating landscaping is prohibited on Fridays and on any day of the week outside of the designated watering windows set forth in Section 13.26.060(C)(2)(a) and (b) hereof.

(3) All irrigation timers shall be adjusted to comply with the provisions of Section 13.26.060(C)(2) hereof.

(4) Notwithstanding the provisions of Section 13.26.060(C)(2), the use of recycled water to irrigate fruit trees, lawns and ground covers, and ornamental trees and shrubs is permitted on any day and at any time. Recycled water shall not be permitted to run into city streets or the city storm water conveyance system.

(5) All open hoses shall be equipped with automatic, positive, shut-off nozzles.

(6) All swimming pools, spas, ponds, and fountains shall be equipped with re-circulating pumps.

(7) All plumbing leaks, improperly adjusted sprinklers, or other water conduits/fixtures that require repair or adjustment shall be corrected to the satisfaction of the city.

(8) No person shall use water to wash down sidewalks, driveways, parking areas, tennis courts, patios, or other paved or hard surface areas, except to alleviate immediate fire or sanitation hazards.

(9) No person shall allow water to leave his or her property by drainage onto adjacent properties or public or private roadways or streets due to excessive irrigation and/or uncorrected leaks.

(10) The washing of automobiles, trucks, trailers, boats, airplanes and other types of mobile equipment, is permitted at any time with a hand-held bucket or a hand-held hose equipped with an automatic, positive, shut-off nozzle for quick rinses. Washing may be done at any time on the immediate premises of a commercial car wash or commercial service station, or by a mobile car wash or on-site car wash using high pressure washing equipment.

(11) Use of water from fire hydrants shall be limited to fire fighting, related activities, or other activities necessary to maintain the health, safety, and welfare of the public.

(12) All restaurants are prohibited from serving water to their patrons except when specifically requested by the patrons.

(13) Construction operations receiving water from a construction meter or water truck shall not use water unnecessarily for any purpose other than those required by regulatory agencies. Construction projects requiring watering for new landscaping materials shall adhere to the designated irrigation requirements set forth in Section 13.26.060(C)(2) hereof.

Section 13.26.070 Water Conservation Stage 3. - Moderate Water Shortage.

(A) Water Conservation Stage 3 is also referred to as a "Moderate Water Shortage" and applies during periods when the city will not be able to meet all of the water demands of its customers. Water Conservation Stage 3 may be caused by, but is not limited to, any or all of the following circumstances or events:

(1) a regional or statewide water supply shortage exists and a regional public outreach campaign is being implemented asking or requiring all persons to reduce water use;

(2) groundwater wells are inoperable or unusable (such as by power outages, mechanical failure, or contamination);

(3) alternative water supplies are limited or unavailable; and

(4) groundwater levels or groundwater quality is approaching levels which may require augmentation of the groundwater basin or other actions necessary to protect the groundwater basin as prescribed by the California Department of Water Resources, the Department of Public Health, the State or Regional Water Quality Control Board, Riverside County, or some other regulatory body.

(B) The objective of the measures undertaken in Water Conservation Stage 3 is to reduce water system consumption within the city by sixteen to twenty percent as determined and recommended by the General Manager.

(C) Except as otherwise provided in this Section 13.26.070, all water conservation and drought response measures of Water Conservation Stages 1 and 2 shall be in full force and effect during Water Conservation Stage 3. Upon declaration of a Water Conservation Stage 3 by the City Council, implementation by the city and publication of notice, the following water conservation and drought response measures shall apply:

(1) Water customers shall reduce their water consumption by sixteen to twenty percent, as determined and recommended by the General Manager, from the base year consumption amount for the duration of Water Conservation Stage 3. Provided, however, the base year consumption amount for any subsequent fiscal year shall be determined by the city as appropriate in the event that the city is required to continue the Water Conservation Stage 3 for more than twelve months.

(2) Lawns and/or ground cover may be watered and landscaping may be irrigated, including construction meter irrigation, for a maximum of twenty minutes per day only during the following designated watering windows and designated days:

(a) lawns and/or ground cover may be watered and landscaping may be irrigated for properties with odd number street addresses, parks, and public right-of-ways, only on Saturdays and Wednesdays between the hours of 8:00 p.m. and 10:00 a.m.;

(b) lawns and/or ground cover may be watered and landscaping may be irrigated for properties with even number street addresses only on Sundays and Thursdays between the hours of 8:00 p.m. and 10:00 a.m.; and

(c) watering lawns and/or ground cover and irrigating landscaping is prohibited on Mondays, Tuesdays and Fridays and on any day of the week outside of the designated water windows set forth in Section 12.26.070(C)(2)(a) and (b) hereof.

(3) Notwithstanding the provisions of Section 13.26.070(C)(2) hereof, the use of recycled water to irrigate fruit trees, lawns and ground covers, and ornamental trees and shrubs is permitted on any day and at any time. Recycled water shall not be permitted to run into city streets or the city storm water conveyance system.

(4) Irrigation timers shall be adjusted to comply with the provisions of Section 13.26.070(C)(2) hereof.

(5) The washing of automobiles, trucks, trailers, boats, airplanes and other types of mobile equipment is permitted only during the hours of 9:00 a.m. to 6:00 p.m. on Saturdays, Sundays, and Mondays with a hand-held bucket or a hand-held hose equipped with an automatic, positive, shut-off nozzle for quick rinses. Washing is permitted at any time on the immediate premises of a commercial car wash. The use of water by all types of commercial car washes not using partially reclaimed or recycled water shall be reduced in volume by an amount determined by the City Council. Further, such washings are exempt from these regulations where the health, safety, and welfare of the public is contingent upon frequent vehicle cleanings, such as garbage trucks and vehicles used to transport food and perishables.

(6) The overfilling of swimming pools and spas is prohibited. The filling or refilling of ponds, streams, and artificial lakes is prohibited.

(7) The operation of any ornamental fountain or similar structure is prohibited except for short periods of time to prevent damage.

(8) The number of new construction meters shall not exceed the number of currently authorized meters removed from service. A new meter shall be issued only when an old meter is returned. Construction projects requiring water from a construction meter or a water truck shall not use water unnecessarily for any purposes other than those required by

regulatory agencies. Construction projects requiring water for new landscapes shall adhere to the designated days and watering windows as set forth in Section 13.26.070(C)(2) hereof. Further, construction projects necessary to maintain the health, safety, and welfare of the public, as determined by the city, are exempt from these regulations.

Section 13.26.080 Water Conservation Stage 4. – Severe Water Shortage.

(A) Water Conservation Stage 4 is also referred to as a "Severe Water Shortage" and applies during periods when the city will not be able to meet all of the water demands of its customers. Water Conservation Stage 4 may be caused by, but is not limited to, any or all of the following circumstances or events:

(1) a regional or statewide water supply shortage exists and a regional public outreach campaign is being implemented asking or requiring persons to reduce water use;

(2) groundwater wells are inoperable or unusable (such as by power outages, mechanical failure, or contamination);

(3) alternative water supplies are limited or unavailable;

(4) groundwater levels or groundwater quality is approaching levels which may require augmentation of the groundwater basin or other actions necessary to protect the groundwater basin as prescribed by the California Department of Water Resources, California Department of Public Health, the Regional Water Quality Control Board, Riverside County, or some other regulatory body; and

(5) a major failure of any supply or distribution facility, whether temporary or permanent, occurs in the water distribution system of the State, the Metropolitan Water District of Southern California, the Western Municipal Water District, or city water facilities.

(B) The objective of the measures undertaken in Water Conservation Stage 4 is to reduce water consumption within the city by twenty-one to forty percent as determined and recommended by the General Manager.

(C) Except as otherwise provided in this Section 13.26.080, all water conservation and drought response measures of Water Conservation Stages 1, 2, and 3 shall be in full force and effect during Water Conservation Stage 4. Upon declaration of a Water Conservation Stage 4 by the City Council, implementation by the city and publication of notice, the following water conservation and drought response measures shall apply:

(1) Water customers shall reduce their water consumption by twenty to forty percent from the base year consumption amount for the duration of the Water Conservation Stage 4. Provided, however, the base year consumption amount for subsequent

fiscal years shall be determined by the city as appropriate in the event that the city is required to continue the Water Conservation Stage 4 for more than twelve months.

(2) Irrigation of landscaping shall be limited to supporting minimal survival of trees and shrubs. Landscaping may be irrigated, including construction meter irrigation, for a maximum of twenty minutes per day only during the following designated watering windows and designated day:

(a) properties with odd number street addresses, parks, and public right of ways may irrigate landscaping only on Saturdays between the hours of 8:00 p.m. and 10:00 a.m.;

(b) properties with even number street addresses may irrigate landscaping and pastures only on Sundays between the hours of 8:00 p.m. and 10:00 a.m.; and

(c) irrigating landscaping is prohibited on Mondays, Tuesdays, Wednesdays, Thursdays, and Fridays and outside the designated watering windows set forth in Section 13.26.080(C)(2)(a) and (b).

(3) Notwithstanding the provisions of Section 13.26.080(C) hereof, the use of recycled water to irrigate fruit trees, lawns and ground covers, and ornamental trees and shrubs is permitted on any day and at any time. Recycled water shall not be permitted to run into city streets or the city storm water conveyance system.

(4) All outdoor watering and irrigation of lawns and ground covers is prohibited with the exception of plant materials classified and determined by the City Manager to be rare, exceptionally valuable, or essential to the well being of the public at large or rare animals, and for which relief has been otherwise granted pursuant to Section 13.26.150.

(5) The washing of automobiles, trucks, trailers, boats, airplanes and other types of mobile equipment is prohibited. Washing is permitted at any time on the immediate premises of a commercial car wash. Commercial car washes shall only use partially reclaimed or recycled water for washing automobiles, trucks, trailers, boats, airplanes and other types of mobile equipment. Further, such washings are exempt from these regulations where the health, safety and welfare of the public is contingent upon frequent vehicle cleanings, such as garbage trucks and vehicles used to transport food and perishables.

(6) The filling, refilling, or adding of water to swimming pools, spas, ponds, streams, and artificial lakes is prohibited.

(7) The operation of any ornamental fountain, pond, or similar structure is prohibited except for short periods of time to prevent damage.

(8) The use of water for cooling mists is prohibited.

(9) The use of water for commercial, manufacturing, or processing purposes shall be reduced in volume by an amount determined by the City Council and/or as recommended by the General Manager.

(10) No new construction meters will be issued. Construction water shall not be used for earth work, road construction purposes, dust control, compaction, or trenching jetting. Construction projects necessary to maintaining the health, safety, and welfare of the public, as determined by the city, are exempt from these regulations.

(11) Provided the City Council has declared a water shortage emergency pursuant to California Water Code sections 350 *et seq*., except as to property for which a building permit has been heretofore issued, no new building permit(s) shall be provided, except in the following circumstances:

(a) for projects necessary to protect the public's health, safety, and welfare, as determined by the city;

(b) when using recycled water;

(c) when the recipient of the building permit can demonstrate that no net increase in water use will occur; or

(d) where the recipient of the building permit provides a conservation offset. A conservation offset may be effected by paying a fee established by the city in an amount necessary to cover the cost of implementing conservation techniques or acquiring alternative water sources. The fee will be based on the conservation offset required for an equivalent dwelling unit. Such fee shall apply to residential as well as commercial and industrial buildings, and may be adjusted from time to time as determined by the city.

Section 13.26.090 Water Conservation Stage 5. – Critical Water Shortage.

(A) Water Conservation Stage 5 is also referred to as a "Critical Water Shortage" and applies during periods when the city will not be able to meet all of the water demands of its customers. Water Conservation Stage 5 may be caused by, but is not limited to, any or all of the following circumstances or events:

(1) a regional or statewide water supply shortage exists and a regional public outreach campaign is being implemented asking or requiring all persons to reduce water use;

(2) groundwater wells are inoperable or unusable (such as by power outages, mechanical failure, or contamination);

(3) alternative water supplies are limited or unavailable;

(4) groundwater levels or groundwater quality is approaching levels which may require augmentation of the groundwater basin or other actions necessary to protect the groundwater basin as prescribed by the California Department of Water Resources, California Department of Public Health, Regional Water Quality Control Board, Riverside County, or some other regulatory body; and

(5) a major failure of any supply or distribution facility, whether temporary or permanent, occurs in the water distribution system of the State, the Metropolitan Water District of Southern California, the Western Municipal Water District, or city water facilities and the city cannot meet all of the water demands of its customers.

(B) The objective of the measures undertaken in Water Conservation Stage 5 is to reduce water consumption by forty percent or more as determined and recommended by the General Manager.

(C) Except as otherwise provided in this Section 13.26.090, all water conservation and drought response measures of Water Conservation Stages 1, 2, 3, and 4 shall be in full force and effect during Water Conservation Stage 5. Upon declaration of a Water Conservation Stage 5 by the City Council, implementation by the city and publication of notice, the following water conservation and drought response measures shall apply:

(1) Water customers shall reduce their water consumption by forty-one percent or more from the base year consumption amount for the duration of Water Conservation Stage 5. Provided, however, the base year consumption amount for subsequent fiscal years shall be determined by the city as appropriate in the event that the city is required to continue the Water Conservation Stage 5 for more than twelve months.

(2) All outdoor watering and irrigation of lawns and ground cover, and landscaping is prohibited, with the exception of the use of recycled water to irrigate fruit trees, lawns and ground covers, and ornamental trees and shrubs, which is permitted on any day and at any time. Recycled water shall not be permitted to run into city streets or the city storm water conveyance system.

(3) Provided the City Council has declared a water shortage emergency pursuant to California Water Code sections 350 *et seq.*, the city shall not allow any new connections to the water system during Water Conservation Stage 5.

Section 13.26.100 Mandatory Conservation Phase Implementation.

(A) The General Manager, or his or her designee, shall monitor the projected supply and demand for water by its customers on a daily basis during periods of a water shortage or drought and shall recommend to the City Council the extent of the conservation required

through the implementation and/or termination of particular water conservation stages to prudently plan and supply water to its customers. Thereafter, the City Council may order the implementation or termination of the appropriate water conservation stage.

(B) The declaration of any stage beyond Water Conservation Stage 1 shall be made by the recommendation of the General Manager and resolution of the City Council. Within ten (10) days of the adoption of the resolution declaring the applicable Water Conservation Stage, the city shall make a public announcement of the applicable Water Conservation Stage, which shall be published a minimum of one (1) time for three (3) consecutive days in a daily newspaper of general circulation. Such declaration and notice shall provide the extent, terms, and conditions respecting the use and consumption of water in accordance with the applicable water conservation stage as provided in this chapter 13.26. Upon such declaration and publication of such notice, due and proper notice shall be deemed to have been given each and every person supplied water within the city. The water conservation stage designated shall become effective immediately upon announcement.

(C) The declaration of a water shortage emergency during any water conservation stage shall be made in accordance with California Water Code sections 350 *et seq.*

Section 13.26.110 Violations and remedies.

(A) It shall be unlawful for any person to willfully violate the provisions of this chapter 13.26. A violation of any of these provisions shall be a misdemeanor subject to imprisonment in the county jail for not more than thirty days or by fine not to exceed $1,000, or by both, as provided in California Water Code section 377.

(B) In addition to any remedies or enforcement measures provided by State law or in this chapter 13.26, any violation of this chapter 13.26 is subject to the provisions of chapters 1.08 and 1.09 of the Corona Municipal code.

(C) In addition to any other remedies provided in this Code or available under applicable law, the city can alternatively seek injunctive relief in the Superior Court or take enforcement action, including discontinuing or appropriately limiting water service to any customer, for violations of this chapter 13.26.

Section 13.26.120 Notices and additional enforcement measures.

(A) In addition to or in conjunction with the notice of violation provided pursuant to the provisions of chapter 1.08, for a first violation of any provision of this chapter 13.26, within two weeks of the violation:

(1) the city may send an enforcement officer or provide written notice to the property owner, customer, occupant, or responsible person of the property where the violation occurred to advise such person of:

(a) the water conservation stage then in effect and the provisions of this chapter 13.26 relating thereto;

(b) water conservation and drought response measures that are required and may be implemented pursuant to this chapter 13.26;

(c) possible consequences and actions which may be taken by the city for future violations of this chapter 13.26, including discontinuance of water service;

(d) penalties that may be imposed for the specific violation and any future violations of this chapter 13.26; and

(2) if the General Manager or his or her designee deems it to be appropriate, the city may order the installation of a flow-restricting device on the service line for any person who violates any term or provision of this chapter 13.26.

(B) In addition to or in conjunction with the notice of violation provided pursuant to the provisions of chapter 1.08, for a second or any subsequent violation of this chapter 13.26, within two weeks of the violation:

(1) the city may send an enforcement officer or provide written notice to the property where the violation occurred to notify the property owner, customer, occupant of the property, or responsible person where the violation occurred to advise such person of:

(a) the water conservation stage then in effect and the provisions of this chapter 13.26 relating thereto;

(b) the water conservation and drought response measures that are required and may be implemented by such person; and

(c) possible consequences, which may occur in the event of any future violations of this chapter 13.26;

(2) if the General Manager or his or her designee deems it to be appropriate, the city may order the installation of a flow-restricting device on the service line for any person who violates any term or provision of this chapter 13.26; and

(3) if the General Manager or his or her designee deems it to be appropriate, the city may discontinue water service at the location where the violation occurred.

(C) The city may, after one written notice of violation, order that a special meter reading or readings be made in order to ascertain whether wasteful or unreasonable use of water is occurring.

(D) All moneys collected under this Section 13.26.140 shall be deposited in a special account of the city and shall be made available for enforcement of this chapter 13.26.

(E) The city may, at its option, elect to petition the Superior Court to confirm any order establishing administrative penalties and enter judgment in conformity therewith in accordance with the provisions of Sections 1285 to 1287.6, inclusive, of the California Code of Civil Procedure.

Section 13.26.130 Civil actions.

(A) In addition to any other remedies provided in the Code, any violation of this chapter 13.26 may be enforced by civil action brought by the city.

(B) In any such action, the city may seek, and the court may grant, as appropriate, any or all of the following remedies:

(1) a temporary and/or permanent injunction;

(2) assessment of the violator for the costs of any investigation, which led to the establishment of the violation, and for the reasonable costs of preparing and bringing legal action under this Section 13.26.130;

(3) any other costs incurred in enforcing the provisions of this chapter 13.26; and

(4) any other action the city deems appropriate to protect the general welfare and the City's water supplies, and to reduce water consumption in accordance with this chapter 13.26 and the declared policies and laws of the State.

(c) Assessments under this subsection shall be paid to the city to be used exclusively for costs associated with implementing or enforcing the water conservation and regulatory provisions of this chapter 13.26.

Section 13.26.140 Recovery of costs.

(A) The General Manager or his or her designee shall serve an invoice for costs upon the person or responsible person who is subject to a notice of violation, a cease and desist order, or an administrative compliance order. An invoice for costs shall be immediately due and payable to the City. If any person or responsible person fails to either pay the invoice for costs or appeal successfully the invoice for costs in accordance with this chapter 13.26, then the City may institute collection proceedings. The invoice for costs may include reasonable attorneys' fees.

(B) The city shall impose any other penalties or regulatory fees, as fixed from time to time by resolution of the City Council, for a violation or enforcement of this chapter 13.26.

(C) In addition to the costs which may be recovered pursuant to Section 1.08.022 of the Code, and in order to recover the costs of the water conservation regulatory program set forth in this chapter 13.26, the City Council may, from time to time, fix and impose by resolution fees and charges. The fees and charges may include, but are not limited to, fees and charges for:

(1) any visits of a water conservation specialist, enforcement officer, or other city staff for time incurred for meter reading, follow-up visits, or the installation or removal of a flow-restricting device;

(2) monitoring, inspection, and surveillance procedures pertaining to enforcement of this chapter 13.26;

(3) enforcing compliance with any term or provision of this chapter 13.26;

(4) reinitiating service at a property where service has been discontinued pursuant to this chapter 13.26;

(5) processing any fees necessary to carry out the provisions of this chapter 13.26; and

(6) any other necessary and appropriate fees and charges to recover the cost of providing the city's water conservation regulatory program.

Section 13.26.150 Relief from compliance.

Consideration of written applications for relief from compliance ("relief") regarding the regulations and restrictions on water use set forth in this chapter 13.26 may be made by the city.

(A) Written applications for relief shall be accepted, and may be granted or denied, by the approving authority at his or her sole discretion. The application shall be in a form prescribed by the city and shall be accompanied by a non-refundable processing fee in an amount as determined by resolution of the City Council for the purpose of defraying the costs incidental to the review proceedings related thereto.

(B) The grounds for granting or conditionally granting an application for relief are:

(1) a customer has reduced water usage to the minimum feasible level but cannot reduce usage by the amount required by then-current mandatory water conservation stage declared pursuant to this chapter due to the number of people in the household or medical necessity, where "reduced water usage to the minimum feasible level" shall mean that the customer has installed xeriscaping or other low-water landscaping (or has ceased watering other types of landscaping), high efficiency water-using appliances, water-efficient toilets, water-saving faucet devices, and low-flow shower heads, and is complying in all other respects with the requirements of this chapter; or

(2) due to unique circumstances other than those described in subsection (1) above, a specific requirement of this chapter 13.26 would result in undue hardship to a person using city water or to property upon which city water is used, that is disproportionate to the impacts to other city water users generally or to similar property or classes of water users; or

(3) failure to grant a relief would adversely affect the health, sanitation, fire protection, or safety of the applicant or the public.

(C) The application for a relief shall be accompanied, as appropriate, with photographs, maps, drawings, and other information substantiating the applicant's request, including a statement of the applicant. Provided, however, the city may request such other additional information as it deems appropriate in order to process and/or review the application for relief.

(D) An application for a relief shall be denied unless the approving authority finds, based on the information provided in the application, supporting documentation, or such other additional information as may be requested, and on water use information for the property as shown by the records of the city, all of the following:

(1) That the relief does not constitute a grant of special privilege inconsistent with the limitations upon other city customers.

(2) That because of special circumstances applicable to the property or its use, comprising any of the circumstances set forth in subsection (B) of this section, the strict application of this chapter 13.26 would have a disproportionate impact on (a) the property or use that exceeds customers generally, or (b) the applicant's health that exceeds customers generally.

(3) That the authorization of such relief will not be of substantial detriment to adjacent properties, and will not materially affect the ability of the city to effectuate the purposes of this chapter 13.26 and will not be detrimental to the public interest.

(4) That the condition or situation of (a) the subject property or the intended use of the property for which the relief is sought is not common, recurrent, or general in nature, or (b) the applicant's health or safety is not common, recurrent, or general in nature.

(E) The denial or grant of a relief shall be acted upon within fifteen (15) business days of the submittal of the complete application, including any photographs, maps, drawings, and other information substantiating the applicant's request and the statement of the applicant. The application may be approved, conditionally approved, or denied, subject to subsection (G) of this section. The decision of the approving authority shall be prepared in writing, include terms and conditions, if any, set forth findings in support of the decision, and be promptly sent to the applicant.

(F) The denial of a request for a relief may be appealed in writing to the City Manager. An appeal shall be made in accordance with the following procedures:

(1) The appellant shall complete and submit in writing a form provided by the city for such purpose and shall state in such form the grounds for his or her appeal. The form shall be accompanied by a non-refundable processing fee in an amount as determined by resolution of the City Council for the purpose of defraying the costs incidental to the proceedings. All appeals shall be submitted to the City Clerk within thirty (30) calendar days of the date of the notice of the denial of the request for a relief.

(2) The City Manager, or his or her designee, shall review the appeal and any related information provided, and, if necessary, cause an investigation and report to be made concerning the request for a relief. The City Manager, or his or her designee, shall have fifteen (15) calendar days from the submission of the appeal to render a decision on whether to grant or deny the appeal and mail notice thereof to the appellant. The decision shall be prepared in writing, include terms and conditions, if any, and set forth findings in support of the decision.

(3) The decision of the City Manager, or his or her designee, may be appealed by the appellant to the City Council. Such appeal must be submitted in writing on the appropriate city form and filed with the City Clerk within fifteen (15) calendar days of the date of decision of the City Manager, or his or her designee. The form shall be accompanied by a non-refundable processing fee in an amount as determined by resolution of the City Council for the purpose of defraying the costs incidental to the proceedings. The City Council shall conduct a hearing on such appeal at its next regularly scheduled City Council meeting; provided, however, the City Council shall have received the notice of appeal at least fifteen (15) calendar days prior to such meeting. If the appeal is not submitted within at least fifteen (15) calendar days prior to a regularly scheduled City Council meeting, then the hearing shall be held at the following regularly scheduled City Council meeting. A notice of the hearing shall be mailed to the appellant at least ten (10) calendar days before the date fixed for the hearing. The City Council shall review the appeal de novo. The determination of the City Council shall be conclusive. Notice of the determination by the City Council shall be mailed to the appellant within ten (10) calendar days of such determination, indicate whether the appeal has been granted in whole or in part, set forth the terms and conditions of the relief, if any, granted to the appellant, and set forth findings in support of the decision. If the appeal is denied in its entirety, the appellant shall comply with all terms and conditions of this chapter 13.26 and the applicable water conservation stage then in effect.

(4) Until the conclusion of the appeal process, all provisions and decisions under appeal shall remain in full force and effect until the conclusion of the appeal process.

(G) Any grant of a request for relief shall be conditioned upon the continued existence of the facts and circumstances which formed the grounds for granting relief, as provided in this section. The approving authority may revoke any grant of relief if such facts and circumstances are determined no longer to exist.

Section 13.26.160 Water Conservation Programs.

(A) Subject to available funds, the City Manager, or his or her designee, is authorized to develop, promote, and administer water conservation programs to encourage and assist persons in conserving water. The water conservation programs may include, but are not limited to, the following:

(1) installing, or providing rebate programs for the installation of, water saving devices and irrigation systems in the landscaped areas of residential, commercial, industrial, and public property and public rights-of-way;

(2) replacing landscaping and turf with drought tolerant plant material and water efficient landscaping;

(3) developing educational programs to promote water conservation; and

(4) converting, where financially and technically feasible, potable water distribution systems to recycled water distribution systems for landscaped areas of residential, commercial, industrial, and public property and public rights-of way.

(B) The City Manager shall prepare and implement policies and procedures governing any water conservation program established pursuant to this Section 13.26.160.

(C) The City Manager is authorized to enter into agreements relating to such water conservation programs, provided such agreements are approved as to form by the City Attorney.

(D) The expenditure of funds for any water conservation program shall be subject to the provisions of Chapter 3.08, as applicable, and any other provisions of the Municipal Code restricting the expenditure of city funds.

Section 13.26.170 Conflicting Provisions.

If provisions of this chapter 13.26 are in conflict with each other, other provisions of the Code, any other resolution or ordinance of the city, or any State law or regulation, the more restrictive provisions shall apply.

Section 13.26.180 Severability.

If any provision, section, subsection, sentence, clause or phrase or sections of this chapter 13.26, or the application of same to any person or set of circumstances, is for any reason held to be unconstitutional, void or invalid, the invalidity of the remaining portions of sections of this chapter 13.26 shall not be affected, it being the intent of the City Council in adopting this chapter 13.26 that no portions, provisions, or regulations contained herein shall become inoperative, or fail by reason of the unconstitutionality of any other provision hereof, and all provisions of this chapter 13.26 are declared to be severable for that purpose.

Section 3. Section 1.08.021(C) of the Corona Municipal Code is hereby amended by adding subsection (29) to read:

(29) Chapter 13.26 (Water Conservation)

Section 4. The Mayor shall sign this Ordinance and the City Clerk shall attest thereto, and pursuant to California Water Code section 376, this Ordinance shall be effective immediately upon its adoption. Within ten (10) days after its adoption, the City Clerk shall cause this Ordinance to be published once pursuant to California Government Code section 6061 and California Water Code section 376 in full in a newspaper of general circulation which is printed, published, and circulated in the city.

ADOPTED this 7th day of January, 2009.

Karen Spiegel
Mayor of the City of Corona, California

ATTEST:

Victoria J. Wasko
City Clerk of the City of Corona, California

CERTIFICATION

I, VICTORIA J. WASKO, City Clerk of the City of Corona, California, do hereby certify that the foregoing Ordinance was regularly introduced at an adjourned regular meeting of the City Council of the City of Corona, California, duly held the 17th day of December, 2008, and thereafter at a regular meeting thereof held on the 7th day of January, 2009, it was duly passed and adopted by the following vote of the Council:

AYES:	**MONTANEZ, SCOTT, SKIPWORTH, SPIEGEL**
NOES:	**NONE**
ABSENT:	**NOLAN**
ABSTAINED:	**NONE**

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the City of Corona, California, this 7th day of January, 2009.

Victoria J. Wasko

City Clerk of the City of Corona, California

(SEAL)

SUMMARY

On January 7, 2009, the Corona City Council will consider adopting an Ordinance to establish water conservation rules and regulations, including authorizing the City Council to declare water conservation stages and water emergencies.

The City Council meets at 7:00 p.m. in the Council Chambers in the Corona City Hall, located at 400 South Vicentia Avenue. The City Clerk's office is located in City Hall near the Council Chambers.

Appendix O – Local Hazard Mitigation Plan

2023 - 2027

Local Hazard Mitigation Plan



City of Corona, CA

Corona Fire Department

Emergency Services Division

Contact Information

City of Corona

Name:	Lee Shin
Title:	Emergency Services Manager
Address:	735 Public Safety Way
City, State and Zip:	Corona, CA 92880
Direct Contact:	951-496-1299
Email:	lee.shin@coronaca.gov

PLAN ADOPTION AND RESOLUTION

The City of Corona will submit plans to the Riverside County Emergency Management Department (EMD) who will then forward the plans to the California Governor's Office of Emergency Services (Cal OES) for review prior to being submitted to the Federal Emergency Management Agency (FEMA). In addition, we will wait to receive an "Approval Pending Adoption" letter from FEMA before taking the plan to our local governing bodies for adoption. Upon approval, the City of Corona will insert the signed resolution into this publication.

EXECUTIVE SUMMARY

The purpose of this Local Hazard Mitigation Plan (LHMP) is to identify the City's hazards, review and assess past disaster occurrences, estimate the probability of future occurrences, and set goals to mitigate potential risks to reduce or eliminate long-term risks to preserve and protect life, property, and the environment from both natural and man-made hazards.

The plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 to achieve eligibility and potentially secure mitigation funding through FEMA's Flood Mitigation Assistance, Pre-Disaster Mitigation, and Hazard Mitigation Grant Programs.

Riverside County's continual efforts to maintain a disaster-mitigation strategy is on-going. Our goal as the City of Corona is to develop and maintain an all-inclusive plan to include all jurisdictions, special districts, businesses, and community organizations to promote consistency, continuity and unification throughout the county and city.

The County's planning process followed a methodology presented by FEMA and Cal OES which included conducting meetings with the Operational Area Planning Committee (OAPC) coordinated by Riverside County EMD comprised of participating Federal, State, Local, Tribal, and Territorial (SLTT)governmental bodies and local jurisdictions agencies, special districts, school districts, non-profit communities, universities, businesses, and public.

The plan identifies vulnerabilities, provides recommendations for prioritized mitigation actions, evaluates resources, identifies mitigation shortcomings, provides future mitigation planning, and maintenance of the existing plan.

The plan will be implemented upon FEMA approval.

THIS PAGE INTENTIONALLY LEFT BLANK

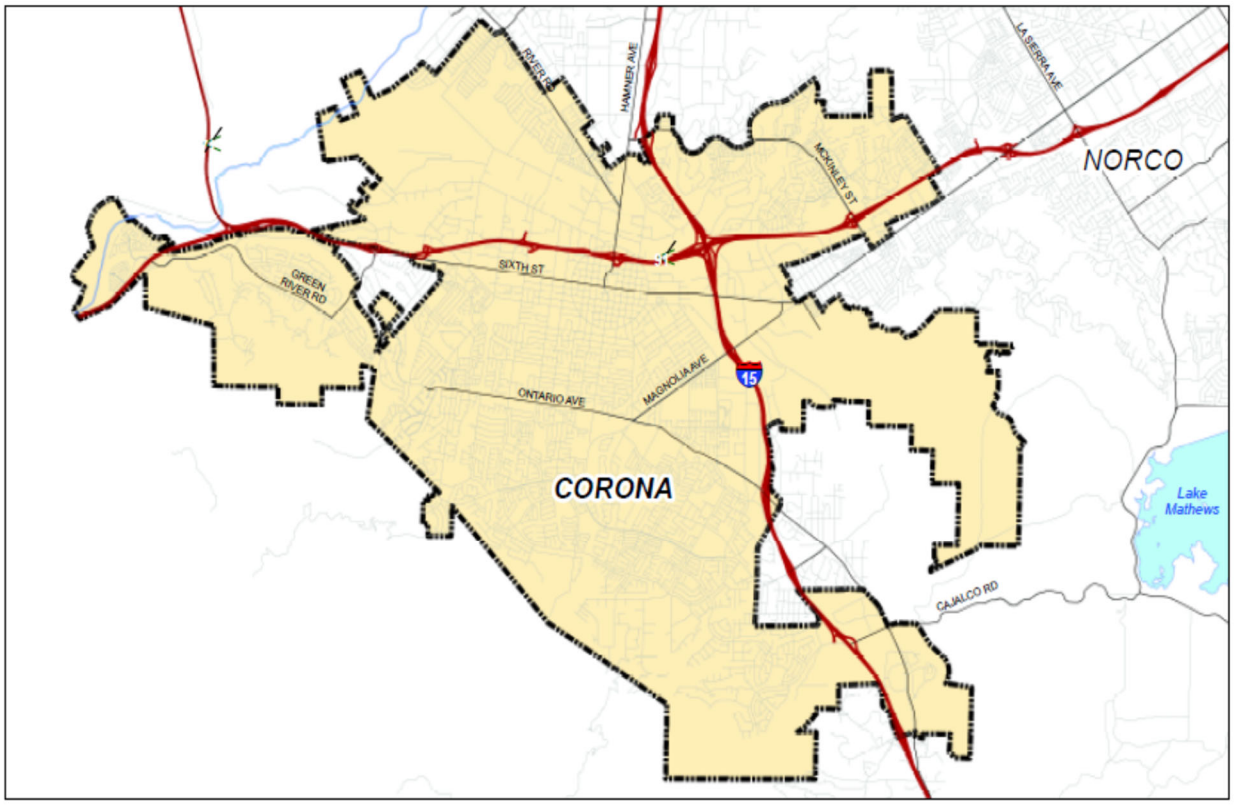
TABLE OF CONTENTS

Contact Information 1
PLAN ADOPTION AND RESOLUTION 2
EXECUTIVE SUMMARY 3
TABLE OF CONTENTS 5
CHAPTER 1- COMMUNITY PROFILE 6
1.1 CITY OF CORONA MAP 6
1.2 GEOGRAPHY AND CLIMATE DESCRIPTION 6
1.3 BRIEF HISTORY OF CORONA 8
1.4 DESCRIPTION OF CORONA'S ECONOMY 10
Figure 1.4.1 – City of Corona Workforce 13
1.5 POPULATION AND HOUSING 14
1. 6 TRENDS AND LAND USE 18
CHAPTER 2 - PLANNING PROCESS 15
2.1 LOCAL PLANNING PROCESS 15
2.2 PARTICIPATION IN REGIONAL PLANNING PROCESS 15
2.3 DATES AVAILABLE FOR PUBLIC COMMENT 16
2.4 PLANS ADOPTED BY RESOLUTION 16
CHAPTER 3 – MITIGATION ACTIONS AND UPDATES 17
3.1 UPDATES FROM 2017 PLAN 17
3.2 LIST OF COUNTY AND CITY HAZARDS 17
3.3 NEW HAZARDS OR CHANGES FROM 2017 LHMP 20
3.4 UNIQUE HAZARDS OF THE COUNTY AND CITY 21
3.5 MITIGATION PROJECT UPDATES 25
CHAPTER 4.0 – HAZARD IDENTIFICATION AND RISK ASSESSMENT 28
4.1 CRITICAL FACILITIES AND INFRASTRUCTURE 28
4.2 ESTIMATING POTENTIAL LOSS 30
4.3 TABLE OF REPLACEMENT VALUES 30
4.4 IDENTIFICATION OF RISKS AND VULNERABILITIES 30
SECTION 5.0 – COMMUNITY RATING SYSTEM 49
5.1 REPETITIVE LOSS PROPERTIES 49
5.2 NATIONAL FLOOD INSURANCE PROPERTIES 49
SECTION 6.0 - CAPABILITIES ASSESSMENT 51
6.1 REGULATORY MITIGATION CAPABILITIES 51
6.2 ADMINISTRATIVE ANDTECHNICAL MITIGATION CAPABILITIES 53
6.3 FISCAL MITIGATION CAPABILITIES 54
6.4 MITIGATION OUTREACH AND PARTNERSHIPS 54
6.5 FUNDING OPPORTUNITIES 55
SECTION 7.0 - MITIGATION STRATEGIES 56
7.1 GOALS AND OBJECTIVES 56
7.2 MITIGATION ACTIONS 57
7.3 ON-GOING MITIGATION STRATEGY PROGRAMS 62
7.4 FUTURE MITIGATION STRATEGIES 64
SECTION 8.0 – PLAN IMPLEMENTATION AND MAINTENANCE PROCESS 65
SECTION 9.0 – INCORPORATION INTO EXISTING PLANNING MECHANISMS 67
SECTION 10.0 - CONTINUED PUBLIC INVOLVEMENT 67
APPENDIX A – PUBLIC NOTICES AND MAPS 69
..... 82

APPENDIX B – INVENTORY WORKSHEETS 88
APPENDIX C – PLAN REVIEW TOOL/CROSSWALK 109

CHAPTER 1- COMMUNITY PROFILE

1.1 CITY OF CORONA MAP



1.2 GEOGRAPHY AND CLIMATE DESCRIPTION

The City of Corona is located approximately 45 miles southeast of Los Angeles in western Riverside County. It is in a valley, framed by forests and mountains, and the Prado Basin. Original settlements in the area focused on development within and adjacent to Grand Boulevard. As the City grew, the geographic limitations imposed by the Cleveland National Forest to the south and the Prado Basin to the northeast created natural barriers that confined the City. Corona is bordered by the City of Norco to the north, the City of Riverside to the east, and other Riverside County cities to the west and south.

The City limits encompass 39.2 square miles and the population is approximately 159,743 (according to the United States Census Bureau's assessment in July 2021). Corona, a city whose heritage spans more than a century, has emerged as an ethnically diverse community, where a significant percentage of the population is made up of young and well-educated families. The City's community boasts many amenities that provide a first-rate quality of life for its residents. It also has more than 394 acres of parks that include sports fields, basketball courts, playgrounds, tennis courts, two skate parks, and an outdoor pool.

Two major freeways and one railroad transect Corona. The Riverside Freeway (SR-91) runs east and west directly north of the City's center, Interstate 15 (I-15) runs north and south near the eastern edge of the City, and the railroad parallels SR-91. These corridors act as major transportation routes to the economic center of Orange County from the Inland Empire.

Two geographical areas are within the boundaries of the City of Corona General Plan Planning Area: lands within the City's corporate limits and lands within its Sphere of Influence (SOI). The City currently includes 39.2 square miles, plus 34.3 square miles in Riverside County designated as being within the SOI.

The SOI was defined by the City, the Southern California Association of Governments (SCAG), and the Riverside County Local Agency Formation Commission (LAFCO). It represents the areas likely to be served by and potentially annexed to the City. The SOI includes three geographically distinct areas including the West, East, and South Spheres. The West Sphere encompasses three geographic areas: the Prado Basin, Coronita, and the Foothill Area. The East Sphere includes the areas of Home Gardens, Eagle Valley East, and El Cerrito. Additionally, the Temescal Canyon makes up the South Sphere.

The City of Corona Planning Area is within the South Coast Air Basin of California (SCAB). The Air Basin is a 6,600-square mile area encompassing the non-desert portions of Riverside, Los Angeles, and San Bernardino Counties as well as all of Orange County. Bounded by the Pacific Ocean to the west and the San Gabriel, San Bernardino, and San Jacinto Mountains to the north and east, the South Coast Air Basin is an area of high air pollution potential.

The climate of the SCAB is dominated by the strength and position of the semi-permanent high-pressure center over the Pacific Ocean near Hawaii.

It creates the climate conditions typical of Southern California, (i.e., relatively cool summers, mild winters, infrequent rainfall, cool daytime sea breezes, comfortable humidity, and ample sunshine). Periods of extremely hot weather, winter storms, or Santa Ana wind conditions interrupt this pattern. Unfortunately, the same atmospheric processes that create the desirable living climate can combine to restrict the ability of the atmosphere to disperse the air pollution generated by the region's population.
The location of the Planning Area (east of the Chino Hills and Santa Ana Mountains) insulates it from the moderating effect of the ocean. Average summertime high temperatures range between about 85 to 92 degrees Fahrenheit from June through September, and average wintertime low temperatures are generally near 40 degrees in the months of December and January. Rainfall is highly variable and confined almost exclusively to the winter months. Rainfall in Corona averages about 12.6 inches annually. Temperatures and precipitation in Corona tend to vary more dramatically than other coastal areas of the basin.

Predominating winds travel from the ocean, across the urbanized coastal areas of Orange and Los Angeles Counties, to Corona through the Santa Ana River Canyon. The canyon acts as a funnel for air masses moving across the basin. Daytime winds are typically channeled through the canyon to create steady, abnormally high (greater than 12 mph) wind velocities from the west. Typical nighttime conditions reverse, and light winds (less than 1 mph) drift back towards the ocean. Exceptions to this pattern occurs when a high-pressure center forms over the western United States and creates the strong, hot, dry, gusty Santa Ana winds, which move through Corona from the eastern deserts into the canyon.

1.3 BRIEF HISTORY OF CORONA

Corona's historic resources are those physical elements, both structural and natural, which define the City's past. They help give the City its unique identity, charm, and orientation. These resources, when well preserved and maintained, provide the community with a sense of permanence, which fosters civic pride and stewardship among its residents and businesses. Information describing the historic and cultural resources were derived from the 2000 Riverside County Integrated Project (RCIP).

Corona's history has evolved on behalf of Native American inhabitation, missionary influence, agricultural development, and eventual rapid urbanization. The City's growth and development is typical of many other areas in Southern California.

In the early 1700s, prior to the arrival of the Spanish, the Gabrieleno and Luiseno Native American Tribes occupied the Corona area. These indigenous peoples used the hot waters in the Temescal Canyon for bathing and religious ceremonies.
Current residents and visitors still enjoy the rejuvenating mud baths and hot springs at the Glen Ivy Springs Resort. Luiseno religious ceremonies were strictly followed and remnants of some of their artistic pictographs and petroglyphs can still be found on rocks in undeveloped areas.

In the early 1800s, the agricultural and cattle ranching base developed, and portions of Corona became part of the Mexican land grant program (i.e., Rancho La Sierra Yorba, Rancho Jurupa, Rancho El Rincon, and Rancho El Sobrante de San Jacinto). With the Treaty of Guadalupe Hidalgo signed in 1846, Mexico ceded the Corona area as part of California to the United States. The Yorba, Serrano, Sepulveda, Cot, and Botiller families' ranched sheep and cattle on the original ranchos in the area. Remnants of the Serrano tanning vats are still found on Old Temescal Canyon Road. In 1849, the California gold rush brought prospectors, settlers, and new developments to Southern California.

In 1886, developer Robert Taylor persuaded his partners: Rimpau, Joy, Garretson, and Merrill to form the South Riverside Land and Water Company. Together they raised approximately $110,000 to purchase approximately 12,000 acres of agricultural land. Taylor realized the importance of water for the soon to be developed community and additional funds were used to ensure that sufficient water rights were obtained. Taylor hired Anaheim engineer H. C. Kellogg to design a circular Grand Boulevard three miles round. Early residents used to parade their fancy buggies on this circular street which enclosed the main functions of the community: schools, churches, residences, and stores. To the north along the railroad tracks were the manufacturing plants and packing houses. The southern end of town featured the citrus industry, and the mining companies were established just outside the City's southeastern and eastern city limits.

The developers initially named their development South Riverside after the successful citrus community of Riverside located nearby. Almost all the new settlers planted orange and lemon trees in hopes of gaining future profits. New groves continued to spring up and by 1912 there were 5,000 acres of established orange and lemon groves. By 1913, Corona shipped more fruit than any other town in Southern California. In 1961, citrus was still considered the backbone of Corona's economy and the largest source of revenue. In that year, citrus covered 7,500 acres. The labor force fluctuated between 400 and 1,800 workers at the peak of the harvest. An additional 500 people worked at the Exchange Lemon Products Plant. By 1982, Corona's

agricultural industry faced a bleak future as production costs made the economics of farming financially unsuccessful. Plans then began to change to replace the groves with approximately 12,500 dwelling units.

On July 13, 1896, residents voted to incorporate and change the name of the community to Corona, which is Spanish for crown, in honor of the City's circular Grand Boulevard.

By 1900, the population had reached 1,434 people.

On September 9th, 1913, in observance of California's Admission's Day, Corona residents celebrated with an international automobile race on the Boulevard. The event attracted auto racing greats such as Ralph DePalma, Barney Oldfield, Terrible Teddy Tetzlaff, and Earl Cooper. More than 100,000 people came to the town to watch Cooper win the race and a prize of $8,250. It was so successful that races were held again in 1914 and 1916. The demise of the Corona Road races was due not only to tragic deaths, which occurred in 1916, but also because of the cost and local effort needed to continually stage such an extravagant event.

1.4 DESCRIPTION OF CORONA'S ECONOMY

Corona continues to maintain its position as the premier location for businesses looking to relocate and expand. Corona's geographic position attracts a highly educated labor force. Vacancy rates in industrial, commercial, and office properties all declined in 2022, with many companies returning to in-person work. Industrial vacancy rates dropped even lower to 1.0%, retail vacancies dropped to 5.2%, and office vacancy rates steadily declined to 7.5%.

Taxable sales in Corona totaled just over $900 million in the fourth quarter of 2020, down 6.3% from the previous year. This is a more modest decline relative to Los Angeles County (-8.9%) and Orange County (-7.4%), but it contrasts with the growth in Riverside County (3.9%) and San Bernardino County (6.2%). From the first quarter of 2020 to first quarter of 2021, the pandemic led to a surge in spending in some categories. E-commerce surged during the pandemic, with spending up 43.4%.

Demographically, Corona benefits from a young median age, higher education levels, higher median incomes, and higher home values compared to Riverside County and other areas in California. As a thriving inland community, Corona is home to young families comprised of 48,905 households averaging 3.25 persons each, with a median age of 38.3. Annual median household income is $92,606 and 76% of the population age 25 and up possess a high school diploma or higher according to U.S. Census. Median home prices continue to improve with median values in excess of $620,600.

New industrial development, business expansions, and relocations to Corona have helped to stabilize Corona's job market, despite economic impacts related to the global pandemic. Job growth in Corona reported a 10% increase with employment numbers increasing to 86,700 in the first quarter of 2022. Major contributors to local economic growth are the construction, health care, and finance industries, in addition to the fast-growing professional, management, and technology sectors in previous years. Job growth will be continuing to be fueled by the 1.8 million square feet of industrial development recently completed or under construction, and the recent completion of 147,000 square feet of Class A offices. The strong local job market keeps the unemployment rate in Corona at 3%, which is approximately 1% below the Riverside County average as of Fiscal Year 2021.

Fiscal Year 2022 continued to see an expanding housing market with increased median home prices and average rents for multi-family communities. New single-family housing developments include Sierra Bella, a new family community consisting of 237 single family homes and Bedford South Corona, which will add more than 1,500 single family units once complete along with Corona's newest retail development, Bedford Marketplace. Both developments are under construction, with some homes complete and occupied by new homeowners. Several proposed condominium developments are in various stages of plan check or construction including 109 attached units on the east side of Temescal Canyon Road and Dos Lagos Drive.

With limited opportunities for large-scale new development, Corona continues looking for opportunities to redevelop and expand currently underutilized properties. Through its ongoing commitment to stimulate the local economy and expand its labor force, the City of Corona will continue to be the premier inland Southern California city to live, work, and play.

Nationwide, the economy has continued to show strong recovery from early COVID-19 pandemic shutdowns. The national unemployment rate was 3.6% at the end of Fiscal Year 2022 and increased to 3.7% in the first quarter of Fiscal Year 2022. However, national economic performance does not directly translate to improved or hindered financial condition for local governments, nor opportunities to fund more services. As an example, a rise in home prices does not directly correlate to the City collecting more in property taxes. With Proposition 13, property tax is capped at 1%, and the property's taxable value cannot increase more than 2% per year. At the same time, the increase in fixed cost for operating City government has outpaced its revenue growth.

Figure 1.4.1 – City of Corona Workforce

OFFICE OF ECONOMIC DEVELOPMENT

WORKFORCE

Workforce at a Glance

- 89,600 labor force
- More than 29% of adults ages 25+ achieved a bachelor's degree or higher
- 43 college campuses within a 40 mile radius
- 94% high school graduation rate
- 16.2% of jobs are in manufacturing

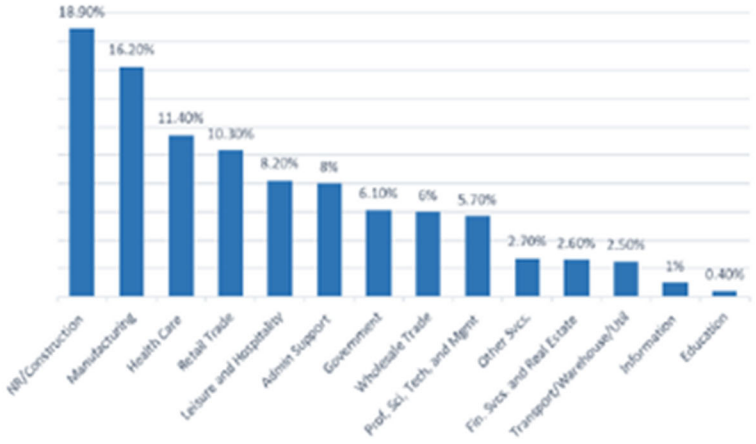
Total Labor Force

	Job Base	Unemployment
2022 Ann. Avg.	88,900	3.2%

Commuting Pattern

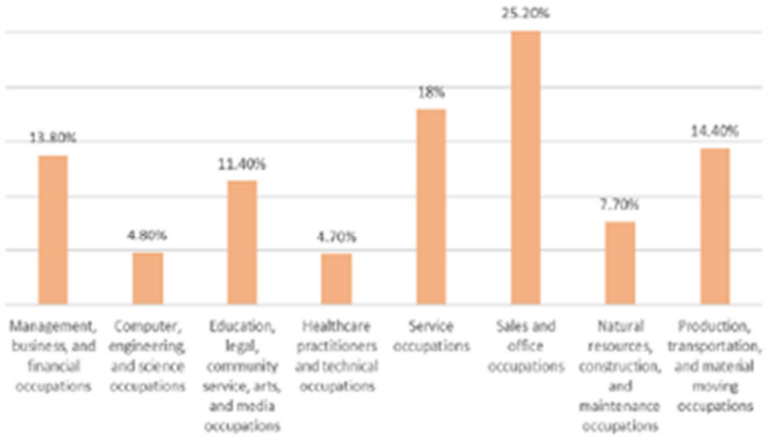
Average Commuting Time: 38 minutes
Source: American Community Survey

Employment by Industry



Source: California Employment Development Department; Analysis by Beacon Economics

Employment by Occupation



Source: U.S. Census Bureau, American Community Survey

(951) 817-5730 EconDev@CoronaCA.gov www.coronaca.gov

1.5 POPULATION AND HOUSING

In a little over a century, the City has evolved from a small town of 1,434 people with deep agricultural roots to a dynamic, diverse community of more than 167,759 people. At the turn of the millennium, Corona's growth had been among the highest in the United States. It's vast agricultural areas at the base of the Santa Ana Mountains, La Sierra Hills, and Chino Hills that is centered on a single place of business and civic identity, has evolved to a suburban community of multiple neighborhoods and centers of commerce and employment. Based on estimates from the California Department of Finance, the City's housing units has increased to 50,287 in 2023 from 48,064 in 2014 from, an increase of approximately 2,223 units.

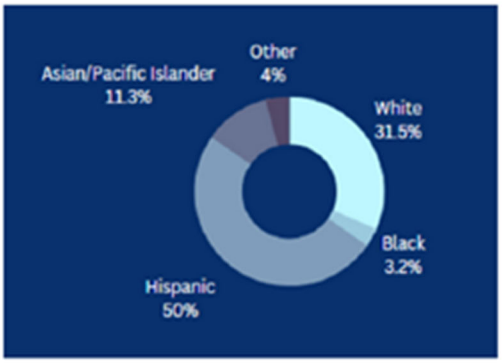
OFFICE OF ECONOMIC DEVELOPMENT

DEMOGRAPHICS

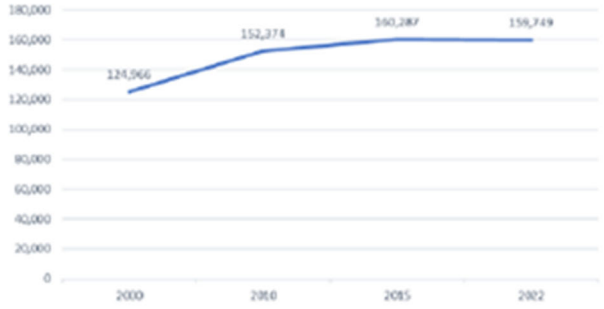
Leading Employers

Company	Employment
Corona-Norco Unified School District	4,807
Fender USA Corona	1,215
Corona Regional Medical Center	1,096
Monster Energy	900
City of Corona	824
TWR Framing Enterprises	725
All American Asphalt	650
Veg Fresh Farms	629
Kaiser Permanente	450
Thermal Structures	404

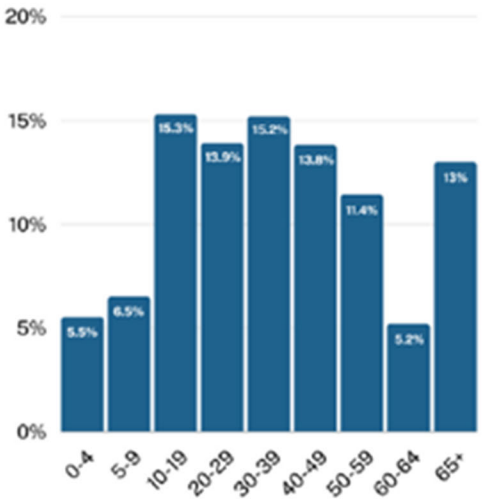
Race/Ethnicity



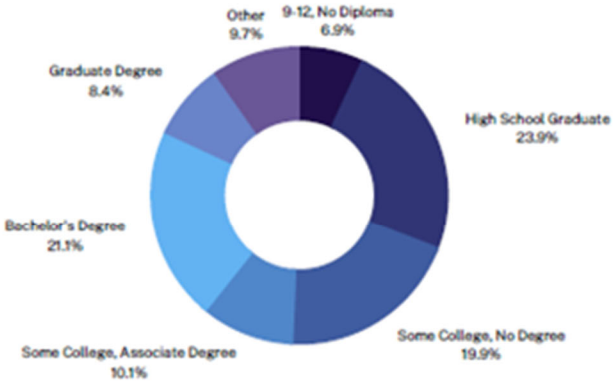
Population Growth



Age Distribution



Education Attainment



Source: Department of Finance

(951) 817-5730 EconDev@CoronaCA.gov www.coronaca.gov

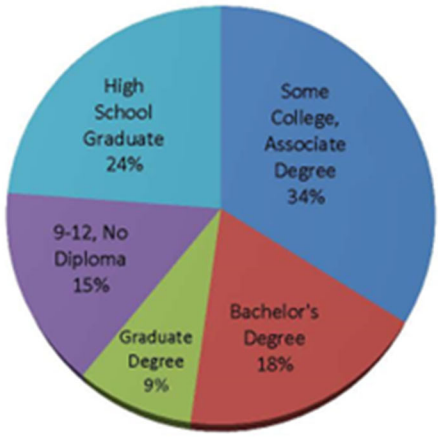
TEAM CORONA

Demographics

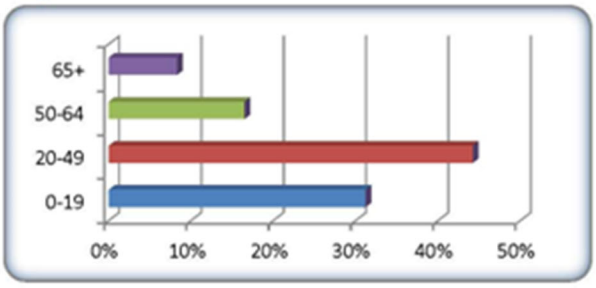
Leading Employers

Company	Employment
Corona-Norco Unified School District	5,098
Corona Regional Medical Center	1,113
Kaiser Permanente	995
All American Asphalt	842
City of Corona	749
Fender USA	600
TWR Framing	600
Monster Energy	544
Thermal Structures	500
CoreMark International	421
Dart Container Corp.	420
Veg-Fresh Farms	350
U.S. Food Service	320
Circor Aerospace	300
Advanced Flow Engineering	154

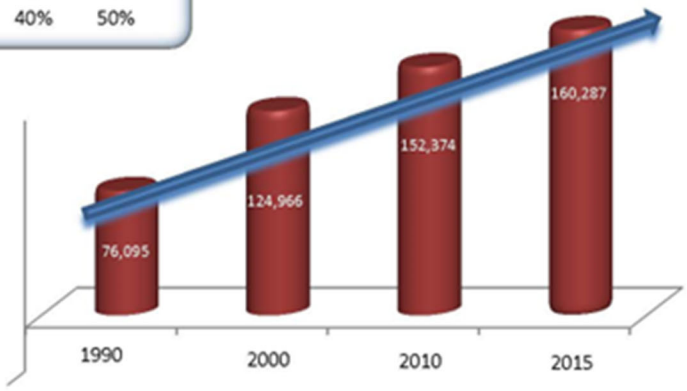
Education Attainment



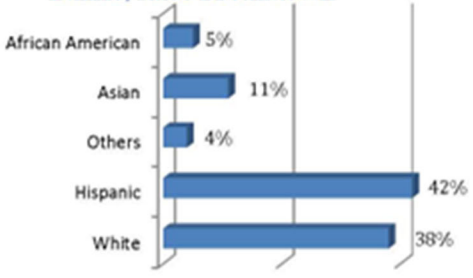
Age Distribution



Population Growth

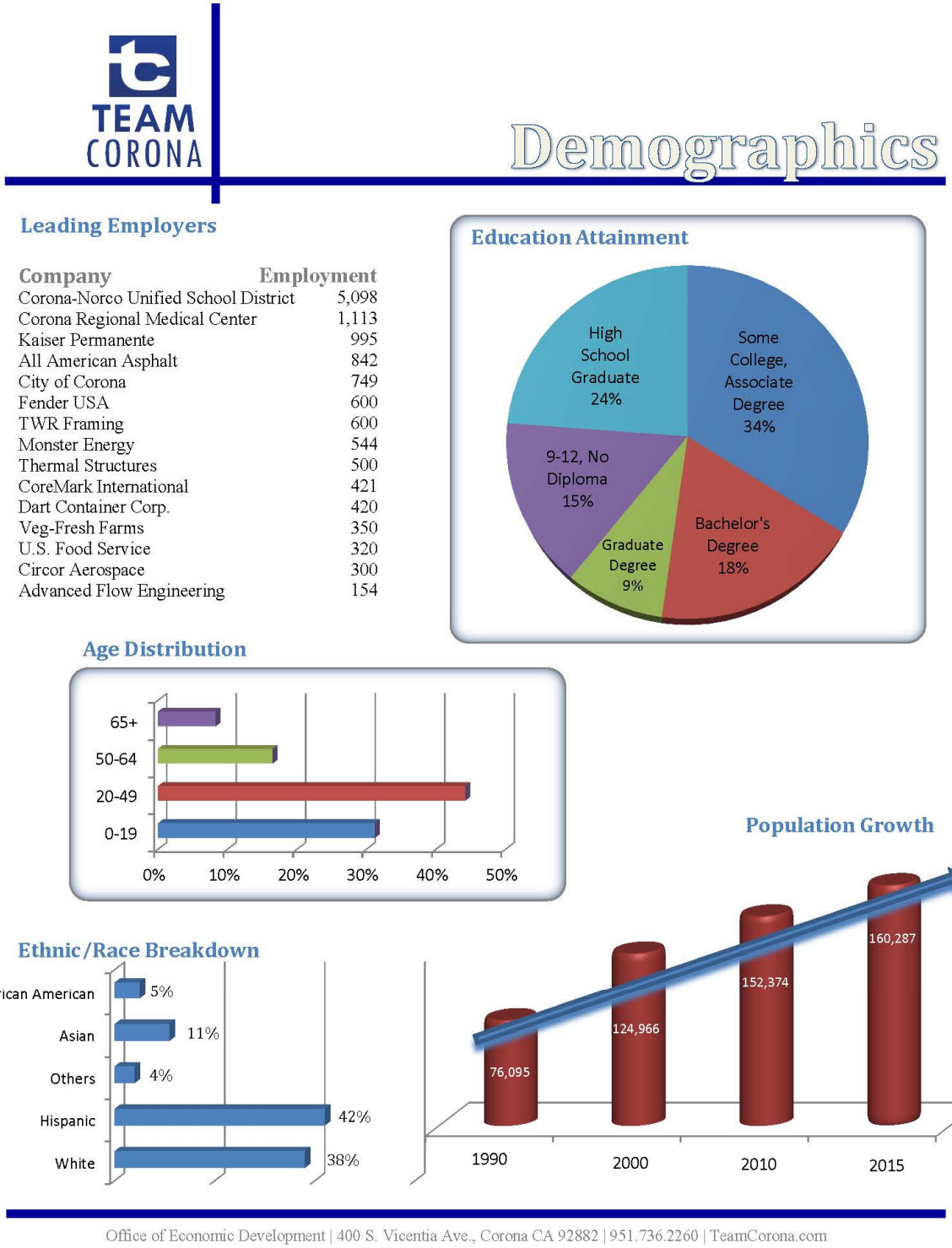


Ethnic/Race Breakdown



Office of Economic Development | 400 S. Vicentia Ave., Corona CA 92882 | 951.736.2260 | TeamCorona.com

Figure 1.5.1 – City of Corona Demographics



1. 6 TRENDS AND LAND USE

Corona's residential market continues to boom. Included in future planned construction are three new housing developments that will be adjacent to high fire hazard severity zones. It is mandated that new development in or adjacent to these zones follow the 2016 California Building Code Chapter 7A and Chapter 49 of the 2016 California Fire Code. It is also mandated by the Corona Fire Department that a separate fuel modification plan be submitted for review and approval.

Figure 1.6.1: Responsibilities within City of Corona

JURISDICTION: CITY OF CORONA	DOES YOUR AGENCY HAVE RESPONSIBILITY FOR LAND USE AND/OR DEVELOPMENT ISSUES WITHIN YOUR JURISDICTIONAL BOUNDARIES?			
	2012 DATA	2017 DATA		2023
Current Population in Jurisdiction or Served	153,649	167,759	Projected Population in Jurisdiction or Served - in 2022	175,000
Current Sq. Miles in Jurisdiction or Served	39.2	39.2	Projected Sq. Miles in Jurisdiction or Served - in 2022	39.2
Does Your Jurisdiction have any ordinances or regulations dealing with disaster mitigation, disaster preparation, or disaster response?	Yes	Yes	If yes, please list ordinance or regulation number. Ordinance No. 2429, 1973, 2077 Corona Municipal Code Chapters 2.52, 3.36, 4.04.80, 7a, 15.12.270 Section 705	
What is the number one land issue your agency will face in the next five years	Economy and Infill/compact development			
Approximate Number of Homes/Apts/etc.	47,182	48,930	Projected Number of Homes/Apts/etc.- in 2022	50,500
Approximate Total Residential Value	$16.3 billion	$17.0 billion	Projected Residential Total Value - in 2022	$19.0 billion
Approximate Number of Commercial Businesses	5,205	9,000	Projected Number of Commercial Businesses - in 2022	9,500
Approximate Percentage of Homes/Apts/etc. in flood hazard zones	0.7%	0.7%	Approximate Percentage of Homes/Apts/etc. in flood hazard zones - in 2022	0.7%
Approximate Percentage of Homes/Apts/etc. in earthquake hazard zones	3.5%	3.5%	Approximate Percentage of Homes/Apts/etc. in earthquake hazard zones - in 2022	3.5%
Approximate Percentage of Homes/Apts/etc. in wildland fire hazard zones	6.55%	6.55%	Approximate Percentage of Homes/Apts/etc. in wildland fire hazard zones - in 2022	6.55%
Approximate Percentage of Commercial Businesses in flood hazard zones	0.003%	0.7%	Approximate Percentage of Commercial Businesses in flood hazard zones - in 2022	0.7%
Approximate Percentage of Commercial Businesses in earthquake hazard zones	1.9%	0.3%	Approximate Percentage of Commercial Businesses in earthquake hazard zones - in 2022	0.3%
Approximate Percentage of Commercial Businesses in wildland fire hazard zones	4.5%	0	Approximate Percentage of Commercial Businesses in wildland fire hazard zones - in 2022	0
Number of Critical Facilities in your Jurisdiction that are in flood hazard zones	0	0	Projected Number of Critical Facilities in your Jurisdiction that are in flood hazard zones - in 2022	0
Number of Critical Facilities in your Jurisdiction that are in earthquake hazard zones	2	2	Number of Critical Facilities in your Jurisdiction that are in earthquake hazard zones - in 2022	2
Number of Critical Facilities in your Jurisdiction that are in wildland fire hazard zones.	7	7	Number of Critical Facilities in your Jurisdiction that are in wildland fire hazard zones - in 2022	7
Does your jurisdiction plan on participating in the County's on-going plan maintenance program every two years as described in Part I of the plan?	Yes	Yes	If not, how will your jurisdiction do plan maintenance? N/A	
Will a copy of this plan be available for the various planning groups within your jurisdiction for use in future planning and budgeting purposes?				Yes

CHAPTER 2 - PLANNING PROCESS

2.1 LOCAL PLANNING PROCESS

Multiple city departments contributed to the update of the 2023 Local Hazard Mitigation Plan. Personnel involved included senior management and staff from the Fire Department, Police Department, Community Development, Public Works, Administrative Services, Department of Water and Power, Management Services, Maintenance Services, Library and Recreation, Information Technology, City Clerk, Legal, and Risk Management. The group also includes civil engineers, planners, building officials, city clerks, public information officers (PIO), Geographic Information System (GIS) administrator, accountants, managers, emergency managers, analysts, and fire and police officials. Outreach to key stakeholders was done through email, phone calls and in person meetings.

The group assisted in the development of mitigation strategies and projects based on the risk and hazard ranking assessment conducted by members of Fire, Police, Public Works Departments as well as the Department of Water and Power. They identified completion of past projects and provided updated City data and statistics. For meetings and correspondence records, please reference local planning efforts within Appendix A.

2.2 PARTICIPATION IN REGIONAL PLANNING PROCESS

The City of Corona committed to participating in the update of the 2022 Riverside County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP). An agency multi-jurisdiction participation form was completed and submitted to Riverside County Emergency Management Department as official notice of participation.

Emergency Management staff attended multiple OA Planning Committee meetings over the course of the planning year where LHMP updates, requirements, and coordinating efforts were conducted.

Neighboring communities were also invited to participate in the update of the LHMP during these quarterly OAPC meetings. Several of Corona's neighboring communities were in the process of updating their respective LHMPs which allowed the city to cross reference mitigation hazards and risks while also identifying potential mitigation projects that may lead to future collaborate efforts.

Corona Emergency Management staff attended multiple LHMP workshops hosted by EMD that provided additional information, review, guidance, and assistance throughout the plan's updating process. These workshops consisted of representatives from various disciplines such as law, fire, hospitals, and schools lending to a well-rounded planning process. These entities were invited by EMD to participate in these workshops via OA emailing distribution lists and calendar invites. In addition to these group settings, the Corona Emergency Services Manager had multiple one on one meetings and email correspondence with EMD planning staff. For meetings and correspondence records, please reference OA planning efforts within Appendix A.

2.3 DATES AVAILABLE FOR PUBLIC COMMENT

In an effort to involve the residents of Corona in the update process, and to better understand their concerns and opinions regarding hazards threatening their community and the City as a whole, a survey was developed and the 2023 plan was provided for review. To reach many community members, the plan and survey were posted on the City's website as well as on social media. The post on the Corona Fire Department Facebook page, which contained the survey and plan, reached over 3,527 individuals.

In addition to these efforts, LHMP information and input was given and received at multiple community meetings.

No new hazards outside of the current contents of the 2023 LHMP were identified. For public notice documentation, please see Appendix A.

2.4 PLANS ADOPTED BY RESOLUTION

Upon approval by FEMA, the LHMP will be presented to the City Council in a public meeting for adoption via an Official Resolution.

CHAPTER 3 – MITIGATION ACTIONS AND UPDATES

3.1 UPDATES FROM 2017 PLAN

The 2023 LHMP update was a complete review and rewrite of many of the sections to align with the four-step planning process and incorporate updated information across the plan. Many of the 2017 LHMP sections were renamed or adjusted in their order within the 2023 update.

Although no new hazards have been identified, the occurrence or severity of some of these hazards has increased, making them a greater mitigation priority than in previous years. Please see section 3.3 for further information on updates since the publication of the 2017 LHMP.

3.2 LIST OF COUNTY AND CITY HAZARDS

The City of Corona is committed to providing protection to residents and businesses from natural and man-made hazards. The City is also committed to coping with and rebuilding from disasters and emergencies in a manner that is efficient, safe, and provides for a quick return to the quality of daily life in Corona. To accomplish this, it is imperative that the City is aware of the hazards it is susceptible to in order to prepare, respond, recover, and mitigate the applicable hazards.

The County of Riverside identified, evaluated, and ranked 23 natural and man-made public safety risks that could have an impact on the health, safety, and social well-being of communities located within it. The rankings were based on severity of damage and probability of occurrence for each risk. The City of Corona then ranked the same 23 hazards and included the top 10 risks in the City's annex to the Riverside County MJHMP. Identifying the risks posed by these hazards and developing strategies to reduce the impact of these hazards can assist in protecting and preserving life, property, and the environment.

All 23 hazards are not individually addressed in the City of Corona's annex. For those hazards not expanded upon, the City feels that the County Plan provides adequate information to address the hazard as it relates to the City. Below are two tables, one identifies the 23 identified hazards with their probability and severity rates and the second lists the County and City final ranking of the hazards.

Figure 3.2.1 – County and City Hazard Rankings

City of Corona & Riverside County Hazard Ranking		
Hazard	**Corona**	**County**
Earthquake	**1**	**1**
Wildland Fire	**2**	**3**
Electrical Failure	**3**	**4**
Terrorist Event	**4**	**7**
Water Supply Disruption/Contamination	**5**	**23**
Flood	**6**	**9**
Emergent Disease/Contamination	**7**	**5**
Transportation Failure	**8**	**14**
Communications Failure	**9**	**8**
Pandemic Flu	**10**	**2**
Cyber Attack	**11**	**6**
Pipeline Disruption	**12**	**20**
Extreme Weather	**13**	**13**
HazMat Incident	**14**	**22**
Dam Failure	**15**	**15**
Civil Disorder	**16**	**10**
Nuclear/Radiological Incident	**17**	**12**
Insect Infestation	**18**	**18**
Drought	**19**	**11**
Landslide	**20**	**21**
Jail/Prison Event	**21**	**19**
Aqueduct	**22**	**16**
Tornado	**23**	**17**

Figure 3.2.2 – Hazard Probability and Severity Rates

HAZARD	PROBABILITY	SEVERITY	HEALTH SYSTEM IMPACT			MITIGATION CAPACITY		RISK SCORE
			HEALTHCARE	EMS	BEHAVIORAL / MENTAL HEALTH	RESPONDER AGENCIES	COMMUNITY AGENCIES	
	Improbable: 0 Remote: 1 Occasional: 2 Probable: 3 Frequent: 4	NA: 0 Negligible: 1 Marginal: 2 Critical: 3 Catastrophic: 4	NA: 0 Negligible: 1 Marginal: 2 Critical: 3 Catastrophic: 4	NA: 0 Negligible: 1 Marginal: 2 Critical: 3 Catastrophic: 4	NA: 0 Negligible: 1 Marginal: 2 Critical: 3 Catastrophic: 4	NA: 0 Low: 1 Moderate: 2 High: 3 Extreme: 4	NA: 0 Low: 1 Moderate: 2 High: 3 Extreme: 4	
Aqueduct	2	3	2	2	2	2	3	**0.38**
Drought	3	3	2	2	2	2	2	**1.13**
Earthquake	2	4	4	4	3	2	2	**3.50**
Extreme Weather	2	3	2	2	2	2	2	**0.75**
Flood	3	3	2	3	2	2	3	**1.13**
Insect Infestation	3	2	2	1	1	2	2	**0.00**
Landslide	3	3	1	1	1	2	2	**-0.56**
Tornado	1	2	2	2	2	2	2	**0.25**
Wildland Fire	4	3	3	3	3	3	3	**2.25**
Civil Disorder	2	3	3	3	1	4	0	**1.13**
Communications Failure	2	3	3	3	3	3	3	**1.13**
Cyber Attack	4	2	3	2	2	3	1	**1.50**
Dam Failure	1	3	2	3	2	2	3	**0.38**
Electrical Failure	4	4	2	2	2	2	2	**2.00**
HazMat Incident	4	3	2	2	1	3	3	**-0.75**
Jail/Prison Event	1	2	1	1	1	4	0	**-0.13**
Nuclear Incident	1	4	2	3	3	2	2	**1.00**
Pipeline Disruption	2	3	2	2	1	3	3	**-0.38**
Radiological Incident	1	2	2	3	3	2	2	**0.50**
Terrorist Event - MCI	1	3	3	3	4	3	1	**1.13**
Transportation Failure	2	3	2	2	1	2	2	**0.38**
Water Supply Disruption/Contamination	3	2	0	0	0	2	2	**-1.50**
Emergent Disease/Contamination	3	3	3	3	2	3	2	**1.69**
Pandemic Flu	2	4	4	4	4	3	2	**3.50**

3.3 NEW HAZARDS OR CHANGES FROM 2017 LHMP

Although no new hazards have been identified from the approval of the 2017 LHMP the occurrence or severity of some of these hazards has increased, making them a greater mitigation priority than in previous years. Examples of these heightened risks include drought, climate change, occurrences of pandemic outbreaks and their associated threats, and the threat and occurrences of both domestic and international terrorist acts.

1. Drought – Drought is a period of unusually constant dry weather that persists long enough to cause deficiencies in the water supply (surface or underground). Droughts are slow-onset hazards, but over time, they can severely affect crops, municipal water supplies, recreation resources, and wildlife. If drought conditions extend over several years, the direct and indirect economic impacts can be significant. High temperatures, high winds, and low humidity can worsen drought conditions and make areas more susceptible to wildfires. In addition, human actions and demands for water resources can accelerate drought-related impacts.

2. Climate change – Climate change may well be the preeminent challenge of our time and it is already having a significant and measurable impact on California's environment. These impacts include decreasing spring snowmelt runoff, rising sea levels, shrinking glaciers, increasing wildfires, warming lakes and oceans, and the gradual migration of many plants and animals in higher elevations. Weather patterns are becoming more variable, causing more severe winter and spring flooding and longer drier droughts. Climate change has already impacted California's water resources. In the future, warmer temperatures, different patterns of precipitation and runoff, and rising sea levels will profoundly affect the ability to manage water supplies and other natural resources.

3. Pandemic – An influenza pandemic is a global outbreak of a new Influenza A virus. A Novel Influenza A virus is one that has caused human infection but is different from current seasonal human influenza A viruses spreading among people. Novel Influenza A viruses can be viruses that originate in animals that gain the ability to infect humans or human viruses that change significantly to be different from current human seasonal Influenza A viruses. Some Novel Influenza A viruses are believed to pose a greater pandemic threat than others and are more concerning to public health officials because they have caused serious human illness, death, and have been able to spread in a limited manner from person-to-person.

4. Novel Influenza A viruses are of extra concern because of the potential impact they could have on public health if they gained the ability to spread from person-to-person easily, which could potentially trigger a pandemic. There are various subtypes of Avian Influenza A viruses to include H5, H7, H9, H1N1v, H3N2v, and H1N2v, which are currently most concerning to public health officials.

5. The COVID-19 pandemic, also known as the coronavirus pandemic, is an ongoing global pandemic of coronavirus disease 2019 caused by severe acute respiratory syndrome. As of January 2023, the COVID-19 pandemic had caused more than 668 million deaths and 6.73 million confirmed deaths, making it one of the deadliest in history.

6. Terrorism – As defined by the FBI, terrorism is "the unlawful use or threatened use of violence committed against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives." The tactics of terrorism are diverse. The fear of such attacks within the target population is just as important as the actual attacks, making the threat of violence as effective as actual violence. Terrorist tactics tend to favor attacks that avoid effective countermeasures and exploit vulnerabilities. As such, terrorists have the potential to utilize many different types of tactics both conventional and unconventional. Some of these tactics include shootings, kidnappings, bombings, suicide attacks, bioterrorism, nuclear terrorism, and cyberterrorism. From 2010 to 2023 there have been roughly 40 confirmed domestic terrorist incidents.

3.4 UNIQUE HAZARDS OF THE COUNTY AND CITY

The City of Corona faces a diverse array of potential natural and human caused hazards. As with most cities in the Inland Empire, one of the primary concerns is the impact of a large earthquake in the region. Flood risks are also a real concern with several creeks, washes, channels, and flood zones contained in the planning area of Corona. In addition, the City is nearly surrounded by hills and mountains with the potential and the history of large wildland fires. The shared boundary between the City and the Cleveland National Forest is about 12 miles in length.

The City's extensive transportation network which includes state highways, public transit, rail lines, and a municipal airport provide additional associated incident risks that may cause severe injuries and/or deaths. They could also cause burns and/or illness due to exposure to fires and/or potential hazardous materials on board. Two major freeways and one railroad transect Corona.

The Riverside Freeway (SR-91) runs east/west directly north of the City's center, Interstate 15 (I-15) runs north/south near the eastern edge of the City, and the railroad parallels the SR-91. These corridors are major transportation routes to the economic center of Orange County from the Inland Empire. The Corona Municipal Airport is home to 300-350 general aviation aircraft and is strictly a recreational airport with no commercial flights.

Although small, the airport is extremely active, with approximately 35,000 annual operations. The City's transportation network of roads, freeways, rail lines and airport has been a priority in the City's planning and mitigation efforts.

Since the original 2005 version of the LHMP was submitted, the City of Corona has experienced 7 federally declared disasters for wildland fires and floods, and a state disaster declaration for high winds. Additionally, 5 major wildland fires occurred in or around the City of Corona that threatened the community. A list of historical disasters for City is included in table 3.4.1.

Figure 3.4.1 - Historical List of Disasters for City of Corona

Disaster Type	Year	Corona Disasters Description of Damage	Fiscal Impact	Federal Disaster Declared
Fire	1889	Santiago Canyon Fire – 300,000 acres of wildland fire from Santa Ana to Elsinore, Corona to Oceanside in 3 days.	Unknown	Unknown
Flood	1938	Flooding included the intersection River Road and Main Street.	$100,000	Unknown
Fire	1948	Green River Fire – 46,000 acres of wildland and 22 homes destroyed.	Unknown	Unknown
Fire	1967	Paseo Fire – 50,000 acres wildland and 66 homes destroyed.	Unknown	Unknown
Flood	1969	City was declared a local disaster area. One hundred twenty five residents were evacuated. Twenty homes were damaged.	$750,000	Yes
Freeze	1969	An ice freeze destroyed 75% of Corona's avocado crop; 50% of its lemons; 35% of Valencia oranges; 25% Navel oranges and 20% grapefruit	$8 million (Riverside County)	Unknown
Fire	1977	Tin Mine Fire - 5,500 acres burned. 1,500 firefighters fought fire at the peak of the fire. 1,610 avocado and fruit trees consumed by fire.	$5.9 million	Unknown
Flood	1978	Water line broken, 100 residents without drinking water; sewer line washed out; airport flooded.	$500,000	Unknown
Fire	1979	Paseo Fire - 2,000 acres burned. 100 people evacuated from homes. No significant property damage.	Unknown	Unknown
Fire	1980	Owl Fire - Wildland	Unknown	Unknown
Flood	1980	Street damage, airport damage, property damage.	$1.6 million	Unknown
Fire	1982	Gypsum Fire – 18,000 acres, 14 homes destroyed.	Unknown	Unknown
Fire	1982	Hagador Fire – Wildland fire, South Corona	Unknown	Unknown
Fire	1987	Silverado Fire – Wildland fire, south Corona	Unknown	Unknown
Fire	1990	Bedford Fire - south of Corona 4,500 Acres, 20 structures. FEMA DR 872	Unknown	Yes
Winds	1990	Powerful winds knocked out power supply to 1,580 homes for as long as two hours.	Unknown	Unknown
Freeze	1991	Crop Freeze-10 nights of temperatures below 27 F. Damage to avocados and citrus.	Unknown	Yes
Flood	1993	Washed out roads, knocked down dikes and damaged public property.	$1.525 million	Unknown
Flood	1998	Flooding to roads, airport, fallen trees El Nino FEMA DR	$650,000	Yes
Fire	1999	Chase Fire - Brush fire burns 500 acres near Skyline Drive. One home destroyed.	Unknown	Unknown

Figure 3.4.1 - Historical List of Disasters for City of Corona (Continued)

Disaster Type	Year	Corona Disasters Description of Damage	Fiscal Impact	Federal Disaster Declared
Fire	2002	Green Fire – Wildland fire Santa Ana River Canyon.	Unknown	Unknown
Fire	2002	Evening Fire – Wildland fire Santa Ana River Canyon.	Unknown	Unknown
Flood	2005	FEMA DR 1577 – Flooding citywide, airport, Debris flow and mudslides.	$353,928	Yes
Fire	2005	Lincoln Fire – 800 acres wildland Eagle Valley.	Unknown	Unknown
Fire	2006	Sierra Fire – 10,600 acres Santa Ana River Canyon.	Unknown	Unknown
Fire	2007	Santiago Fire - west of Corona 27,000 acres and destroyed more than a dozen homes. FEMA DR 1731	$52,118	Yes
Winds	2007	Fallen trees and debris. State declaration CDAA DR	$18,616	Yes
Fire	2007	Cerrito Fire – Wildland fire, Eagle Valley.	Unknown	Unknown
Fire	2008	Freeway Fire – 18 homes damaged or destroyed in the Green River Homes caused by fire near Santa Ana River. FEMA DR 1810	$78,936	Yes
Flood	2010	Flooding, slope failures, fallen trees and road damage. FEMA DR 1884	$177,000	Yes
Fire	2010	McKinley Fire – Wildland fire, Eagle Valley.	Unknown	Unknown
Flood	2011	Flooding and damage to roads, fallen trees, airport flooding and damage. FEMA DR 1952	$370,000	Yes
Fire	2015	Highway Fire – 1,049 acres Hwy71/Hwy91 near Prado Basin	Unknown	No
Flood	2015	Heavy down pore causing flooding and civilian water rescues	Unknown	No
Flood	2017	Flooding and damage to PD facility and fallen trees. FEMA DR 4305	$67,000	Yes

3.5 MITIGATION PROJECT UPDATES

Since the adoption of the 2017 LHMP, the City of Corona has undertaken several measures and completed several projects to lessen the impact of disasters and prevent the loss of life and property. Some of these mitigation actions are identified in table 3.5.1.

Figure 3.5.1 – Mitigation Projects Completed

Hazard Type	Project Description	Status
All	Incorporated 2012 Approved Local Hazard Mitigation Plan with City of Corona General Plan	Complete
Fire, Water Supply Disruption	Updated Booster Station buildings to current fire standards (Kraft Ranch, Montana Ranch,SDO, Maybe Canyon,Eagle Glen, Harlin Hills)	Complete
Fire	Purchased 6 portable booster stations for emergency fire response	Complete
Earthquake	All above ground steel storage reservoirs were evaluated to ensure proper venting in the event of an earthquake. Modifications were made where needed.	Complete
Earthquake, Electrical Failure	Installation of emergency generators for 3 groundwater well sites.	Complete
Electrical Failure, Emergent Disease Contamination	Emergency generators installed at all lift stations, plus a portable sewage lift station for emergency bypass	Complete
Flood	Annual maintenance service on storm drains	Complete
Flood	Construction of Main St storm drain. Alleviate flooding from 11th to 8th St.	Complete
Flood	Construction of Harris storm drain. Alleviate flooding on 6th St and apartments of 5th St..	Complete
Water Supply/ Contamination	Converted out of service well to a triple-nested monitoring well. Will increase local ground water supply.	Complete
Water Supply Disruption/ Contamination	Replaced 4,700 feet of 6 and 8 inch waterlines with 12 inch Ductile Iron Waterline pipe	Complete
Flood	Cota Channel restoration	Complete
Terrorism	Became members of the BioWatch Program - BioWatch provides early detection of biological agents in the air used for a bioterrorism attack	Complete
Terrorism	Corona PD & Fire established a Tactical Response to Violent Incidents Team and adopted the RCFCA Standard Operating Guidelines	Complete
Pandemic Flu	Partnered with Riverside County Public Health with the development and implementation of the City of Corona Pandemic Influenza Plan	Complete
HazMat, Transportation Failure, Fire	2013 complete update to Hazardous Material Area Plan - to assist in the prevention or mitigation of damage from the release or threatened release of hazardous materials.	Complete

Figure 3.5.1 – Mitigation Projects Completed (Continued)

Hazard Type	Project Description	Status
Water Supply Disruption/ Drought	2015 complete update to the Urban Water Management Plan - conservation and efficient water use	Complete
Water Supply Disruption/ Drought	Instituted multiple residential water conservation programs, resulting in a nearly 20% reduction over the declared drought period	Complete
Flood/Water Supply Contamination	2017 complete update to Sewer System Management Plan - preventative maintenance, schedule, response plan	Complete
Transportation Failure	2012 development of Neighborhood Traffic Management Program	Complete
Transportation Failure	2014 development of Corona Municipal Airport Emergency Plan	Complete
Climate Change/Drought, Emergent Disease	2012 developed the City of Corona Climate Action Plan - reduce GHG emissions	Complete
Fire	2015 implementation of a Suppression Inspection Action Plan - facilitates the completion of hazard reduction inspections	Complete
HazMat, Fire	Contracted with G & G Environmental to ensure all on-site hazardous material inspections were completed within required timeframe.	Complete
Communications Failure/Fire	2015 complete update to the SOLAR - Multi-County Mutual Threat Zone Guide	Complete
Communications Failure/Fire	2015 update to the Corona Fire Radio Guide - Internal and external agency communications	Complete
All	Fire Department Annual Master Training Plan - improves the safety and performance of Department's members in order for them to prevent or minimize loss of life, damage to the environment and loss of property.	Complete
All	2015 update to the Corona Fire Department Emergency Medical Services Quality Improvement Program - delivery of consistent, high quality, compassionate pre-hospital patient care.	Complete
All	Police Department Annual Master Training Plan - improves the safety and performance of Department's members in order for them to prevent or minimize loss of life, damage to the environment and loss of property.	Complete
All	2017 implementation of the new Emergency Medical Dispatch Program - delivery of pre arrival medical direction	Complete

CHAPTER 4.0 – HAZARD IDENTIFICATION AND RISK ASSESSMENT

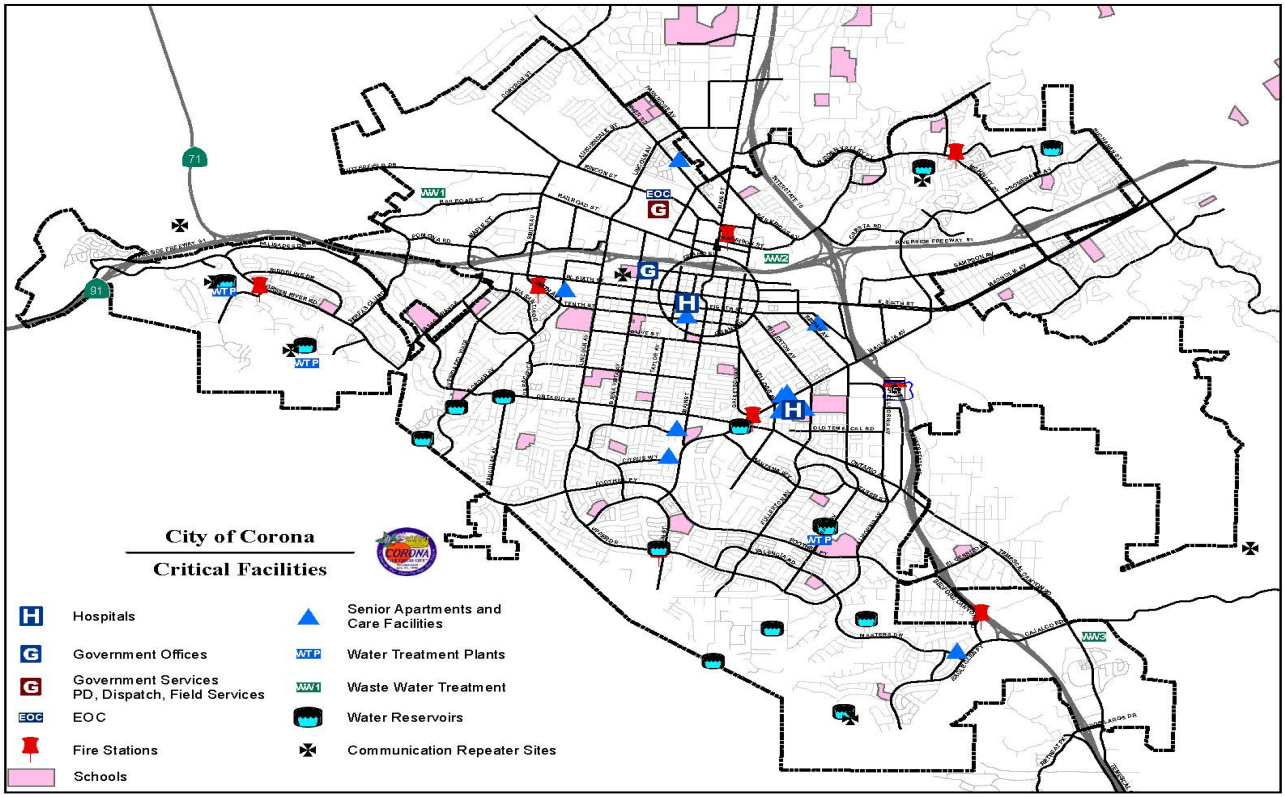
4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

A critical facility can be defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. An inventory of critical facilities in the City of Corona is included in figures 4.1.1 and 4.1.2.

Figure 4.1.1 – Critical Facilities for City of Corona 2023

Critical Facilities Type	Number
Public Safety Dispatch	1
Emergency Operations Center	1
City Services	2
Fire Stations	7
Water Reservoirs	15
Water Treatment Plants	3
Wastewater Treatment Plants	3
Hospitals	2
Police Facility	1
Maintenance Yards	1
Senior Care	26
Schools	44
Radio Repeaters	7

Figure 4.1.2 Critical Facilities Map for City of Corona



4.2 ESTIMATING POTENTIAL LOSS

The most vulnerable structures in the City are downtown, the Fire Station, City Hall, Cabot's Pueblo Museum, and other unreinforced structures. These facilities are the weakest in the city. A major earthquake the proximity to the San Andreas Fault would also cause damage to any of these facilities due to their proximity to the San Andreas Fault.

4.3 TABLE OF REPLACEMENT VALUES

Figure 4.3.1 – Assets Table/Replacement Value for City of Corona

Name of Asset	Replacement Value ($)	Occupancy/ Capacity #	Hazard Specific Info.
City Hall	$45,094,961	N/A	Unsecured Perimeter
Fire Stations (7)	$25,200,000	N/A	Unsecured Perimeters
Police Department	$15,154,127	N/A	Proximity to railroad Proximity to large diameter gas line Proximity to the desalinization plant Flight Path of Corona Airport Flood Zone
Emergency Operations Center	$15,976,093	N/A	Proximity to railroad

4.4 IDENTIFICATION OF RISKS AND VULNERABILITIES

The County of Riverside identified, evaluated, and ranked 23 natural and human-induced public safety risks that could have an impact on the health, safety, and social well-being of the community. The ranking was based on severity of damage and probability of occurrence for each risk. The City of Corona then ranked the same 23 hazards and included the top 10 risks in the City's annex to the Riverside County MJHMP. Below are the top 10 hazards in order of ranking. For a complete list of hazards, their probability and severity see Figure 3.2.1.

1. Earthquake

The City of Corona is seismically active, as is most of Southern California. Several known active or potentially active faults are in and around Corona.

The Elsinore Fault Zone is the closest major fault system to the City and one of the largest in Southern California. Historically, the Elsinore Fault Zone has also been one of the least active systems. At its northern end, near the City, the Elsinore Fault Zone splays into two segments, the Chino-Central Avenue Fault and the Whittier Fault. Along the southwestern portion of the City, the Elsinore Fault Zone is referred to as the Glen Ivy Fault. For more information on the faults zone around the city, please reference Figure 4.4.1.

Ground surface rupture due to active faulting is considered possible in the western portion of the City where known active or potentially active faults are mapped. Geological evidence indicates that the Glen Ivy Fault and portions of the Whittier Fault are active and that the Chino-Central Avenue Fault is potentially active.

Historically, the Corona region has generally not been affected by a major, destructive earthquake. However, based on a search of earthquake databases of the United States Geological Survey (USGS) National Earthquake Information Center, several major earthquakes (magnitude 6.0 or more) have been recorded within approximately 100 kilometers of the City since 1769.

The City's General Plan Public Health and Safety Element has identified various implementation programs with respect to fault rupture and other geologic disturbances. These programs specify various requirements including that detailed geologic investigations are to be conducted in conformance with guidelines of the California Division of Mines and Geology (CDMG) for all construction of transportation infrastructure in an Alquist-Priolo Special Study Zone and for construction of essential facilities within 200 feet of an active fault or potentially active fault. They also state that field information is to be developed as part of any California Environment Quality Act (CEQA) investigations and geologic reports by the City and/or County geologists should be kept current and accessible for use in report preparation, geologic reviews, and policy development.

Additionally, the City's General Plan Public Health and Safety Element has identified various implementation programs to be carried out by the City and/or County affecting seismic safety of critical facilities.

These programs include detailed site studies for faults are to be conducted as background to the design process for critical facilities under City and county discretionary approval as well as existing critical facilities are to be reviewed for any significant siting, design, or construction problems that would make them vulnerable in the event of an earthquake. The findings shall be incorporated into Emergency Operations Plans (EOPs) as well as addressed in longer-term programs of facilities upgrading or relocation unless satisfactorily demonstrated that a building setback from an active or potentially active fault will not adversely impact public health, safety, and welfare. New facilities deemed essential shall not be located within 200 feet of an active fault or potentially active fault. (See Riverside County OA MJHMP Section 4.0)

2. Wildland/Urban Fire

The combination of population density, weather, and growing residential and commercial development presents a potential year-round threat of conflagration. However, late spring through early fall months is commonly referred to as the “fire season.”

The City of Corona is nearly surrounded by hills and mountains with the potential and the history of large wildland fires. To the south, the City sits at the base of the Santa Ana mountain range, and borders against the Cleveland National Forest. The shared boundary between the City and the Forest is about 12 miles in length. The fuels are heavy brush with oaks, sycamore and pines on the slopes and drainages. Residential structures are immediately adjacent to this forest area throughout the entire boundary. Some are newer constructions with good clearances, and some are much older with less clearance.

The western portion of the City sits at the base of Prado Dam which is the headwater for the Santa Ana River Canyon. The Santa Ana Canyon’s steep topography and East-West alignment serve as a wind funnel. The geography increases the wind’s speed and magnifies the effects of fire on the available fuel bed, contributing to the rapid rate of fire spread. The northern side of this canyon comprises primarily light flashy fuels due to frequent burning and fuel type-conversion, and the southern side comprises primarily of heavy brush. There is a significant fire history in this canyon area. The 91 Freeway parallels the Santa Ana River throughout the canyon. There are areas of development where structures sit adjacent to wildland areas throughout the western areas of the City.

The northwest area of the City sits in the Prado Basin behind the Prado Dam and there are several developments that adjoin some heavy fuels.

The northeast area sits in the Corona Hills, and developments are built up to and on top of the hills. These hills comprise primarily of light flashy fuels due to frequent burning and type-conversion.

The eastern edge of the City is bordered by hills and Eagle Valley. This area has not been developed and is comprised of light flashy fuels due to frequent burning and type-conversion. Fires occur frequently, but there is very little structural threat.

In addition to interface areas within the City Limits, many of these areas also have significant residential development in unincorporated areas that are immediately adjacent to the City.

Over the years, there have been several significant fires, many of sizeable acreage, within the City or areas just outside its borders. Many of these fires have resulted in destroyed and damaged structures. There have been six state declarations for wildfire in Riverside County since the last LHMP update in 2017, and 34 federal declarations for Riverside County for wildfires, since 1990.

Weather

Weather patterns combined with certain geographic locations can create a favorable climate for wildfire activity. Areas where annual precipitation is less than 30 inches per year are extremely fire susceptible. High risk areas in Southern California share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. The frequent occurrence of 40-50 mile per hour Santa Ana or foehn winds, coupled with temperatures more than 90 degrees, relative humidity of 20 percent or less and dense and extremely dry ground cover in inaccessible mountain or canyon areas causes the kinds of wildland fires Southern California experiences every year.

Topography

Topography has considerable effect on wildland fire behavior and on the ability of firefighters and their equipment to take action to suppress those fires. Simply because of topography, a fire starting in the bottom of a canyon may expand quickly to the ridge top before initial attack forces can arrive. Rough topography greatly limits road construction, road standards, and accessibility by ground equipment.

Steep topography also channels airflow, creating extremely erratic winds on leeward slopes and in canyons. Water supply for fire protection to structures at higher elevations is frequently dependent on pumping units. The source of power for such units is usually from overhead distribution lines, which are subject to destruction by wildland fires.

Vegetation

A key to effective fire control and the successful accommodation of fire in wildland management is the understanding of fire and its environment. Fire environment is the complex of fuel, topographic, and air mass factors that influence the inception, growth, and behavior of a fire. The topography and weather components are, for all practical purposes, beyond man's control, but it is a different story with fuels, which can be controlled before the outbreak of fires. In terms of future urban expansion, finding new ways to control and understand these fuels can lead to possible fire reduction.

Of these different vegetation types, coastal sage scrub, chaparral, and grasslands reach some degree of flammability during the dry summer months and, under certain conditions, during the winter months.

For example, as chaparral gets older, twigs and branches within the plants die and are held in place. A stand of brush 10- to 20- years of age usually has enough dead material to produce rates of spread about the same as in grass fires when the fuels have dried out. In severe drought years, additional plant material may die, contributing to the fuel load.

Wildfire Characteristics

There are three categories of interface fire: The classic wildland/urban interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas; the mixed wildland/urban interface is characterized by isolated homes, subdivisions and small communities situated predominantly in wildland settings; and the occluded wildland/urban interface exists where islands of wildland vegetation occur inside a largely urbanized area. Certain conditions must be present for significant interface fires to occur. The most common conditions include hot, dry and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, several conditions influence its behavior, including fuel, topography, weather, drought and development. Southern California has two distinct areas of risk for wildland fire: the foothills and lower mountain areas which are most often

covered with scrub brush or chaparral and the higher elevations of mountains with heavily forested terrain.

Wildfire Hazard Areas

The State of California Department of Forestry and Fire Protection (CAL FIRE) is required by law to periodically map areas of significant fire hazards based on history, fuels, terrain, weather, and other relevant factors that influence fire potential and behavior. The fire hazard areas are delineated into zones known as Fire Hazard Severity Zones (FHSZ) that influence the construction of buildings and property protection to reduce the risks associated with wildland fires. In addition to areas of state responsibility, the map also displays areas where local governments have financial responsibility for wildland fire protection depicting moderate, high and very high delineations.

The Corona Fire Department collaborated with CAL FIRE in the development of our local Fire Hazard Severity Zone map. The Fire Chief approved the map on May 1, 2010, and it was adopted by the Corona City Council on May 19, 2010. See Figure 4.2.2 – Fire Hazard Zones.

The Fire Hazard Severity Zone Map will be used for:

- Implementing wildland-urban interface building standards for new construction using the 2007 California Building Code, Section 7A (Wildland-Urban Interface).
- Natural hazard real estate disclosure at the time of sale.
- One-hundred-foot defensible space clearance requirements around buildings.
- Property development standards such as road widths, water supply and signage.
- Reference for City and County General Plans.

3. Electrical Failure

Corona's electric utility was established on April 4, 2001, by City Council Resolution No. 2001-25 in response to state-wide rolling blackouts and electric price instability. The electric utility provides fully bundled electric service to City owned and operated facilities and eight areas within the City. It also provides energy delivery services to municipal and commercial customers within the City.

Corona's electric utility was established on April 4, 2001, by City Council Resolution No. 2001-25 in response to state-wide rolling blackouts and electric price instability. The electric utility provides fully bundled electric service to City owned and operated facilities and eight areas within the City. It also provides energy delivery services to municipal and commercial customers within the City.

The current lack of back-up electricity at the City's well sites leaves the City and its residents vulnerable to water service interruptions in the event of an electrical power failure. The Corona Department of Water and Power is responsible for the provision of water to more than 40,000 service connections. Currently, approximately half of the City's water is imported (via the Metropolitan Water District) and the other half is produced via local groundwater wells. Most (add %) of the City's groundwater wells do not have back-up generator power. This critical water source has great potential to be compromised by a power failure. A lack of pumping capability could interrupt water supply and delivery to thousands of residents. A power failure could deeply affect water supplies to residents, hospitals, and other essential facilities.

The loss of potable water is one of the most devastating effects from a natural disaster and can have long-term and lethal impacts. The lack of drinking water quickly leads to water-borne illness and dehydration and these conditions disproportionately affect the elderly, young and infirm.

The City's above ground power lines are susceptible to the high winds that pass through the City. The potential for arcing lines causing sparks to drop onto buildings or brush is a hazard that the utility department continues to address, however there have been few major fires caused by this type of event. In addition to the overhead lines, there is a potential for events relating to underground vaults and power lines. These vaults and lines are susceptible to flooding during heavy rains as well as being broken by contractors digging in the streets and on property where underground utilities are used. (See Riverside County OA MJHMP Section 4.0)

4. Terrorist Event

Terrorism, as defined by the FBI, is "the unlawful use of force against persons or property to intimidate or coerce a government, the civilian population or any segment thereof, in the furtherance of political or social objectives.

The tactics of terrorism are diverse. As important as the actual attacks is the cultivation in the target population of the fear of such attacks, so that the threat of violence becomes as effective as actual violence. Terrorist tactics tend to favor attacks that avoid effective countermeasures and exploit vulnerabilities.

As such, terrorists have the potential to utilize many different types of tactics both conventional and unconventional. Some of these tactics include shootings, kidnappings, bombings, suicide attacks, bioterrorism, agroterrorism, nuclear terrorism, and cyberterrorism. From 2010 to 2022 there have been roughly 40 confirmed domestic terrorist incidents (See Riverside County OA MJHMP Section 4.0)

5. Water Supply Disruption/Contamination

The Corona Department of Water and Power is responsible for the provision of water, serving approximately 150,000 customers. Currently, approximately half of the City's water is imported (via the Metropolitan Water District) and the other half is produced via local groundwater wells. Most of the City's groundwater wells do not have back-up generator power. This critical water source has great potential to be compromised by a power failure. A lack of pumping capability could interrupt water supply and delivery to thousands of residents. A power failure could deeply affect water supplies to residents, hospitals, and other essential facilities. The loss of potable water is one of the most devastating effects from a natural disaster and can have long-term and lethal impacts. The lack of drinking water quickly leads to water-borne illness and dehydration and these conditions disproportionately affect the elderly, young and infirm.

In addition, water reservoir failure could critically impair the City's fire fighting capabilities. The Corona Fire Department currently uses potable water for fighting fires. Plans are in place for the recycled water to be utilized as new infrastructure is constructed and more water is treated for recycled use. However, city-wide availability of recycled water for firefighting is several years away.

On June 4, 2008, the Governor of the State of California proclaimed a condition of statewide drought and strongly encouraged local agencies to take aggressive, immediate action to reduce water consumption and prepare for potentially worsening conditions. Once again, conditions worsened and on January 17, 2014, California State Governor, Jerry Brown, declared a drought state of emergency. On April 17, 2017, Brown issued Executive Order B-40-17, officially ending the drought state of emergency in all California counties except Fresno, Kings, Tulare, and Tuolumne.

During these times the City of Corona adopted, implemented, and enforced water conservation programs to reduce the quantity of water used by consumers within the City to ensure that there was sufficient water for human consumption, sanitation, and fire protection. The City was diligent in conserving water, resulting in a nearly 20% reduction in Corona over the declared drought period.

The City is authorized to declare a water shortage emergency to prevail within its jurisdiction when it finds and determines that the City will not be able to or cannot satisfy the ordinary demands and requirements of water consumers without depleting the water supply of the City to the extent that there would be insufficient water for human consumption, sanitation, and fire protection.

6. Flood

Several creeks, washes, channels, and flood zones are contained in the Planning area of Corona. Areas of the City adjacent to the Santa Ana River, Temescal Creek and Mabey Canyon Wash are designated as Flood Zone A, which indicates the area is inundated by one percent annual chance flooding. Portions of the Planning Area surrounding the Temescal Wash, Main Street Wash, and the Arlington Channel have been designated as Flood Zone X500, which is inundated by 0.2 percent annual chance flooding. Other portions of the Planning Area are either designated as Flood Zone D, which is an area with undetermined possible flood hazards, or Flood Zone X, which lies outside the one percent and 0.2 percent annual chance flood plains. See Figure 4.7.2 – Flood Zones.

Several creeks, washes, channels, and flood zones are contained in the Planning area of Corona. Areas of the City adjacent to the Santa Ana River, Temescal Creek and Mabey Canyon Wash are designated as Flood Zone A, which indicates the area is inundated by one percent annual chance flooding.

Portions of the Planning Area surrounding the Temescal Wash, Main Street Wash, and the Arlington Channel have been designated as Flood Zone X500, which is inundated by 0.2 percent annual chance flooding. Other portions of the Planning Area are either designated as Flood Zone D, which is an area with undetermined possible flood hazards, or Flood Zone X, which lies outside the one percent and 0.2 percent annual chance flood plains. See Figure 4.7.2 – Flood Zones.

Temescal Wash has the highest flooding potential in the Corona Planning Area. Due to the size of the Temescal Watershed and the amount of rainfall received, several peak discharges have been recorded.

Based on the stream gauge analysis data obtained from Flood Insurance Study dated September 30, 1992, the peak discharges for the 500-year, 100-year, and 10-year are 110,000 cfs (cubic feet per second), 25,000 cfs, 11,000 cfs, and 2,000cfs, respectively, for the 164-square mile watershed. These discharges are obtained from the Flood Insurance Study Report for Stream Gauge No. 11-720 near Corona above the 3M plant location.
The peak discharges are determined from the stream gauge data analysis, which is based on clear flow and existing conditions.

The Planning Area has experienced major flooding during periods of heavy runoff. The 1969 flooding in Temescal Wash caused extensive damage, which was determined to be higher than 100-year storm levels. Major flooding in the Planning Area could occur along the Temescal Wash and in west Corona, and storm sheet flows would produce a variety of damage depending upon the location. This sheet flow would be the result of overflows from the Oak Street Channel, Lincoln Avenue drain, Main Street Channel, Buena Vista drain, and Taylor Avenue drain. Other significant flooding areas are found along the open channel facilities near the City Yard. These facilities are determined to be inadequate for the 2-year storm event.

Several flood control projects including the Main Street Channel and Arlington Channel have been built in the Planning Area to help lessen the severity of heavy flooding.

The City of Corona participates in the National Flood Insurance Program (NFIP), as administered through the Federal Emergency Management Agency (FEMA). Consequently, property owners can purchase Federal Flood Insurance.

In turn, the City of Corona has identified flood hazard areas and protective controls, including land use planning measures to reduce the potential risk of flood damage to property and loss of human life. (See Riverside County OA MJHMP Section 4.0)

7. Emergent Disease/Contamination

Infectious diseases have for centuries ranked wars and famine as major challenges to human progress and survival. They remain among the leading causes of death and disability worldwide. Against a constant background of established infections, epidemics of new and old infectious diseases periodically emerge, greatly magnifying the global burden of infections. Studies of these emerging infections reveal the evolutionary properties of pathogenic microorganisms and the dynamic relationships between microorganisms, their hosts and the environment.

Climate change may well be the pre-eminent challenge of our time and it is already having a significant and measurable impact on California's environment.

Climatic factors influence the emergence and reemergence of infectious diseases, in addition to multiple human, biological, and ecological determinants.
Climatologists have identified upward trends in global temperatures and now estimate an unprecedented rise of 2.0°C by the year 2100. Of major concern is that these changes can affect the introduction and dissemination of many serious infectious diseases.

The incidence of mosquito-borne diseases, including malaria, dengue, and viral encephalitis, are among those diseases most sensitive to climate. Climate change would directly affect disease transmission by shifting the vector's geographic range and increasing reproductive and biting rates and by shortening the pathogen incubation period. Climate-related increases in sea surface temperature and sea level can lead to higher incidence of water-borne infectious and toxin-related illnesses, such as cholera and shellfish poisoning. Human migration and damage to health infrastructures from the projected increase in climate variability could indirectly contribute to disease transmission. Human susceptibility to infections might be further compounded by malnutrition due to climate stress on agriculture and potential alterations in the human immune system caused by increased flux of ultraviolet radiation.

8. Transportation Failure

The City of Corona's extensive transportation network which includes state highways, public transit, rail lines, and municipal airport provide additional associated incident risks that may cause severe injuries and/or deaths. Two major freeways and one railroad transect Corona. The Riverside Freeway (SR-91) runs east/west directly north of the City's center, Interstate 15 (I-15) runs north/south near the eastern edge of the City.

Along with the potential for death and injuries from large-scale motor vehicle accidents, there is the potential for hazardous material spills or fires as numerous commercial transportation vehicles travel the highways and freeways with various types and quantities of hazardous materials.

The BNSF Railroad parallels SR-91, it is a strictly commercial freight transportation system. Large quantities and numerous types of hazardous materials are transported through Corona by rail daily.

These corridors are major transportation routes to the economic center of Orange County from the Inland Empire. The primary hazard with rail service has not been any train vs. train or track derailments. There continues to be a large number of train v. vehicle or train v. pedestrian accidents in the City.

These accidents have caused both traffic and rail service delays. The danger with these types of accidents is that they can create train derailments or accidents when the train impacts with a vehicle or when the train engineer attempts to stop the train quickly.

The Corona Municipal Airport is home to 350-400 general aviation aircraft and is strictly a recreational airport with no commercial flights. Although small, the airport is extremely active, with approximately 50,000 annual operations. The City's transportation network of roads, freeways, rail lines and airport has been a priority in the city's planning and mitigation efforts.

A Traffic Safety Plan has been implemented for the management of traffic events that occur in the City. Public Works, Police, and Fire have identified routes through the city to mitigate traffic issues that might occur. Command Posts, staging areas and other aspects of Incident Command have been addressed in the Traffic Safety Plan.

9. Communication Failure

One of the most immediate and significant impacts of disasters is the sudden and wide-scale breakdown or interruption of communications infrastructure.

When public communication networks fail, the impact can be widely felt and can wipe out access to standard mobile or landline telecommunications, in addition to Internet, fiber-optic cables, and even satellite-based emergency communication devices. Whether these systems are completely or just partially knocked offline, communications systems during a disaster can be the difference between life and death for those affected. Locating those who may be trapped or injured becomes nearly impossible for emergency responders, and rescue efforts are further complicated by the inability to coordinate via standard methods of communication.

In addition to disruptions caused by physical damage you will more than likely encounter network congestion. When disaster strikes, the "pipes" that make up our communications networks often become congested with exceptionally high levels of data traffic, as those impacted seek to contact family and friends, emergency personnel work to coordinate relief efforts, and hundreds more upload pictures and videos of the damage.

Aggregation hubs are often the failure point for congested networks. This occurs when data from several smaller sources flows into a central processing point and creates bottlenecks. When this happens, communication can be severely limited or cut off completely.

Consequences from these communication infrastructure failures can greatly affect emergency response and lead to the spread of false information and confusion.

10. Pandemic Flu

An influenza pandemic is a global outbreak of a new influenza A virus. A novel influenza A virus is one that has caused human infection but is different from current seasonal human influenza A viruses spreading among people. Novel influenza A viruses can be viruses that originate in animals that gain the ability to infect humans or human viruses that change significantly to be different from current human seasonal influenza A viruses. Some novel flu A viruses are believed to pose a greater pandemic threat than others and are more concerning to public health officials because they have caused serious human illness and death and have been able to spread in a limited manner from person-to-person. Novel influenza A viruses are of extra concern because of the potential impact they could have on public health if they gained the ability to spread from person-to-person easily, triggering a pandemic.

Three subtypes of avian influenza A viruses H5, H7 and H9, along with variant viruses H1N1v, H3N2v and H1N2v are currently most concerning to public health officials. In September 2009, the H1N1 influenza received worldwide attention as a threat to public health. Cases of death related to the H1N1 flu surfaced first in Riverside County, as the illness spread throughout the State as well as the Nation. The City was not exempt and had cases emerge at local schools. Conference calls with the County Health Officer, local government and school officials, and emergency managers helped the City to prepare for the threat of a pandemic emergency. Subsequently, the City of Corona took measures to mitigate and adopted a Plan for Pandemic emergencies. (See Riverside County OA MJHMP Section 4.0)

Figure 4.4.1 – Earthquake Fault Zones for City of Corona

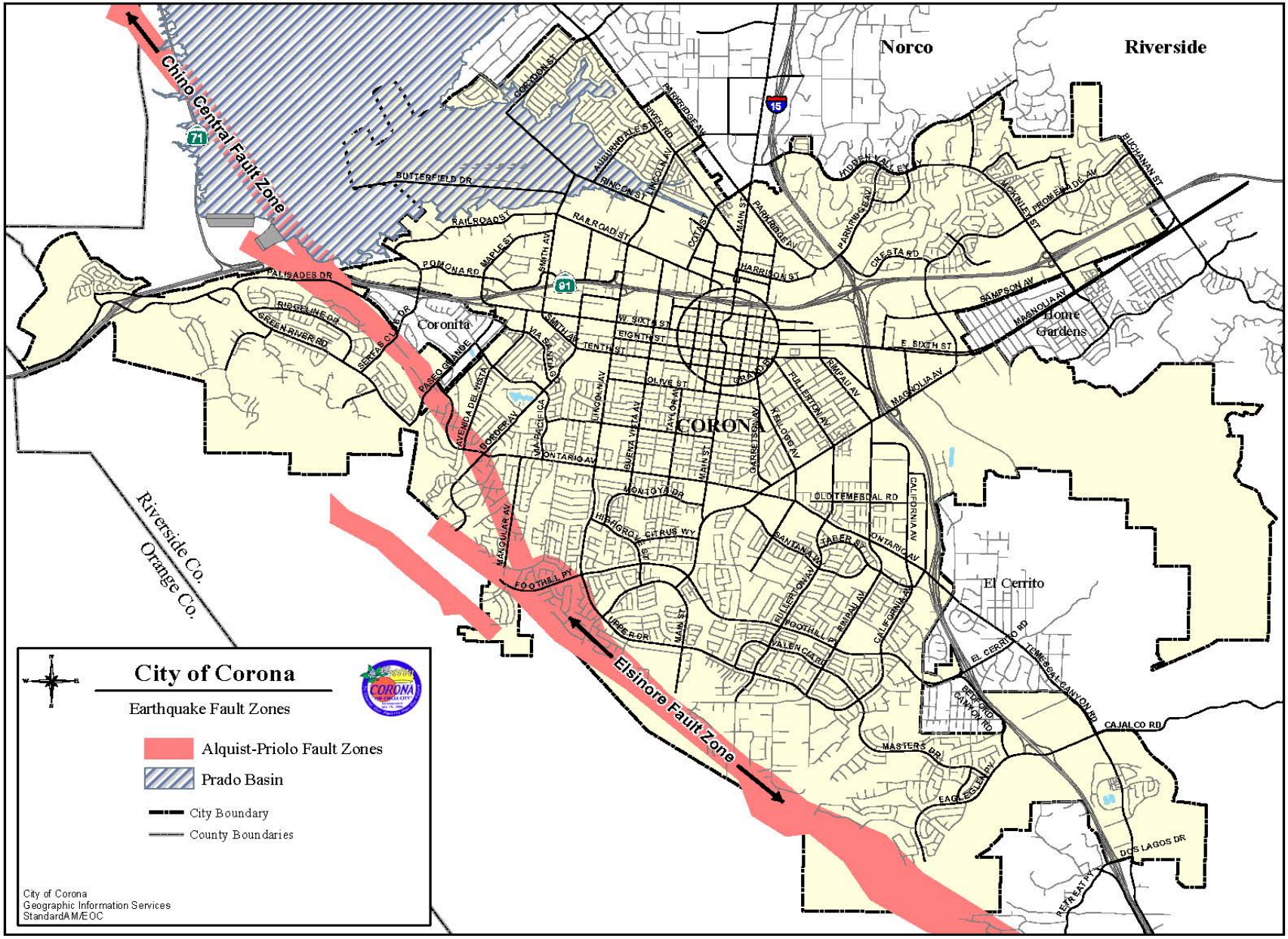

Chino Central Fault Zone
Elsinore Fault Zone
Norco
Riverside
Coronita
CORONA
Home Gardens
El Cerrito
Riverside Co.
Orange Co.
City of Corona
Earthquake Fault Zones
Alquist-Priolo Fault Zones
Prado Basin
City Boundary
County Boundaries
City of Corona
Geographic Information Services
StandardAM/EOC

Figure 4.4.2 – Flood Zones for City of Corona

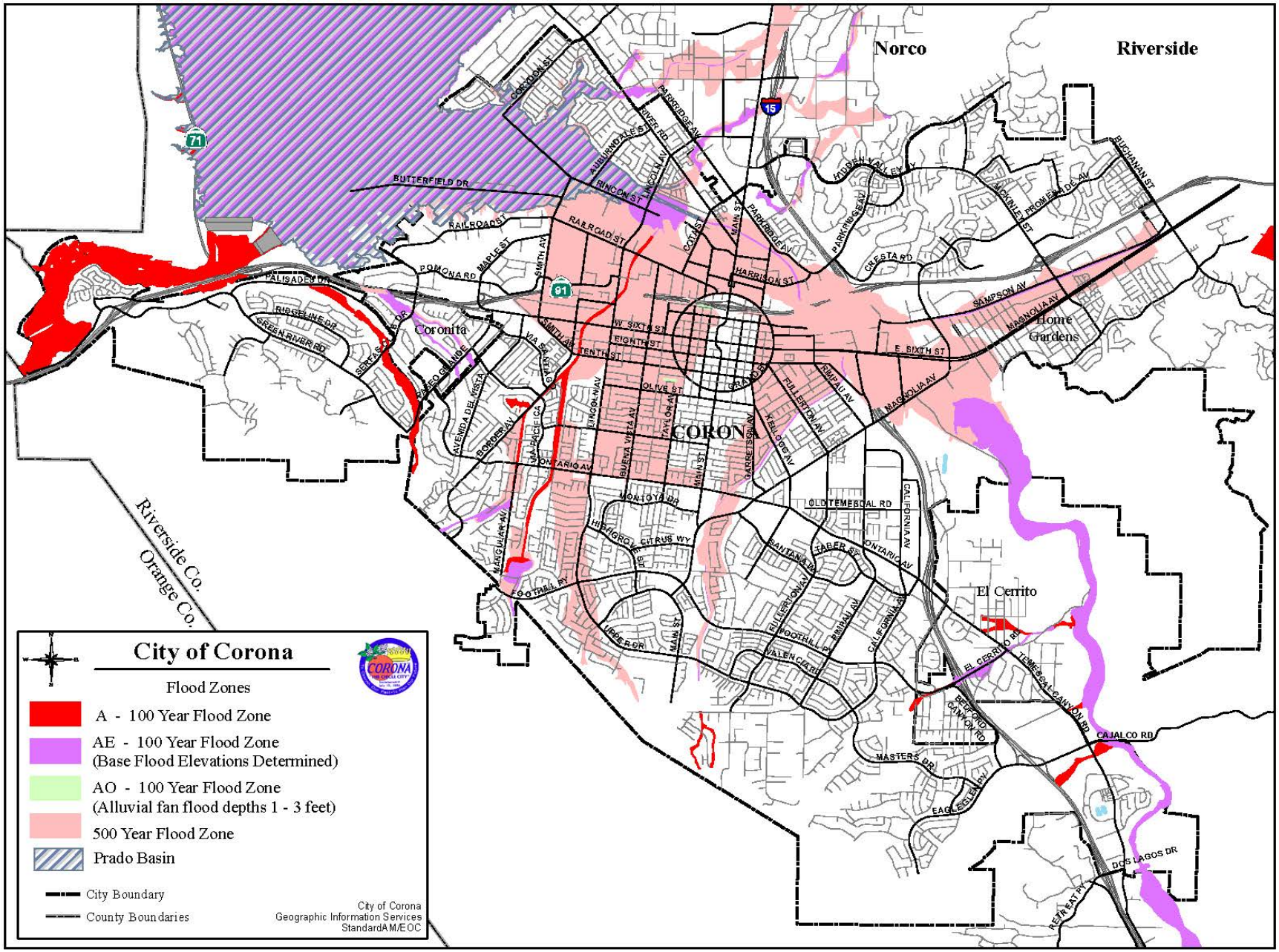
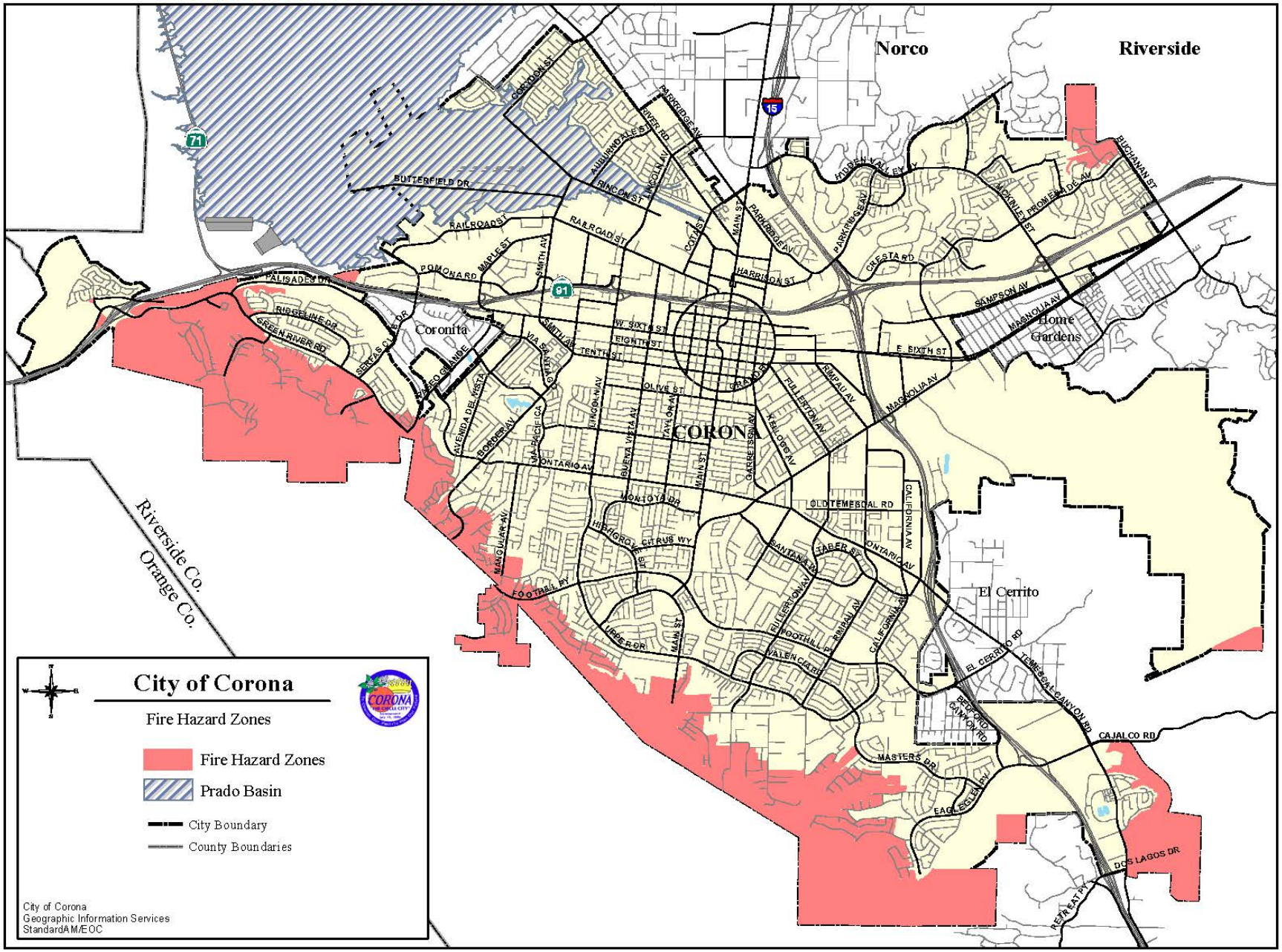

Norco
Riverside
Coronita
CORONA
Home Gardens
El Cerrito
Riverside Co.
Orange Co.
City of Corona
Flood Zones
A - 100 Year Flood Zone
AE - 100 Year Flood Zone
(Base Flood Elevations Determined)
AO - 100 Year Flood Zone
(Alluvial fan flood depths 1 - 3 feet)
500 Year Flood Zone
Prado Basin
City Boundary
County Boundaries
City of Corona
Geographic Information Services
StandardAM/FOC

Figure 4.4.3 – Fire Hazard Zones for City of Corona



SECTION 5.0 – COMMUNITY RATING SYSTEM

5.1 REPETITIVE LOSS PROPERTIES

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements.

As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:

1. Reduce flood losses.
2. Facilitate accurate insurance rating; and
3. Promote the awareness of flood insurance.

5.2 NATIONAL FLOOD INSURANCE PROPERTIES

The City of Corona has participated in the National Flood Insurance Program since 1978.

a. ***Describe participation in NFIP, including any changes since previously approved plan.*** Corona's recent activity related to NFIP includes updated Riverside County Flood Insurance Study and digitized Flood Insurance Rate Maps (FIRM) on August 28, 2008. City of Corona Floodplain Management Ordinance updated on December 3, 2008.

b. ***Date first joined NFIP*** - May 15, 1978

c. ***Identify actions related to continued compliance with NFIP*** – Corona Floodplain Management Ordinance was updated in 2008 to meet the minimum NFIP requirements pursuant to Title 44 Code of Federal Regulations Sections 59, 60.3-60.6, and 65.3 and the California Department of Water Resources (DWR) Model Ordinance. The Public Works Department reviews development permit applications and plans to ensure they are following our Ordinances and requires map revisions as necessary and maintains records such as elevation certificates, Letters of Map Changes, and Flood Insurance Rate Maps (FIRMs) for public availability. The Community Services and Public Works Department investigate violations and issue enforcement orders to bring developments in compliance with City Ordinances.

d. **CRS member** – No
e. **CRS class** – n/a
f. ***Describe any data used to regulate flood hazard area other than FEMA maps***- Riverside County Flood Insurance Study issued August 28, 2008; Drainage studies used to support CLOMR and LOMR issuance.
g. ***Have there been issues with community participation in the program?*** No
h. ***What are the general hurdles for effective implementation of the NFIP?*** Funding for updating outdated drainage studies and for performing new studies in previously unstudied flood hazard areas.
i. **Summarize actions related to continued compliance with NFIP** –See item Above.

SECTION 6.0 - CAPABILITIES ASSESSMENT

The City's ability to reduce hazards by improving upon existing mitigation strategies or implementing newly identified mitigation strategies, include it's legal and regulatory authorities, administrative, technical, and fiscal capabilities, and imperative to the success of all these strategies, are its continuous outreach, education, and partnership building capabilities.

6.1 REGULATORY MITIGATION CAPABILITIES

The City formally adopts, reviews, and updates regulatory policies and plans, along with implementing regulations such as zoning and subdivision ordinances. The City partners and coordinates with Riverside County Operational Area to ensure we are apprised of all regional efforts, and adhere to State and Federal mandates.

The hazard mitigation plan update process provides the City with an opportunity to review, evaluate, and expand on existing policies, plans, and city programs. Figure 6.1.1. is an example of regulatory capabilities that assist the City in mitigation strategies.

Figure 6.1.1 Regulatory Mitigation Capabilities for City of Corona

Regulatory Tool	Yes/No	Comments
General plan	Yes	Comprehensive General Plan for the City and SOI areas 2004, updating began 2017
Zoning ordinance	Yes	Corona Municipal Code (CMC) - Title 17
Subdivision ordinance	Yes	Corona Municipal Code - Title 16
Site plan review requirements	Yes	Development Plan Review CMC 17.102
Growth management ordinance	No	Included in Corona General Plan – Growth Development Plan
Floodplain ordinance	Yes	Corona Municipal Code Title 18
Other special purpose ordinance (storm water, water conservation, wildfire)	Yes	Water Conservation Ordinance, 2009; Chapter 13.26 of the Corona Municipal Code, Airport General Provisions Title 4 CMC, Fire Facilities Fee Chapter 3.36 CMC.
Building code	Yes	Green Buildings Code, CMC 15.05.010, Fuel Modification CMC 15.12.110, Eave Protection Chapter CMC 15.12.270.
Fire department ISO rating	Yes	Rating: Two
Erosion or sediment control program	Yes	CMC 15.36.80 (Ord. 2806 and 2568)
Storm water management program	Yes	CMC 13.27, Riverside County Drainage Area Management Plan (DAMP), Drainage Master Plan-Riverside County NPDES co-permittee
Capital Improvements Program	Yes	Five-year plan; updated annually.
Economic development plan	No	Team Corona, program for expansion, relocation or development of commercial projects since.
Local Emergency Operations Plan	Yes	Emergency Operations Plan, November 1999, replaced 2005, updated 2011 and 2015
Other special plans		• Water Master Plan, • Urban Water Management Plan • Corona DWP Standard Plans and Specifications for Sewer & Water • Wildland Urban Interface Strategic Pre Plan 2 • California Fire Code Chapter 49, 2010 • Hazardous Materials Area Plan, California Fire Code, • Certified Unified Program Agency, • Fire Mutual Aid Threat - S.O.L.A.R. Plan
Flood Insurance Study or other engineering study for streams	Yes	Riverside County Flood Insurance Study, which includes City of Corona streams

6.2 ADMINISTRATIVE AND TECHNICAL MITIGATION CAPABILITIES

The figure below shows City personnel responsible for activities related to hazard mitigation. Expertise is used in hazard mitigation identification, planning and strategies, and where information is shared across various City plans.

Figure 6.2.1 Administrative and Technical Mitigation Capabilities for Corona

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes	Community Development Director
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Public Works Director and Building Official/Community Development
Planner/engineer/scientist with an understanding of natural hazards	Yes	Public Works Director
Personnel skilled in GIS	Yes	IT – GIS Division
Full time building official	Yes	Building Official/Community Development
Floodplain manager	Yes	City Manager
Emergency manager	Yes	Fire Department/Emergency Services Coordinator
Grant writer	Yes	Fire/ Police and contract with outside consultant.
GIS Data—Land use	Yes	IT – GIS Division
GIS Data—Links to Assessor's data	Yes	IT – GIS Division
Warning systems/services	Yes	Automated emergency notification system.

6.3 FISCAL MITIGATION CAPABILITIES

The figure below identifies financial tools and resources the City could potentially use to help fund mitigation activities. City continually identifies potential Federal and State grant opportunities to supplement mitigation financial capabilities. See Section 6.5 Funding Opportunities.

Figure 6.3.1 - Fiscal Mitigation Capabilities for City of Corona

Financial Resources	Accessible/Eligible to Use (Yes/No)	Comments
Community Development Block Grants	Yes	Depending on budget & grantor approval
Capital improvements project funding	Yes	Depending on available budget
Authority to levy taxes for specific purposes	Yes	With voter/city council approval
Fees for water, sewer, gas, or electric services	Yes	With voter/city council approval
Impact fees for new development	Yes	With city council approval
Incur debt through general obligation bonds	Yes	With voter/city council approval
Incur debt through special tax bonds	Yes	With voter/city council approval
Incur debt through private activities	No	With voter/city council approval
Withhold spending in hazard prone areas	n/a	With voter/city council approval

6.4 MITIGATION OUTREACH AND PARTNERSHIPS

The City of Corona has an active emergency preparedness, education, and outreach program. Mitigation strategies are taught throughout the year at various community events, fairs, schools, businesses, and other functions. The greatest outreach efforts are being conducted through our CERT Program.

We coordinate with local profit, non-profit, volunteer, and special district entities, such as the school district, the hospital, and the American Red Cross in addition to our Operational Area partners and their volunteer organizations, to plan for and participant in all hazards joint training and exercises. The vast array of knowledge and resources these entities bring to the table greatly improves our emergency management capabilities.

An example of these coordinated planning and training efforts is our city's participation in the regional mass care and shelter planning as we incorporate planning for access and functional needs individuals. In addition, the city has designated cooling and warming centers to utilize during severe weather emergencies, when the establishment of a shelter is not necessary.

One of the most successful systems used to improve upon and augment our City's capabilities and resources is our participation and partnership in the various mutual aid systems. Our Police and Fire Departments participate in mutual aid agreements in the event the City's forces are stretched beyond their capabilities. California Emergency Management Agency coordinates the Emergency Management Assistance Act for the response of emergency management resources to assist in the management of emergencies and disasters. Our Corona Department of Water and Power participates in Cal WARN and the local ERNIE water resource mutual aid organizations. The City manages emergencies under the National Incident Management System (NIMS) which utilizes the Master Mutual Aid concept.

6.5 FUNDING OPPORTUNITIES

In addition to the fiscal capabilities identified in figure 6.3.1 – Fiscal Mitigation Capabilities for City of Corona, some of the greatest funding opportunities come in the form of State and Federal grants, such as the Hazard Mitigation Grant Program.

The Hazard Mitigation Grant Program (HMGP) is authorized by Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (the Stafford Act), Title 42, United States Code (U.S.C.) 5170c. The key purpose of HMGP is to ensure that the opportunities to take critical mitigation measures to reduce the risk of loss of life and property from future disasters are not lost during the reconstruction process following a disaster. HMGP is available, when authorized under a Presidential major disaster declaration, in the areas of the State requested by the Governor. The amount of HMGP funding available to the Applicant is based upon the total Federal assistance to be provided by FEMA for disaster recovery under the Presidential major disaster declaration.

The City of Corona applies for various grants to augment our mitigation financial capabilities. Examples of successful grants awarded to the City to assist in our mitigation efforts are as follows.

1. The city applied for and received a grant award from the California Department of Water Resources (DWR) Flood Emergency Response Projects – Statewide Grant Round Two. The grant provided funding for the city to prepare the Flood Emergency Response Plan, develop, and conduct a tabletop and functional training exercise to test the plan and prepare the city and other participating agencies for flood response (a flood in the city can be caused by both a storm event and dam failure). The plan development is underway and will be completed in December 2018.

2. The city applied for and was awarded Hazard Mitigation Grant Program #4653-307-01R funding for a hydro-seeding project in the burn scar of the 2017 Canyon Fire. The approved activity is to hydro-seed 200,000 square feet of fire damaged area behind a residential area bordering 48 homes and infrastructure using an endemic mixture of California Native Species. The re-establishment of ground cover will assist in the prevention of or lessening the effects of erosion, flash flooding and debris flow. This project was completed by October 2018

SECTION 7.0 - MITIGATION STRATEGIES

7.1 GOALS AND OBJECTIVES

The City of Corona coordinated through the Riverside County Emergency Management Department and other multiple cities and agencies throughout Riverside County in the creation/update of the LHMP. The cooperation and discussions both in regional meetings, community outreach, and internal meetings allowed a global perspective and local jurisdictional perspective to identify additional exposures and hazards within Corona.

Goal 1: Reduce loss of life and injuries.

Objective 1.1: Provide timely notification and direction to the public in preparation for and response to imminent and potential hazards.
Objective 1.2: Protect public health and safety through mitigation, preparing for, responding to, and recovering from the effects of natural, technological, or man-made disasters.
Objective 1.3: Reduce hazard impacts and protect life, property, and the environment from damage.

Goal 2: Reduce Hazard Related Property Losses

Objective 2.1: Encourage new development to occur in locations that avoid or minimize exposure to hazards.
Objective 2.2: Reduce hazard related property losses by enforcing strong building, fire, and municipal codes.
Objective 2.3: Reduce repetitive losses for fire, flood, and earthquakes by encouraging protective measures and by anticipating future events.
Objective 2.4: Reduce hazard impacts to critical facilities, utilities, and services through the implementation of mitigation strategies.
Objective 2.5: Continue to strengthen land use regulations in high hazard areas.

Goal 3: Protect the environment

Objective 3.1: Mitigate the impact of recurring drought conditions that impact both ground water supply and the agricultural industry.
Objective 3.2: Protect the environment from hazardous material releases or exposures.
Objective 3.3: Protect the environment from sewage, wastewater, and storm water pollution or contamination.

Goal 4: Improve coordination and collaboration with City Departments and partnering agencies throughout all phases of emergency management.

Objective 4.1: Coordinate with County EMD, Cal OES, and FEMA to ensure SEMS/NIMS compliancy and to ensure any updates or changes are instituted.
Objective 4.2: Improve City's ability for continuity of operations for all hazard incidents.
Objective 4.3: Incorporate mitigation related activities into other disaster planning mechanisms, such as the General Plan and Capital Improvement Plan.
Objective 4.4: Participate in Operational Area meetings, committees, and exercises.

Goal 5: Improve Community and Agency Awareness

Objective 5.1: Improve mitigation and hazard related outreach to the public, businesses, and other stakeholders to increase their understanding of the various types, locations and effects of hazards and vulnerabilities, and actions they can take to reduce those hazard impacts.
Objective 5.2: Improve, standardize, and expand the emergency preparedness education and outreach program.

7.2 MITIGATION ACTIONS

The City of Corona identified the following mitigation actions to be taken based on the Goals and Objectives established, pertinent to the hazard ranking assessment.

These actions are in addition to the on-going mitigation strategies identified in Section 7.3 and the projects to be completed in the comprehensive Five-Year Capital Improvement Program (CIP), which provides for the maintenance and improvement of the City's infrastructure.

The following mitigation projects have been identified by the responsible city department, scheduled and a funding mechanism has been allocated.

1) **Goal 4**: Improve coordination and collaboration with City Departments and partnering agencies throughout all phases of emergency management.

   Objective 4.2: Improve City's ability for continuity of operations for all hazard incidents.
   Action: Enhance communication interoperability by purchasing Harris Unity Radios; these radios will operate on the Public Safety Enterprise Communications 10.

   Responsible Dept: Police Department
   Mitigated Hazard: Communications Failure
   Status: In progress
   Funding: FY 17 State Homeland Security Program

2) **Goal 1**: Reduce loss of life and injury.

   Objective 1.1: A Provide timely notification and direction to the public in preparation for and response to imminent and potential hazards.

   Action: Replace/upgrade current Computer Aided Dispatch system which has been in place for over 30 years.

   Responsible Dept: Police Department
   Mitigated Hazard: All
   Status: In progress will be completed in January 2023.
   Funding: City General Fund

3) **Goal 3**: Protect the environment.

Objective 3.2: Protect the environment from hazardous material releases or exposures.

Action: The 2021 Hazardous Materials Area Plan was updated in coordination with Riverside County Environmental Health to assist in the prevention or mitigation of damage from the release or threatened release of hazardous materials.

Responsible Dept: Fire Department
Mitigated Hazard: HazMat, Fire
Status: Updates to the plan have been completed and it is with the State for review. The approved plan will be taken to the Council for formal adoption in October 2018.
Funding: City General Fund

4) **Goal 1**: Reduce loss of life and injuries.

Objective 1.3: Reduce hazard impacts and protect life, property, and the environment from damage.

Action: Conduct Active Shooter exercises Citywide. Enter scene under force protection to provide care to victims that otherwise would have died from preventable death injuries.
Responsible Dept: Police and Fire Department
Mitigated Hazard: Terrorism
Status: Quarterly exercises beginning May 2023 into 2024/2025
Funding: City General Fund

5) **Goal 2**: Reduce Hazard Related Property Losses

Objective 2.3: Reduce repetitive losses for fire, flood, and earthquakes by encouraging protective measures and by anticipating future events.

Action: Department of Water and Power in conjunction with Emergency Management Division will facilitate the creation of a flood plan for the City of Corona

Responsible Dept: Department of Water and Power and Fire Department
Mitigated Hazard: Flood
Status: Plan completed in December 2018

Funding: California Dept. of Water Resources – Flood Emergency Response Projects – Statewide Grant

6) **Goal 2**: Reduce Hazard Related Property Losses

Objective 2.3: Reduce repetitive losses for fire, flood, and earthquakes by encouraging protective measures and by anticipating future events.

Action: Design and construction of Corona MDP Line 52 to alleviate flooding on Grand Avenue and Joy Street

Responsible Dept: Department of Water and Power
Mitigated Hazard: Flood
Status: Completed in November 2018
Funding: City General Fund – Capital Improvement Project

7) **Goal 3**: Reduce Hazard Related Property Losses

Objective 2.2: Reduce hazard related property losses by enforcing strong building, fire, and municipal codes.

Action: Ensure new development in the fire hazard severity zones follows Chapter 49 of the Fire Code and all other applicable codes. A separate fuel modification plan to be submitted for review and approval by the Fire Department

Responsible Dept: Fire Department/Prevention
Mitigated Hazard: Fire
Status: Ongoing and continuous
Funding: Permit and inspection fees

8) **Goal 4**: Improve Community and Agency Awareness

Objective 5.1: Improve mitigation and hazard related outreach to the public, faith-based organizations, businesses, and other stakeholders to increase their understanding of the various types, locations and effects of hazards and vulnerabilities, and actions they can take to reduce those hazard impacts.

Action: Provide Community Emergency Response Team training to the community. Offer this training twice a year to the community.

Responsible Dept: Fire Department/Emergency Management Division
Mitigated Hazard: All
Status: Two classes a year. One in English, and one in Spanish.
Funding: State Homeland Security Program grant funding.

9) **Goal 5**: Improve coordination and collaboration with City Departments and partnering agencies throughout all phases of emergency management.

Objective 4.3: Incorporate mitigation related activities into other disaster planning mechanisms, such as the General Plan and Capital Improvement Plan.

Action: Coordination with Caltrans, Riverside County Transportation Commission with the Corona Freeway Improvement Projects. These projects hope to reduce traffic, increase capacity and mobility.

- Interstate 15 corridor improvement project
- State Route 91 corridor improvement project
- State Route 91/SR-71 interchange improvement project

Responsible Dept: Public Works
Mitigated Hazard: Transportation Failure
Status: All projects completed by 2020
Funding: Caltrans District 8

10) **Goal 6**: Improve coordination and collaboration with City Departments and partnering agencies throughout all phases of emergency management.

Objective 4.2: Improve City's ability for continuity of operations for all hazard incidents.

Action: Develop a multi-year EOC training and exercise plan, enhancing the city's ability to respond and recover from all hazard incidents, lessening the negative impacts to our residents.

Responsible Dept: Fire Department/Emergency Management Department
Mitigated Hazard: All
Status: EOC Training began in March of 2023, with regular exercises.
Funding: City General Fund

7.3 ON-GOING MITIGATION STRATEGY PROGRAMS

The City of Corona has implemented and or updated several policies, procedures, programs and plans to lessen the impact of disasters and prevent the loss of life and property. Some of these on-going mitigation efforts are identified in the table below.

Figure 7.3.1 On-Going Mitigation Strategy Programs

Hazard Type	Mitigation Action	Mitigation Strategy
All	2017 LHMP Update and annual review	Update 2012 Local Hazard Mitigation Plan to identify projects to lesson the impact of disasters and prevent the loss of life and property. Review to ensure priorities are not changed.
Contamination, Pollution, Flood	Storm Water and Urban Runoff Pollution Prevention Program	Prevents pollution of local waterways, regulates what can be discharged into storm drains.
Terrorism	BioWatch Program Participant	BioWatch provides early detection of biological agents in the air used for a bioterrorism attack.
Transportation Failure, Terrorism	Traffic Management Center	Single location to monitor throughout the City over 70 traffic signals, 15 monitoring cameras and a video and data link between CalTrans District 8 TMC in San Bernardino.
Transportation Failure	Advanced Traffic Management System	Ability to make adjustments to timing of traffic signal systems on local streets and bottom of freeway ramps to assist in moderating congestion.
Terrorism	Train and Exercise PD & Fire Tactical Response Team	Enter scene under force protection to provide care to victims that otherwise would have died from preventable death injuries.
HazMat, Transportation Failure, Fire	Hazardous Material Area Plan	Hazardous Material Area Plan, assists in the prevention or mitigation of damage from the release or threatened release of hazardous materials.
Pandemic Flu	Pandemic Influenza Plan	City of Corona Pandemic Influenza Plan facilitates coordination with County Public Health for an organized and quick response to a pandemic effecting the City, lessening the
Fire, Transportation Failure, Terrorism	Emergency Airport Plan	Corona Municipal Airport Emergency Plan, provides agency coordination, communication procedures and lines of authority.
Flood/Water Supply Contamination	Sewer System Management Plan	Sewer System Management Plan, outlines preventative maintenance, schedule of maintenance and response plan.
Water Supply Disruption/ Drought	Urban Water Management Plan	Urban Water Management Plan - conservation and efficient water use
Climate Change/Drought, Emergent Disease	Climate Action Plan	Climate Action Plan - identifies and implements actions to reduce GHG emissions.
Fire	Suppression Inspection Action Plan	Suppression Inspection Action Plan - facilitates the completion of hazard reduction inspections.
HazMat, Fire	G&G Environmental Contract	Conduct on-site inspections for businesses housing hazardous materials to ensure compliance of State, County and local policies and procedures.
Communications Failure/Fire	SOLAR/Multi - County Mutual Threat Zone Guide	Continued participation with the SOLAR group in contingency planning for communications, resources and response to mutual threat areas.
All	Fire & PD Annual Master Training Plan	Improves the safety and performance of Department's members in order for them to prevent or minimize loss of life, damage to the environment and loss of property.

7.4 FUTURE MITIGATION STRATEGIES

Below are identified mitigation strategies. A funding source has either not yet been identified for these projects or the project is only partially funded. The City of Corona is continuously looking for funding opportunities to augment its financial mitigation capabilities.

For example, the city has submitted Notice of Intents in the hopes of being successful recipients of Hazard Mitigation Grant funds, because of FEMA-4305-DR. If we are not successful in our efforts, we will continue to pursue available funding opportunities and will utilize, when available, financial resources identified in 6.3 Fiscal Mitigation Capabilities. If funding can be secured, we will move forward with the following projects.

The City will continue to foster and develop Review Cooperative Agreements with the Cities of Norco, Riverside, and Eastvale in connection with hazard mitigation projects, outreach, and preparedness.

1) **Goal 2**: Reduce Hazard Related Property Losses

   Objective 2.4: Reduce hazard impacts to critical facilities, utilities, and services through the implementation of mitigation strategies.

   Action: Purchase and install back-up generators at City's groundwater wells and blend station

   Responsible Dept: Department of Water and Power
   Mitigated Hazard: Electrical Failure, Water Supply Disruption, Earthquake
   Status: Not started
   Funding: Submitted Notice of Intent for Hazard Mitigation Grant Funds

2) **Goal 2**: Reduce Hazard Related Property Losses

   Objective 2.4: Reduce hazard impacts to critical facilities, utilities, and services through the implementation of mitigation strategies.

Action: Ensure the city's oldest fire stations with ages ranging from 30 to 50 years of service can withstand a significant seismic event. Station 2 will be replaced by the end of 2025 by the American Rescue Plan federal grant.

A comprehensive fire facility assessment will be completed by the fall of 2024 for overall capital improvement for the other 6 stations. Seven fire stations currently exist.

Responsible Dept: Fire Department
Mitigated Hazard: Earthquake
Status: In Progress
Funding: Federal Grant Funds

3) **Goal 2**: Reduce Hazard Related Property Losses

Objective 2.4: Reduce hazard impacts to critical facilities, utilities, and services through the implementation of mitigation strategies.

Action: Conduct maintenance identified in the Caltrans bridge inspection reports. The passing of SB 1 will provide the City funding for repairs to roads and bridges. Allocation of funds and priorities of projects have not yet been determined.

Responsible Dept: Public Works
Mitigated Hazard: Transportation Failure, Earthquake
Status: TBD
Funding: Senate Bill 1 funds not yet allocated

4) **Goal 2**: Reduce Hazard Related Property Losses

Objective 2.4: Reduce hazard impacts to critical facilities, utilities and services through the implementation of mitigation strategies.

Action: Conduct inspections of older water treatment facilities to ensure the ability to handle a seismic event and address any deficiencies.

SECTION 8.0 – PLAN IMPLEMENTATION AND MAINTENANCE PROCESS

Implementation and maintenance of this 2023 LHMP is critical to the overall success of hazard mitigation planning. This is the 4th step in the planning process. This chapter provides an overview of the overall strategy for plan implementation and maintenance,

and outlines the method and schedule for monitoring, updating, and evaluating the LHMP. We will review the LHMP and assess:

- The goals and objectives and address current and expected conditions.
- If the nature, magnitude, and/or type of risks have changed.
- Current resources for implementing the plan and exploring new resources.
- Implementation problems, such as technical, political, legal, or coordination issues with other agencies.
- The outcomes to ensure they are in line with the expected outcome, if not we will modify plan.
- Changes in Federal, State, or local ordinances, laws and regulations
- Involve the public by posting notices on websites and announcements during public meetings intent to review and update LHMP allowing for public comment and input.

If we discover changes that have occurred during the evaluation, we will update the LHMP Revision Page, and notify Riverside County EMD to update our Annex.

The Fire Department Emergency Services Division will coordinate the monitoring, evaluation, and update of the LHMP.

The City has incorporated the LHMP by adoption into the Safety Element of the City's General Plan.

SECTION 9.0 – INCORPORATION INTO EXISTING PLANNING MECHANISMS

The City has incorporated the Local Hazard Mitigation Plan by adoption into the Safety Element of the City's General Plan. The Safety Element includes discussion of fire, earthquake, flooding, and landslide hazards. Based on the ranking of hazards identified in the LHMP priority of mitigation projects to address these hazards will be determined and used in the development of the City's Capital Improvement Plan.

In addition, the City has often developed plans, policies and adopted ordinance to assist in the mitigation of hazards identified in the LHMP. These mitigation efforts can be seen in the following figures:

See Figure 3.5.1 Mitigation Project Updates
See Figure 6.1.1 Regulatory Mitigation Capabilities
See Figure 7.3.1 On-Going Mitigation Strategy Programs

SECTION 10.0 - CONTINUED PUBLIC INVOLVEMENT

Continued public involvement is imperative to the overall success of the LHMP implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders and to publicize success stories from the plan implementation and seek additional public comment. The LHMP maintenance and update process will include continued public and stakeholder involvement and input through attendance at City Council Meetings, Community Based Organization meetings, other meetings or events that may be scheduled, web postings, social media, and public hearings.

If any changes are made in the Scheduled Plan Maintenance Process, the public will be notified through actions taken at City Council meetings by posting of the agenda, cable TV viewing of these meetings, posting on the City's website and outreach at community meetings.

APPENDIX A – PUBLIC NOTICES AND MAPS

RIVERSIDE COUNTY
QUARTERLY OPERATIONAL AREA PLANNING COMMITTEE
(OAPC)

October 13, 2016
9:00 a.m. – 11:00 a.m.
Beaumont City Hall, 550 East 6th St., Beaumont, CA 92223

AGENDA

I) Pledge of Allegiance, Welcome & Opening Remarks
Kim Saruwatari, Director, Riverside County Emergency Management Department (EMD)

II) Introductions

III) Approval of Minutes
OAPC Meeting Minutes of July 14, 2016

IV) New Business
1. Designation of the OAPC Vice-Chair
2. Designation of the Emergency Management representatives to serve on the Anti-Terrorism Approval Authority (ATAA) Board

V) Presentation
a) "ESRI - Emergency Management Tools". Justin Fan, Solutions Engineer for the Environmental Standards and Research Institute (ESRI), will provide an overview of available emergency management tools such as situational awareness dashboards, story maps, etc.

b) "Natural Gas Safety for Emergency Responders". Lea Peterson, Southern California Gas Company, will share information about the Gas Company's emergency incident response and safety procedures in and around natural gas pipelines.

VI) Standing Items
1. California Operational Area Coalition (COAC) Update
2. Standardized Emergency Management System (SEMS) / National Incident Management System (NIMS) Update / NIMSCAST
3. Grant Updates & Status Reports
4. Sub-Committees/Task Forces
    a. Training and Exercise
    b. Communications
5. Community Emergency Response Training (CERT) Program Managers' Update
6. VOAD – Volunteer Organizations Active in Disasters
7. CalOES Update
8. Local Hazard Mitigation Plan (LHMP) Update

VII. Roundtable & Public Comment

VIII. Next Quarterly OAPC Meeting .....Thursday, January 12, 2017
Next Riverside County Disaster Council Meeting.....Thursday, January 12, 2017

IX. Adjournment

RIVERSIDE COUNTY
ANNUAL DISASTER COUNCIL and
QUARTERLY OPERATIONAL AREA PLANNING COMMITTEE
(OAPC)

April 5, 2017
10:00 a.m. to 12:00 p.m.
Beaumont City Hall, 550 East 6th St., Beaumont, CA 92223

AGENDA

I) **Pledge of Allegiance, Welcome & Opening Remarks**
John Tavaglione, Chair, Riverside County Board of Supervisors and Riverside County Disaster Council
Kim Saruwatari, Director, Riverside County Emergency Management Department

II) **Introductions**

III) **Approval of Minutes**
Disaster Council meeting minutes of January 14, 2016.....ATTACHMENT I
OAPC meeting minutes of January 12, 2017.....ATTACHMENT II

IV) **New Business**
Presentation of Awards

V) **Presentations**
a) Emergency Preparedness and Response from a Large Urban School District Perspective, Jill Barnes, Ed.D, CEM, Coordinator, Office of Emergency Services, Division of District Operations, Los Angeles Unified School District (LAUSD).

b) Experience and Lessons-Learned from the February 2017 Oroville Dam Incident, Chief Justin McGough, CalFire/Riverside County Fire Department.

V) **Standing Items**
1. California Operational Area Coalition (COAC) Update
2. Standardized Emergency Management System (SEMS) / National Incident Management System (NIMS) Update / NIMSCAST
3. Grant Updates & Status Reports
4. Sub-Committees/Task Forces
    a. Training and Exercise
    b. Communications
5. Community Emergency Response Training (CERT) Program Managers' Update
6. VOAD – Volunteer Organizations Active in Disasters
7. CalOES Update
8. Local Hazard Mitigation Plan (LHMP) Update

VI. **Roundtable & Public Comment**

VII. **Next Annual Disaster Council Meeting**.....Thursday, January 11, 2018
Next Quarterly OAPC Meeting .....Thursday, July 13, 2017

VIII. **Adjournment**

RIVERSIDE COUNTY
QUARTERLY OPERATIONAL AREA PLANNING COMMITTEE
(OAPC)

January 12, 2017
9:00 a.m. – 11:00 a.m.
Beaumont City Hall, 550 East 6th St., Beaumont, CA 92223

AGENDA

I) **Pledge of Allegiance, Welcome & Opening Remarks**
Kim Saruwatari, Director, Riverside County Emergency Management Department

II) **Introductions**

III) **Approval of Minutes**
OAPC Meeting Minutes of October 13, 2016

IV) **New Business**
Designation of the OAPC Vice-Chair for 2017
OAPC Appointment of Designee Form

V) **Presentation**
Crisis Communications and Media Response Training for Today's Leaders. Richard Brundage, President, Center for Advanced Media Studies.

V) **Standing Items**
1. California Operational Area Coalition (COAC) Update
2. Standardized Emergency Management System (SEMS) / National Incident Management System (NIMS) Update / NIMSCAST
3. Grant Updates & Status Reports
4. Sub-Committees/Task Forces
    a. Training and Exercise
    b. Communications
5. Community Emergency Response Training (CERT) Program Managers' Update
6. VOAD – Volunteer Organizations Active in Disasters
7. CalOES Update
8. Local Hazard Mitigation Plan (LHMP) Update

VI. **Roundtable & Public Comment**

VII. **Next Annual Disaster Council Meeting**.....Date in April to be determined
Next Quarterly OAPC Meeting .....Date in April to be determined

VIII. **Adjournment**

COUNTY OF RIVERSIDE
EMD
Emergency Management Department

Kim Saruwatari, MPH
Director

City LHMP Workshop

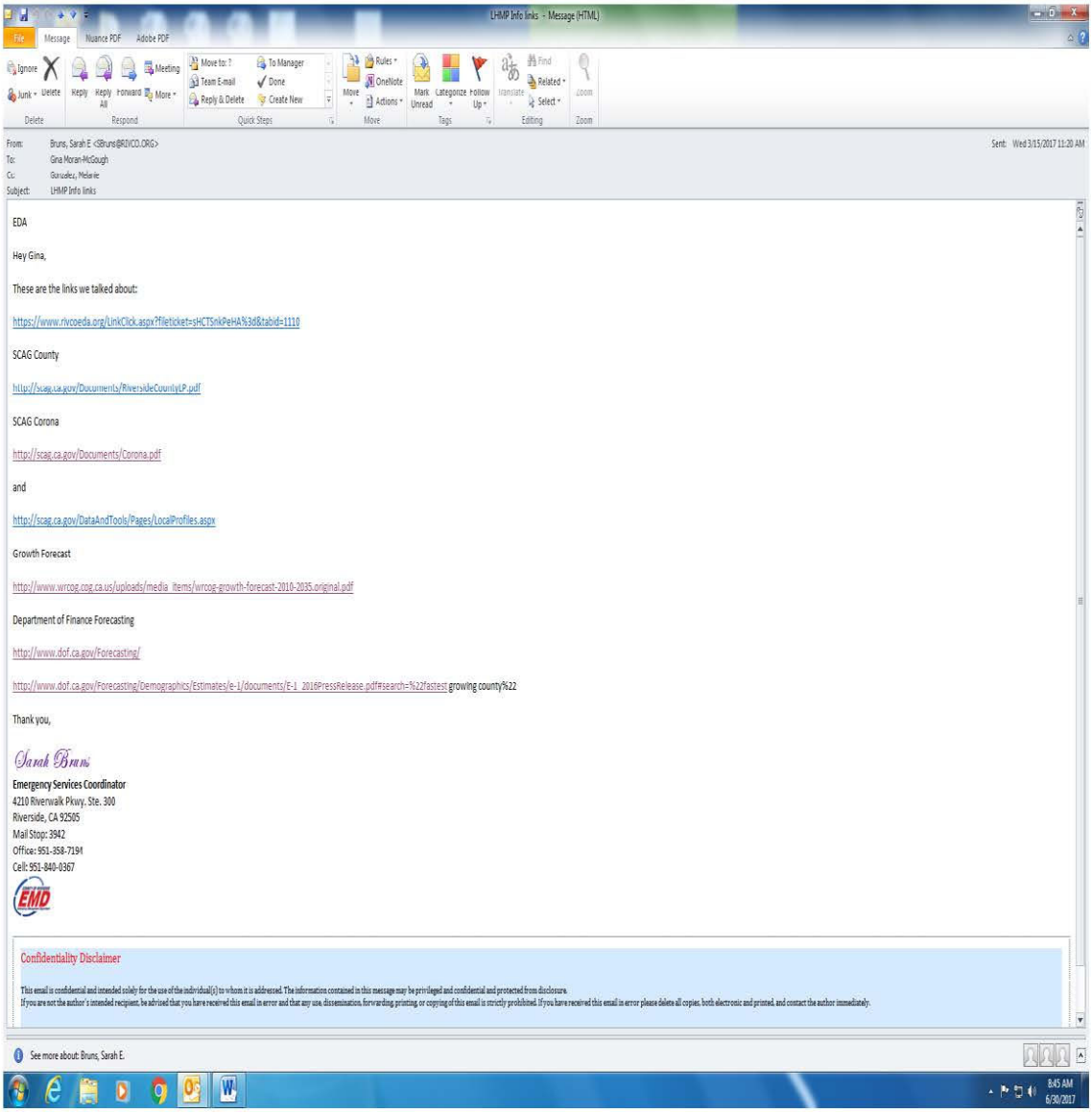
AGENDA

Tuesday June 6, 2017
9:00 a.m. – 10:00 a.m.

Subject	Time	Presented By	Purpose
I. Welcome and Introductions	5 Min.	Sarah Bruns	Inform
II. Hazard Mitigation Grant Program (HMGP)	10 Min.	Sarah Bruns	Inform/Discuss/ Handout
III. Region IX Review Guide	15 Min.	Sarah Bruns	Inform/Handout
IV. County Plan Update	5 Min.	Sarah Bruns	Inform
V. Next Steps • LHMP Submission & Review Process	10 Min.	Sarah Bruns	Inform
VI. Roundtable	10 Min.	All	
VII. Adjournment	5 Min.	Sarah Bruns	

4210 Riverwalk Parkway, Suite 300
Riverside, California 92505
T: 951.358.7100 ♦ F: 951.358.7105 ♦ Web: www.rivcoready.org

County assistance given to City of Corona 3/15/17



LHMP Info links - Message (HTML)

File Message Nuance PDF Adobe PDF

Ignore Junk Delete Reply Reply All Forward Meeting More Move to: ? To Manager Team E-mail Done Reply & Delete Create New Move Rules OneNote Actions Mark Unread Categorize Follow Up Translate Find Related Select Zoom

Delete Respond Quick Steps Move Tags Editing Zoom

From: Bruns, Sarah E <SBruns@RIVCO.ORG>
To: Gina Moran-McGough
Cc: Gonzalez, Melanie
Subject: LHMP Info links
Sent: Wed 3/15/2017 11:20 AM

EDA

Hey Gina,

These are the links we talked about:

https://www.rivcoeda.org/LinkClick.aspx?fileticket=sHCTSnkPeHA%3d&tabid=1110

SCAG County

http://scag.ca.gov/Documents/RiversideCountyLP.pdf

SCAG Corona

http://scag.ca.gov/Documents/Corona.pdf

and

http://scag.ca.gov/DataAndTools/Pages/LocalProfiles.aspx

Growth Forecast

http://www.wrcog.cog.ca.us/uploads/media_items/wrcog-growth-forecast-2010-2035.original.pdf

Department of Finance Forecasting

http://www.dof.ca.gov/Forecasting/

http://www.dof.ca.gov/Forecasting/Demographics/Estimates/e-1/documents/E-1_2016PressRelease.pdf#search=%22fastest growing county%22

Thank you,

Sarah Bruns

Emergency Services Coordinator
4210 Riverwalk Pkwy. Ste. 300
Riverside, CA 92505
Mail Stop: 3942
Office: 951-358-7191
Cell: 951-840-0367

EMD

Confidentiality Disclaimer

This email is confidential and intended solely for the use of the individual(s) to whom it is addressed. The information contained in this message may be privileged and confidential and protected from disclosure.
If you are not the author's intended recipient, be advised that you have received this email in error and that any use, dissemination, forwarding printing, or copying of this email is strictly prohibited. If you have received this email in error please delete all copies, both electronic and printed, and contact the author immediately.

See more about: Bruns, Sarah E.

8:45 AM
6/30/2017

From: Gonzalez, Melanie
To: Gina Moran-McGough
Subject: RE: LHMP
Date: Tuesday, April 11, 2017 3:11:48 PM
Attachments: 2017 Hazard Ranking.docx
Final Risk Scores.xlsx

Of course! I attached the 2017 county hazards and the risk scores that we gave to each of these county hazards, in regards to their severity and probability. I hope this helps to complete that specific page on the inventory worksheet. If not, please feel free to contact me and I can further assist you on what you may need. Thank you!

Melanie Gonzalez
Health Education Assistant II
Emergency Management Department
4210 Riverwalk Pkwy, Suite 300
Riverside CA.92505
Mail Stop: 3942
Direct Line: 951-955-5505
Work Cell: 951-476-4009
Main Department Line: 951-358-7100
Email: Melanie.Gonzalez@rivco.org

From: Gina Moran-McGough [mailto:Gina.Moran-McGough@ci.corona.ca.us]
Sent: Tuesday, April 11, 2017 2:58 PM
To: Gonzalez, Melanie <Melanie.Gonzalez@RIVCO.ORG>
Subject: LHMP

Hello Melanie,

I am conducting meetings with my City Departments and am reviewing the hazard rankings. In the Inventory worksheet that was included in the CD, the VULNERABILITY WORKSHEET is the one from 2012 which is missing some of the hazards identified in the 2017. Do you have the latest and greatest that you could possibly send me?? PLEASE☺

Thank you,

Gina Moran-McGough
Emergency Services Coordinator
Corona Fire Department – Emergency Services Division
(951) 736-2458

From: Gonzalez, Melanie
To: Gina Moran-McGough
Subject: LHMP Information
Date: Wednesday, March 15, 2017 11:32:13 AM
Attachments: 2017 Hazard Ranking.docx

Good Afternoon!

Training

EMD is in the process of bringing FEMA course G-318, Hazard Mitigation Planning Training, to our Riverwalk location the last week of March. It is a two day course, from 8a.m. to 5p.m. If this is something that you are interested please email Sarah at sbruns@rivco.org by **February 22, 2017**

LHMP 2017 County Hazard Ranking

Attached to this email participants will find the finalized hazard ranking for Riverside County for the 2017 LHMP. Each of these hazards will be addressed in the plan update. Please note, these rankings are for the county plan and do not affect your jurisdictions rankings. However, we do ask that at a minimum you reference our rankings in your plan to illustrate the collaboration between plans.

Mapping Website Link

In previous LHMP workshops, we were informed that some participants were having trouble accessing Hazus. After talking about this issue with the Cal OES, they provided us with an alternative option for jurisdictions to create maps. Unfortunately, we were informed that we are not able to make one whole county map for reference, each jurisdiction must include jurisdiction specific maps. The link to Cal OES's MyPlan system is www.myplan.caloes.ca.gov. This website is very user friendly and includes information on flood, fire, faults zones and licensed healthcare facilities. If you need any further assistance in mapping or using this alternative link, please feel free to reach out to us.

In addition, NOAA has climate mapping that you can add to your plan. The link is https://www.climate.gov/maps-data.

Senate Bill 379

We would like to inform all jurisdictions that according to a Senate Bill (SB 379), the county and cities need to incorporate their LHMP into their General Plan by the year 2022. Riverside County's LHMP was adopted into the General Plan in 2015. If your plan is not yet incorporated, we ask that you add this as a mitigation action for the 2017 LHMP update for your jurisdiction. The link to view and read the entire bill is as follows: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB379

Senate Bill 1000

In addition to SB 379, 1000 must also be incorporated by 2022. This bill states that "*climate adaptation and resilience strategies* [must be incorporated], *upon either the next revision of a local hazard mitigation plan after a specified date or on or before January 1, 2022*". The link to view and read the entire bill is as follows: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1000
If you have any questions or concerns, as always please feel free to contact me or Sarah. Thank you and have a great day!

Thank you,

Melanie Gonzalez

Health Education Assistant II
Emergency Management Department
4210 Riverwalk Pkwy, Suite 300
Riverside CA.92505
Mail Stop: 3942
Direct Line: 951-955-5505
Work Cell: 951-476-4009
Main Department Line: 951-358-7100
Email: Melanie.Gonzalez@rivco.org

Confidentiality Disclaimer

This email is confidential and intended solely for the use of the individual(s) to whom it is addressed. The information contained in this message may be privileged and confidential and protected from disclosure.
If you are not the author's intended recipient, be advised that you have received this email in error and that any use, dissemination, forwarding, printing, or copying of this email is strictly prohibited. If you have received this email in error please delete all copies, both electronic and printed, and contact the author immediately.

County of Riverside California

From: Bruns, Sarah E
To: Gina Moran-McGough
Subject: Accepted: LHMP meeting w/ EMD

Confidentiality Disclaimer

This email is confidential and intended solely for the use of the individual(s) to whom it is addressed. The information contained in this message may be privileged and confidential and protected from disclosure.
If you are not the author's intended recipient, be advised that you have received this email in error and that any use, dissemination, forwarding, printing, or copying of this email is strictly prohibited. If you have received this email in error please delete all copies, both electronic and printed, and contact the author immediately.
HYPERLINK "http://www.countyofriverside.us/" County of Riverside California

Multi-Jurisdictional Local Hazard Mitigation Plan (MJLHMP) Update
Steering Committee Meeting Minutes
Date: October 5, 2022
Time: 10:00 a.m. to 11:30 a.m.

Email Designated for LHMP: LHMP@RIVCO.ORG

Brian MacGavin called the meeting to order and reviewed housekeeping items and meeting minutes from August 3, 2022.

Meeting Purpose: To provide a forum for MJLHMP participants to be able to share information and provide feedback into the oversight of the MJLHMP update process.

Review of Update / Requirements and timeline.

- Jennifer Smith reviewed the immediate update requirements and the MJLHMP timeline.
- August-October: identify goals, objectives, and actions to take and have data compiled.
- Inventory Worksheets and Risk Assessments should be completed by October 25 and mitigation actions should be finalized In November.
- A Teams meeting will be held with all county department representatives on October 25 to discuss completing Inventory and Risk Assessments that are due by October 25th.

Data Collection and HAZUS

- Breakdown of every risk category.
  - https://hazards.fema.gov/nri/map
- Risk Assessment Survey has been sent out.

Tracking and Scoring Mitigation Projects

- Brian MacGavin presented information on the tracking and scoring of mitigation projects.
- A new spreadsheet will be formulated for 2023 mitigation projects and actions.
- Separate spreadsheets will be reviewed as we go forward with the update.

Jurisdictional and County Department Assessments

- William Luna provided information on completing jurisdictional and county department assessments.

Additional Discussion and Feedback

- Something to do after plan is approved, going back and reviewing the definitions.

Next steps and Action Items

- Complete Inventory Worksheets and Risk Assessments.
- Contact Brian MacGavin, Jennifer Smith, or William Luna for assistance or questions.

Adjournment / Next Meeting

- Brian MacGavin adjourned the meeting and announced that the next meeting will be on January 4, 2023.

Multi-Jurisdictional Local Hazard Mitigation Plan (MJLHMP) Update
OA Steering Committee Agenda
Date: January 4, 2023
Time: 10:00 AM to 11:30 AM

Subject	Time	Presented by	Purpose	Attachments
Introductions / Housekeeping	10 mins	Brian MacGavin	Inform	Sign-in Sheet
Review of Minutes from October 5, 2022	5 mins.	Brian MacGavin	Inform	October 5, 2022 Steering Committee Minutes
Review of update requirements and timeline	10 mins.	Jennifer Smith	Inform	Local Mitigation Plan Review Guide & Timeline
GIS / Data Collection	10 mins	Moses Martinez	Information	
2023-2028 Tracking and Scoring Mitigation Projects / Actions	15 mins	Brian MacGavin	Inform	Mitigation Projects Spreadsheet
Jurisdictional LHMP Status Reports	15 mins.	William Luna	Information	
Additional Discussion and Feedback from Steering Committee Members	15 mins.	All	Discuss	N/A
Next Steps /Action Items	5 mins.	Brian MacGavin	Discuss	N/A
Adjourn / Next Meeting	2 mins.	Brian MacGavin	Inform	N/A


HOME
CONTACT US
Quick Links
city of corona
THE CIRCLE CITY
ABOUT CORONA
CITY COUNCIL
CITY DEPARTMENTS
ONLINE SERVICES
SEARCH
Local Hazard Mitigation Plan Update
SURVEY
HOME > CITY DEPARTMENTS > FIRE DEPARTMENT > LHMP UPDATE SURVEY
LOCAL HAZARD MITIGATION PLAN UPDATE
LOCAL HAZARD MITIGATION PLAN UPDATE
The City of Corona is conducting a 5 year update to our Local Hazard Mitigation Plan (LHMP). The intent of the plan is to help identify, reduce or remove long-term risk and protect people and property from the effects of events like earthquake, fire, flood, terrorism, etc. Under the Disaster Mitigation Act of 2000 (Public Law 106-390), State, Local and Tribal governments are required to develop a hazard mitigation plan to be eligible for certain federal disaster assistance.
HAZARD MITIGATION
Hazard mitigation planning is the process governments use to identify risks and vulnerabilities associated with natural disasters and to develop long-term strategies for protecting people and property in future hazard events. The process results in a mitigation plan that offers a strategy for breaking the cycle of disaster damage, reconstruction, and repeated damage. The planning process and the resultant plan bring together a framework for developing feasible and cost-effective mitigation projects. It is important to state that there may not be funds currently available for identified projects, but it is important to identify them, in the event funds become available during this plan life cycle.
OPPORTUNITIES FOR INPUT
A draft of the current LHMP is available for review and comment by the public and all interested stakeholders. Our hopes are to receive public input as to hazards unique to our jurisdiction that may not have been addressed in the master planning document or may not have been an identified hazard at the time the 2012 plan was written. This feedback will be used during the review and updating process.
SURVEY
Local Hazard Mitigation Plan Update
SURVEY
LHMP Update
Community Development
Department of Water & Power
Finance
Fire Department
About Our Department
Emergency Information
Fire Prevention and Planning
LHMP Update Survey
News and Events
Preparedness
Programs and Services
Safety Information
Sharps Disposal
The Fire Explorer Program
Human Resources
Information Technology
Library
Maintenance Services
Management Services
Police Department
Public Works
Recreation Services
Community Development
Department of Water & Power
Finance
Fire Department
About Our Department
Emergency Information
Fire Prevention and Planning
LHMP Update Survey


Corona Fire Department
Page
Messages
Notifications 3
Insights
Publishing Tools
Like
Follow
Share
4,684 people reached
Boost Post
Like
Comment
Share
Sharon Andrade, Adolfo Aguilar and 118 others
Write a comment...
Corona Fire Department
@CoronaFireDept
Home
About
Events
Posts
Videos
Photos
Likes
Reviews
Jobs
Promote
Corona Fire Department
Published by Brittany Ritzi Foust [?] · April 13 at 5:38pm ·
[LINK TO SURVEY: http://www.discovercorona.com/.../Fir.../LHMP-Update-Survey.aspx]
The City of Corona is conducting a 5-year update to our Local Hazard Mitigation Plan (LHMP). The intent of the plan is to help identify, reduce or remove long-term risk and protect people and property from the effects of events like earthquake, fire, flood, terrorism, etc.
A draft of the current LHMP is available for review and comment by the public and all interested stakeholders. Our hopes ar... See More
LOCAL HAZARD MITIGATION PLAN UPDATE
COMMUNITY INPUT NEEDED
PLEASE TAKE OUR SURVEY
Green River
3,527 people reached
Boost Post
Like
Comment
Share

CERT Leadership Agenda

March 23, 2017 7:00 PM to 9:00 PM

Instructor: Richard Boltinghouse

I. Welcome
II. CERT Animal Response Module I
III. Discussion on Local Hazard Mitigation Plan for the City of Corona- The purpose of the local hazard mitigation plan is to identify the hazards, review and assess past disaster occurrences, estimate the probability of future occurrences and set goals to mitigate potential risks to reduce or eliminate long-term risk to people and property from natural and man-made hazards.
IV. CERT upcoming Community Events
V. End of meeting

Corona Fire Department – Emergency Services Division
Community Discussion: Local Hazard Mitigation Planning
ESD Representative: Richard Boltinghouse
March 23, 2017

Name	Signature
SAJID AHMED BOBY	
Rebecca Nunez	
PAT STEET	
Kim Victorine	
Patti Victorine	
Rey Wilbourne	
Jeremy Smith	
Cari Smith	
CJ Roach	
Michelle Kolano	
Beverly Smallwood	
Adriana Miranda	

City of Corona LHMP Planning

Public Meeting
Hazard Ranking & Proposed Mitigation Projects
4/27/17

Print Name	*Zip Code/Area*	*Signature*
1. [illegible] Victorine	92879	
2. Patti Victorine	92879	Patti Victorine
3. Chelie Voland	92881	Michelle Voland
4. PAT STEET	92879	Pat Steet
5. Beverly Smallwood	92882	Beverly Smallwood
6. Adriana Miranda	92879	Adriana Miranda
7. Lisa Powell	92880	Lisa Powell
8. SAUD ALHMIZI BORY		92881
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
21.		
22.		
23.		
24.		
25.		

City of Corona 2017 Planning

Representatives from multiple City departments contributed in the updating of the 2012 Local Hazard Mitigation Plan. The team assisted in the development of mitigation strategies and projects based on the risk and hazard ranking assessment, they identified completion of past projects, assisted with public outreach, and provided updated City data and statistics.

Name	Title	Signature
David Duffy	Fire Chief	
Mike Samuels	Deputy Fire Chief	
Gina McGough	Emergency Services Coordinator	
Richard Boltinghouse	CERT Program Lead	
Cindi Schmitz	Fire Marshal	
Jennifer Schaefer	Finance CDBG Manager	
Nelson Nelson	Public Works Director / City	
Brittany Ritzi	Community Information Specialist	
Tom Moody	Assistant General Manager	
Ed Lockhart	Maintenance Manager	
Tracy Martin,	Utility Project Manager	
Katie Hockett	Operations Manager	
Jerry Rodriguez	Police Captain	
Chris Milosevic	Building Official/Inspection Manager	

APPENDIX B – INVENTORY WORKSHEETS

RIVERSIDE COUNTY MULTI-JURISDICTIONAL
LOCAL HAZARD MITIGATION AGENCY
2023 INVENTORY WORKSHEETS

City of Corona

JUNE 2023

TABLE OF CONTENTS

Introduction: These documents are meant to be discussed, used, and reviewed by a multi-disciplinary team. Participation by a wide range of stakeholders who play a role in identifying and implementing mitigation actions is required.

SPECIAL CONCERNS:

1. *The completed Letter of Commitment has been returned to EMD.*
2. *The completed Letter of Participation has been returned to EMD.*

1. Local Jurisdiction Contact Information	Page 3
2. Hazard Identification Questionnaire	Pages 4-6
3. Specific Hazards Summary	Page 7
4. Jurisdiction Vulnerability Worksheet	Pages 8-9
5. Jurisdiction Mitigation Strategies and Goals	Pages 10-14
6. Local Jurisdiction Proposed Mitigation Action and Strategy Proposal	Pages 14-16
7. Local Jurisdiction Development Trends	Pages 17-18
8. Appendix A-Plan Review Tool	Pages A1-10

Appendix A the Plan Review Tool for your reference. This is the document Cal EMA and FEMA will utilize to verify that all the required information is in the submitted documents.

1. LOCAL JURISDICTION CONTACT INFORMATION

The information on this page identifies:

- Jurisdiction and the contact person
- Jurisdiction's service area size and population
- EOP Plan and a Safety Element of their General Plan

PLEASE PROVIDE THE FOLLOWING INFORMATION:

Agency/Jurisdiction:		City of Corona		
Type Agency/Jurisdiction:		Local Government		
Contact Person:	Title:	Emergency Services Manager		
First Name:	Lee	Last Name:	Shin	
Agency Address:	Street:	735 Public Safety Way		
	City:	Corona		
	State:	CA		
	Zip:	92880		
Contact Phone	951-496-1299		FAX	951-736-2497
E-mail	lee.shin@coronaca.gov			

Population Served	167,759
Square Miles Served	39.2

Does your organization have a general plan?	Yes
Does your organization have a safety component to the general plan?	Yes
What year was your plan last updated?	2018

Does your organization have a disaster/emergency operations plan?	Yes
What year was your plan last updated?	2023
Do you have a recovery annex or section in your plan?	Yes
Do you have a terrorism/WMD annex or section in your plan?	Yes

2. Hazard Identification Questionnaire

The purpose of the questionnaire is to help identify the hazards within your service area. The list was developed from the first round of meetings with the various working groups in the 2023 plan creation, and from the hazards listed in the County's General Plan. Each hazard is discussed in detail in Part I of the 2023 LHMP. The information will be used as the basis for each jurisdiction to evaluate its capabilities, determine its needs, and to assist in developing goals and strategies. The information identifies:

a) What hazards can be identified within or adjacent to the service area of the jurisdiction.
b) Which of those hazards have had reoccurring events.
c) What specific hazards and risks are considered by the jurisdiction to be a threat specifically to the jurisdiction? (These locations should be identified by name and location for inclusion in the Specific Hazard Summary Table).
    a. Specific types of facilities owned and operated by the jurisdiction.
    b. Locations damaged from prior disasters or hazard causing events.
d) Information about the jurisdiction's EOC

With your Multi-Disciplinary Planning Team:

a. Instructions for Updating Jurisdictions, with your planning team: Review your old Questionnaire for accuracy and relevance, mark changes.
b. Instructions for New Jurisdictions and Special Districts, with your planning team, meet and go over the questionnaire. Fill in YES, NO or NA on the Questionnaire.

HAZARD IDENTIFICATION QUESTIONNAIRE

DOES YOUR ORGANIZATION HAVE:	
AIRPORT IN JURISDICTION	Yes
AIRPORT NEXT TO JURISDICTION	No
DAIRY INDUSTRY	No
POULTRY INDUSTRY	No
CROPS/ORCHARDS	No
DAMS IN JURISDICTION	Yes
DAMS NEXT TO JURISDICTION	Yes
LAKE/RESERVOIR IN JURISDICTION	Yes
LAKE/RESERVOIR NEAR JURISDICTION	Yes
JURISDICTION IN FLOOD PLAIN	Yes
CONTROLLED FLOOD CONTROL CHANNEL	Yes
UNCONTROLLED FLOOD CONTROL CHANNEL	Yes
EARTHQUAKE FAULTS IN JURISDICTION	Yes
EARTHQUAKE FAULTS NEXT TO JURISDICTION	Yes
MOBILE HOME PARKS	Yes
NON-REINFORCED FREEWAY BRIDGES	No
NON-REINFORCED BRIDGES	No
BRIDGES IN FLOOD PLAIN	No
BRIDGES OVER OR ACROSS RIVER/STREAM	Yes
ROADWAY CROSSING RIVER/STREAM	No
NON-REINFORCED BUILDINGS	No
FREEWAY/MAJOR HIGHWAY IN JURISDICTION	Yes
FREEWAY/MAJOR HIGHWAY NEXT TO JURISDICTION	Yes
FOREST AREA IN JURISDICTION	No
FOREST AREA NEXT TO JURISDICTION	Yes
WITHIN THE 50 MILES SAN ONOFRE EVACUATION ZONE	Yes
MAJOR GAS/OIL PIPELINES IN JURISDICTION	Yes
MAJOR GAS/OIL PIPELINES NEXT TO JURISDICTION	Yes
RAILROAD TRACKS IN JURISDICTION	Yes
RAILROAD TRACKS NEXT TO JURISDICTION	Yes
HAZARDOUS WASTE FACILITIES IN JURISDICTION	Yes
HAZARDOUS WASTE FACILITIES NEXT TO JURISDICTION	Yes
HAZARDOUS STORAGE FACILITIES IN JURISDICTION	Yes
HAZARDOUS STORAGE FACILITIES NEXT TO JURISDICTION	Yes
DOES YOUR ORGANIZATION OWN OR OPERATE A FACILITY	
IN A FLOOD PLAIN	Yes
NEAR FLOOD PLAIN	Yes
NEAR RAILROAD TRACKS	Yes
NEAR A DAM	Yes
UPSTREAM FROM A DAM	Yes
DOWNSTREAM FROM A DAM	Yes
DOWNSTREAM OF A LAKE	Yes
DOWNSTREAM FROM A RESERVOIR	Yes
NEAR A CONTROLLED FLOOD CONTROL CHANNEL	Yes
NEAR UNCONTROLLED FLOOD CONTROL CHANNEL	Yes
ON AN EARTHQUAKE FAULT	Yes
NEAR AN EARTHQUAKE FAULT	Yes
WITHIN THE 50 MILE SAN ONOFRE EVACUATION ZONE	Yes
IN A FOREST AREA	No
NEAR A FOREST AREA	Yes
NEAR A MAJOR HIGHWAY	Yes
A HAZARDOUS WASTE FACILITY	Yes

NEAR A HAZARDOUS WASTE FACILITY	Yes
A HAZARDOUS STORAGE FACILITY	Yes
NEAR A HAZARDOUS STORAGE FACILITY	Yes
NON-REINFORCED BUILDINGS	No
A MAJOR GAS/OIL PIPELINE	No
NEAR A MAJOR GAS/OIL PIPELINE	Yes
DOES YOUR ORGANIZATION HAVE ANY LOCATIONS THAT:	
HAVE BEEN DAMAGED BY EARTHQUAKE AND NOT REPAIRED	No
HAVE BEEN DAMAGED BY FLOOD	Yes
HAVE BEEN DAMAGED BY FLOOD MORE THAN ONCE	Yes
HAVE BEEN DAMAGED BY FOREST FIRE	No
HAVE BEEN DAMAGED BY FOREST FIRE MORE THAN ONCE	No
HAVE BEEN IMPACTED BY A TRANSPORTATION ACCIDENT	Yes
HAVE BEEN IMPACTED BY A PIPELINE EVENT	No
EMERGENCY OPERATIONS INFORMATION	
DOES YOUR ORGANIZATION HAVE AN EOC	Yes
IS YOUR EOC LOCATED IN A FLOOD PLAIN	Yes
NEAR FLOOD PLAIN	Yes
NEAR RAILROAD TRACKS	Yes
NEAR A DAM	Yes
UPSTREAM FROM A DAM	Yes
DOWNSTREAM FROM A DAM	Yes
DOWNSTREAM OF A LAKE	Yes
DOWNSTREAM FROM A RESERVOIR	Yes
NEAR A CONTROLLED FLOOD CONTROL CHANNEL	Yes
NEAR UNCONTROLLED FLOOD CONTROL CHANNEL	Yes
ON AN EARTHQUAKE FAULT	No
NEAR AN EARTHQUAKE FAULT	Yes
WITHIN THE 50 MILE SAN ONOFRE EVACUATION ZONE	Yes
IN A FOREST AREA	No
NEAR A FOREST AREA	Yes
NEAR A MAJOR HIGHWAY	Yes
A HAZARDOUS WASTE FACILITY	Yes
NEAR A HAZARDOUS WASTE FACILITY	Yes
A HAZARDOUS STORAGE FACILITY	Yes
NEAR A HAZARDOUS STORAGE FACILITY	Yes
NON-REINFORCED BUILDINGS	No
A MAJOR GAS/OIL PIPELINE	Yes
NEAR A MAJOR GAS/OIL PIPELINE	Yes
OTHER FACILITY INFORMATION **ARE THERE LOCATIONS WITHIN YOUR JURISDICTION THAT:**	
COULD BE CONSIDERED A TERRORIST TARGET	Yes
COULD BE CONSIDERED A BIO-HAZARD RISK	Yes

With your planning team, list the “Yes” answers and discuss. Use the information as a group to summarize your jurisdiction’s hazards and vulnerabilities.

3. SPECIFIC HAZARDS SUMMARY

This table helps to identify the information (name, owner, location, etc.) about the specific hazards identified in the Hazard Questionnaire.

In the Summary Table, list the basic information of the hazards identified by the jurisdiction in the Hazard Identification Questionnaire as a potential threat. These specific hazards were used in the development of response plans, maps, and other analysis data.

a. Instructions for Updating Jurisdictions and Special Districts: With your planning team, review the "Yes" answers and see if there were any changes, if so, summarize why there is a difference from 2017 LHMP.

b. Instructions for New Jurisdictions and Special Districts: With your planning team, review the "Yes" answers and discuss. Use the information as a group to summarize your jurisdiction's hazards and vulnerabilities.

SPECIFIC HAZARDS SUMMARY

Jurisdiction	Hazard Type	Hazard Name	In Jurisdiction?	Adjacent to Jurisdiction?
Corona	Dam	Lake Mathews	No	Yes
	Dam	Prado	No	Yes
	Fault	Elsinore	Yes	Yes
	Flood Channel	Mabey Canyon	Yes	No
	Flood Channel	Temescal Creek	Yes	Yes
	Hazmat Manufacturing Facility	Downs Energy	Yes	No
	Hazmat Manufacturing Facility	Dart Containers	Yes	No
	Hazmat Manufacturing Facility	G & S Associates	Yes	No
	Hazmat Manufacturing Facility	Golden Cheese	Yes	No
	Hazmat Manufacturing Facility	GTM, Inc.	Yes	No
	Hazmat Manufacturing Facility	Hi-Country	Yes	No
	Hazmat Manufacturing Facility	Us Battery	Yes	No
	Hazmat Manufacturing Facility	Watson Pharmaceuticals	Yes	No
	Hazmat Storage Location	Advanced Fuel Filtration	Yes	No
	Hazmat Storage Location	All American Asphalt	Yes	No
	Hazmat Storage Location	Liston Aluminum	Yes	No
	Hazmat Storage Location	United Agri Products	Yes	No
	Lake	Lake Mathews	No	Yes
	Pipeline	Four Corners Oil Pipeline	Yes	No
	Pipeline	Natural Gas	Yes	No
	Railroad Track	BNSF	Yes	No
	Reservoir	Lake Mathews	No	Yes
	River	Santa Ana River	No	Yes

4. JURISDICTION VULNERABILITY WORKSHEET

This table is a listing of the primary hazards identified by the 2022 LHMP working groups. Each jurisdiction was asked to evaluate the potential for an event to occur in their jurisdiction by hazard. They were also asked to evaluate the potential impact of that event by hazard on their jurisdiction. The impact potential was determined based on:

1. Economic loss and recovery
2. Physical loss to structures (residential, commercial, and critical facilities)
3. The loss or damage to the jurisdiction's infrastructure
4. Their ability to continue with normal daily governmental activities
5. Their ability to quickly recover from the event and return to normal daily activities
6. The loss of life and potential injuries from the event.

The jurisdictions were asked to rate the potential and severity using a scale of between 0 and 4 (4 being the most severe). The jurisdictions were also asked to rank the listed hazards as they relate to their jurisdiction from 1 to 19 (1 being the highest overall threat to their jurisdiction).

With the assistance of the RCIP Plan and County Departments, Riverside County EMD conducted an extensive evaluation of the severity and probability potential for the county. The hazards were also ranked for the County. Those numbers and rankings were provided to the jurisdictions as a comparison guide.

A separate table was created to address the hazards relating to agriculture and was assessed by the agriculture working group.

a. Instructions for Updating Jurisdictions and Special Districts: Please review the table, determine if you're ranking from the 2017 LHMP remains the same, and note that Pandemic has been added to the list. Please discuss and document new or unchanged severity and rankings.

b. Instructions for New Jurisdictions and Special Districts: Please evaluate the potential for an event to occur in your jurisdiction by hazard. Then, evaluate the potential impact of that event by hazard on your jurisdiction according to #1-6 from the potential impact list above.

NOTE: Under Medical, Pandemic was added. This was a result of the H1N1 and other incidents.

NAME: City of Corona AGENCY: DATE: 2/20/2023

	COUNTY		CITY OF CORONA		
HAZARD	**SEVERITY 0 - 4**	**PROBABILITY 0 - 4**	**SEVERITY 0 - 4**	**PROBABILITY 0 - 4**	**RANKING 1 - 19**
EARTHQUAKE	4	2	4	3	1
WILDLAND FIRE	3	4	3	3	2
FLOOD	3	3	3	3	6
OTHER NATURAL HAZARDS					
DROUGHT	3	3	3	3	12
LANDSLIDES	3	3	2	1	20
INSECT INFESTATION	2	3	1	1	18
EXTREME SUMMER/WINTER WEATHER	3	2	2	2	13
SEVERE WIND EVENT					NA
AGRICULTURAL					
DISEASE/CONTAMINATION	3	3	3	3	7
TERRORISM	3	1	4	2	4
OTHER MAN-MADE					
PIPELINE	3	2	3	2	19
AQUEDUCT	3	2	2	2	22
TRANSPORTATION	3	2	3	2	8
POWER OUTAGE	4	4	4	4	3
HAZMAT ACCIDENTS	3	4	3	2	14
NUCLEAR ACCIDENT	4	1	4	1	17
TERRORISM	3	1	4	2	4
CIVIL UNREST	3	2	2	2	16
JAIL/PRISON EVENT	2	1	1	2	21
MEDICAL					
PANDEMIC	4	2	4	2	10

5. JURISDICTION MITIGATION STRATEGIES AND GOALS

This comprehensive table is a listing of the various mitigation strategies, goals, and objectives developed by the 2022 LHMP working groups.

The jurisdictions were also given the opportunity to list additional strategies, goals, and objectives

specific to their jurisdiction.

LOCAL JURISDICTION MITIGATION STRATEGIES AND GOALS

With your Planning Team

a. Instructions for Updating Jurisdictions and Special Districts: please review the table; determine if you're ranking from the 2023 LHMP remains the same.

b. Instructions for New Jurisdictions and Special Districts: please follow below:

Please evaluate the priority level for each listed mitigation goal identified below as it relates to your jurisdiction or facility. If you have any additional mitigation goals or recommendations, please list them at the end of this document.

Place an H (High), M (Medium), L (Low), or N/A (Not Applicable) for your priority level for each mitigation goal in the box next to the activity.

EARTHQUAKE	
M	Aggressive public education campaign in light of predictions
M	Generate new literature for dissemination to:
M	◊ Government employees
M	◊ Businesses
L	◊ Hotel/motel literature
M	◊ Local radio stations for education
M	◊ Public education via utilities
M	◊ Identify/create television documentary content
M	Improve the Emergency Alert System (EAS)
M	◊ Consider integration with radio notification systems
H	◊ Upgrade alerting and warning systems for hearing impaired
H	◊ Training and maintenance
L	Procure earthquake-warning devices for critical facilities
H	Reinforce emergency response facilities
N/A	Provide training to hospital staffs
L	Require earthquake gas shutoffs on remodels/new construction
M	Evaluate re-enforcing reservoir concrete bases
L	Evaluate EOCs for seismic stability
H	Install earthquake cutoffs at reservoirs
M	Install earthquake-warning devices at critical facilities
L	Develop a dam inundation plan for new Diamond Valley Reservoir
M	Earthquake retrofitting
N/A	◊ Bridges/dams/pipelines
L	◊ Government buildings/schools
N/A	◊ Mobile home parks
L	Develop educational materials on structural reinforcement and home inspections **(ALREADY DEVELOPED)**
M	Ensure Uniform Building Code compliance
M	◊ Update to current compliance when retrofitting
L	Insurance coverage on public facilities
L	Funding for non-structural abatement (Earthquake kits, etc.)
L	Pre - identify empty commercial space for seismic re-location
L	Electrical co-generation facilities need retrofitting/reinforcement (Palm Springs, others?)
L	Mapping of liquefaction zones
M	Incorporate County geologist data into planning
N/A	Backup water supplies for hospitals
M	Evaluate pipeline seismic resiliency
M	Pre-positioning of temporary response structures
M	Fire sprinkler ordinance for all structures
L	Evaluate adequacy of reservoir capacity for sprinkler systems
L	Training/standardization for contractors performing retrofitting
L	Website with mitigation/contractor/retrofitting information
L	◊ Links to jurisdictions
M	◊ Alerting information

L	◊ Volunteer information
M	Evaluate depths of aquifers/wells for adequacy during quakes
L	Evaluate hazmat storage regulations near faults
	COMMUNICATIONS IN DISASTER ISSUES
M	Communications Interoperability
M	Harden repeater sites
H	Continue existing interoperability project
M	Strengthen/harden
M	Relocate
H	Redundancy
M	Mobile repeaters
	FLOODS
L	Update development policies for flood plains
L	Public education on locations of flood plains
L	Develop multi-jurisdictional working group on floodplain management
L	Develop greenbelt requirements in new developments
L	Update weather pattern/flood plain maps
L	Conduct countywide study of flood barriers/channels/gates/water dispersal systems
M	Required water flow/runoff plans for new development
M	Perform GIS mapping of flood channels, etc.
L	Install vehicular crossing gates/physical barriers for road closure
H	Maintenance of storm sewers/flood channels
M	Create map of flood channels/diversions/water systems etc.
L	Require digital floor plans on new non-residential construction
M	Upgrade dirt embankments to concrete
M	Conduct countywide needs study on drainage capabilities
H	Increase number of pumping stations
L	Increase sandbag distribution capacities
M	Develop pre-planned response plan for floods
M	◊ Evacuation documentation
M	◊ Re-examine historical flooding data for potential street re-design
L	Training for city/county PIOs about flood issues
L	Warning systems - ensure accurate information provided
L	◊ Publicize flood plain information (website?)
L	◊ Install warning/water level signage
L	◊ Enhanced public information
L	◊ Road closure compliance
L	◊ Shelter locations
L	◊ Pre-event communications
L	Look at County requirements for neighborhood access
L	◊ Secondary means of ingress/egress
M	Vegetation restoration programs
M	Ensure critical facilities are hardened/backed up
L	Hardening water towers
L	Terrorism Surveillance - cameras at reservoirs/dams

M	Riverbed maintenance
M	Evaluate existing lift stations for adequacy
L	Acquisition of property for on-site retention
M	Evaluate regulations on roof drainage mechanism
M	Erosion-resistant plants
L	Traffic light protection
M	Upkeep of diversionary devices
M	Install more turn-off valves on pipelines
H	Backup generation facilities
H	Identify swift water rescue capabilities across County
	WILDFIRES
M	Aggressive weed abatement program
M	◊ Networking of agencies for weed abatement
N/A	Develop strategic plan for forest management
H	Public education on wildfire defense
M	Encourage citizen surveillance and reporting
L	Identify hydrants with equipment ownership information
M	Enhanced firefighting equipment
L	Fire spotter program/red flag program
L	◊ Expand to other utilities
N/A	Research on insect/pest mitigation technologies
L	Volunteer home inspection program
L	Public education program
L	◊ Weather reporting/alerting
M	◊ Building protection
L	◊ Respiration
M	Pre-identify shelters/recovery centers/other resources
M	Roofing materials/defensive spacing regulations
M	Community task forces for planning and education
M	Fuel/dead tree removal
L	Strategic pre-placement of firefighting equipment
L	Establish FEMA coordination processes based on ICS
M	Brush clearings around repeaters
L	Research new technologies for identifying/tracking fires
M	Procure/deploy backup communications equipment
N/A	"Red Tag" homes in advance of event
N/A	Provide fire-resistant gel to homeowners
L	Involve insurance agencies in mitigation programs
N/A	Clear out abandoned vehicles from oases
H	Code enforcement
H	Codes prohibiting fireworks
H	Fuel modification/removal
L	Evaluate building codes
H	Maintaining catch basins

OTHER HAZARDS	
N/A	Improve pipeline maintenance
N/A	Wetlands mosquito mitigation (West Nile Virus)
M	Insect control study
N/A	Increase County Vector Control capacities
H	General public drought awareness
H	◊ Lawn watering rotation
N/A	Develop County drought plan
H	Mitigation of landslide-prone areas
N/A	Develop winter storm sheltering plan
N/A	Ease permitting process for building transmission lines
L	Evaluate restrictions on dust/dirt/generating activities during wind seasons
N/A	Rotational crop planning/soil stabilization
N/A	Enhance agricultural checkpoint enforcement
N/A	Agriculture - funding of detection programs
M	Communications of pipeline maps (based on need to know)
M	Improved notification plan on runaway trains
M	Improve/maintain blackout notification plan.
M	Support business continuity planning for utility outages
H	Terrorism training/equipment for first responders
H	◊ Terrorism planning/coordination
M	◊ Staffing for terrorism mitigation
M	Create a SONGS regional planning group
L	◊ Include dirty bomb planning
M	Cooling stations - MOUs in place
N/A	Fire Ant eradication program
N/A	White Fly infestation abatement/eradication program
M	Develop plan for supplemental water sources
H	Public education on low water landscaping
N/A	Salton Sea desalinization
N/A	Establish agriculture security standards (focus on water supply)
M	ID mutual aid agreements
M	Vulnerability assessment on fiber-optic cable
N/A	Upgrade valves on California aqueduct
L	Public education
L	◊ Bi-lingual signs
L	◊ Power Outage information
M	Notification system for rail traffic - container contents
H	Control and release of terrorism intelligence
N/A	Develop prison evacuation plan (shelter in place?)

Use the list and rankings to narrow down or identify “your” strategies.

The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The mitigation strategy includes the development of goals, objectives, and prioritized mitigation actions.

Goals are general guidelines that explain what you want to achieve. They are broad policy statements and are usually long-term and represent global visions, such as “Protect Existing Property.”

Objectives define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific, measurable, and may have a defined completion date. Objectives are more specific, such as “Increase the number of buildings protected from flooding.”

The development of effective goals and objectives enables the planning team to evaluate the merits of alternative mitigation actions and the local conditions in which these activities would be pursued. A potential mitigation action that would support the goal and objective goal example above is “Acquire repetitive flood loss properties in the Acadia Woods Subdivision.”

In the 2017 LHMP, each jurisdiction was required to develop a Mitigation Strategy Proposal based on one of the following:

1. The strategy, goal, or objective rating “High Priority” on the Local Jurisdiction Mitigation Strategies and Goals (WORKSHEET ABOVE)
2. A specifically identified strategy, goal, or objective that was developed as part of one of the working groups planning sessions such as the hospitals or agriculture.
3. A specifically identified strategy, goal, or objective that was developed as part of one of the jurisdiction’s internal working group planning sessions

6. LOCAL JURISDICTION PROPOSED MITIGATION ACTION AND STRATEGY PROPOSAL

a. Instructions for Updating Jurisdictions and Special Districts: With your planning team, please review the table from # 5, and determine if you’re ranking from the 2023 LHMP remains the same.

Review the chosen Mitigation Strategy that your jurisdiction submitted. The updated plan **must** identify the completed, deleted, or deferred actions or activities from the previously approved plan as a benchmark for progress.

If the mitigation actions or activities remain unchanged from the previously approved plan, the updated plan **must** indicate why changes are not necessary. Further, the updated plan **shall** include in its prioritization any new mitigation actions identified since the previous plan was approved or through the plan update process.

b. Instructions for New Jurisdictions and Special Districts: With your planning team, Use the “High Priority” rated strategy, goal or objective as a starting point to determine your Mitigation Strategy Proposal.

LOCAL JURISDICTION PROPOSED MITIGATION ACTION AND STRATEGY PROPOSAL

Jurisdiction:	City of Corona
Contact:	Lee Shin
Phone:	951-496-1299

MITIGATION STRATEGY INFORMATION

Proposal Name:

DWP Emergency Generators

Proposal Location:

Citywide – Ground Water Wells and Blending station

Proposal Type

Place an "X" by the type of mitigation strategy (one or more may apply)

	Flood and mud flow mitigation
	Fire mitigation
	Elevation or acquisition of repetitively damaged structures or structures in high hazard areas
	Mitigation Planning (i.e., update building codes, planning develop guidelines, etc.)
	Development and implementation of mitigation education programs
	Development or improvement of warning systems
	Additional Hazard identification and analysis in support of the local hazard mitigation plan
	Drinking and/or irrigation water mitigation
X	Earthquake mitigation
	Agriculture - crop related mitigation
	Agriculture - animal related mitigation
	Flood inundation/Dam failure
	Weather/Temperature event mitigation

DESCRIPTION OF THE PROPOSED MITIGATION STRATEGY

List any previous disaster related events (dates, costs, etc.)

Proposal/Event History

The proposed project is to purchase emergency generators for each ground water well and blending station as an earthquake mitigation strategy. The Mexico, Easter earthquake of 2010 caused significant damage to the water systems in Imperial County and the action is a result of lessons learned. There have been earthquakes in the region that have made it apparent that emergency generators will be necessary at ground water wells and blending stations to lessen the possibility of water disruption.

Give a detailed description of the need for the proposal, any history related to the proposal. List the activities necessary for its completion in the narrative section below, including estimated timeline. (How long will it take)

Description of Mitigation Goal Narrative:

Because the City of Corona is in an area of seismic faults, back-up power for pumping water at ground water wells to the community is a good mitigation measure. There have been earthquakes in the region that have made it apparent that emergency generators will be necessary at ground water wells and the blending station to lessen the possibility of water disruption.

Does your jurisdiction have primary responsibility for the proposal? If not, what agency does?

Yes	X	No		Responsible Agency: Dept. of Water and Power

FUNDING INFORMATION

Place an "X" by the proposed source of funding for this proposal

	Unfunded proposal - funds are not available for the proposal currently
	Local jurisdiction General Fund
	Local jurisdiction Special Fund (road tax, assessment fees, etc.)
	Non-FEMA Hazard Mitigation Funds
X	Local Hazard Mitigation Grant Funds - Future Request
X	Hazard Mitigation Funds
X	Other no general fund source.
	Has your jurisdiction evaluated this mitigation strategy to determine its cost benefits? yes (i.e., has the cost of the mitigation proposal been determined to be beneficial in relationship to the potential damage or loss using the attached Cost/Benefit Analysis Sheet or another internal method)

As part of this process, each Submitting Jurisdiction is required to perform a cost-benefit analysis. They were required to answer the question at the bottom of the Proposal page that asks if they had conducted a Cost-Benefit Analysis of some type. This analysis was conducted either by completing a Cost Benefit form or by some other approved method. Many of the jurisdictions used the cost-effective analysis approach outlined in the FEMA publication, *Cost and Benefits of Natural Hazards Mitigation.* This cost-benefit analysis was not restricted to natural hazards.

In some cases, the jurisdiction or working group identified a proposal that highlighted a life- safety issue over a standard hazard proposal. This was done when there was either historical data or other sources of information indicating that the life-safety issue needed to be emphasized or brought to the public's attention.

LOCAL JURISDICTION DEVELOPMENT TRENDS QUESTIONNAIRE

JURISDICTION: CITY OF CORONA	DOES YOUR AGENCY HAVE RESPONSIBILITY FOR LAND USE AND/OR DEVELOPMENT ISSUES WITHIN YOUR JURISDICTIONAL BOUNDARIES? YES NO			
	2012 DATA	2017 DATA		2023
Current Population in Jurisdiction or Served	153,649	167,759	Projected Population in Jurisdiction or Served - in 2022	175,000
Current Sq. Miles in Jurisdiction or Served	39.2	39.2	Projected Sq. Miles in Jurisdiction or Served - in 2022	39.2
Does Your Jurisdiction have any ordinances or regulations dealing with disaster mitigation, disaster preparation, or disaster response?	Yes	Yes	If yes, please list ordinance or regulation number. Ordinance No. 2429, 1973, 2077 Corona Municipal Code Chapters 2.52, 3.36, 4.04.80, 7a, 15.12.270 Section 705	
What is the number one land issue your agency will face in the next five years	Economy and Infill/compact development			
Approximate Number of Homes/Apts/etc.	47,182	48,930	Projected Number of Homes/Apts/etc.- in 2022	50,500
Approximate Total Residential Value	$16.3 billion	$17.0 billion	Projected Residential Total Value - in 2022	$19.0 billion
Approximate Number of Commercial Businesses	5,205	9,000	Projected Number of Commercial Businesses - in 2022	9,500
Approximate Percentage of Homes/Apts/etc. in flood hazard zones	0.7%	0.7%	Approximate Percentage of Homes/Apts/etc. in flood hazard zones - in 2017	0.7%
Approximate Percentage of Homes/Apts/etc. in earthquake hazard zones	3.5%	3.5%	Approximate Percentage of Homes/Apts/etc. in earthquake hazard zones - in 2022	3.5%
Approximate Percentage of Homes/Apts/etc. in wildland fire hazard zones	6.55%	6.55%	Approximate Percentage of Homes/Apts/etc. in wildland fire hazard zones - in 2022	6.55%
Approximate Percentage of Commercial Businesses in flood hazard zones	0.003%	0.7%	Approximate Percentage of Commercial Businesses in flood hazard zones - in 2022	0.7%
Approximate Percentage of Commercial Businesses in earthquake hazard zones	1.9%	0.3%	Approximate Percentage of Commercial Businesses in earthquake hazard zones - in 2022	0.3%
Approximate Percentage of Commercial Businesses in wildland fire hazard zones	4.5%	0	Approximate Percentage of Commercial Businesses in wildland fire hazard zones - in 2022	0
Number of Critical Facilities in your Jurisdiction that are in flood hazard zones	0	0	Projected Number of Critical Facilities in your Jurisdiction that are in flood hazard zones - in 2022	0
Number of Critical Facilities in your Jurisdiction that are in earthquake hazard zones	2	2	Number of Critical Facilities in your Jurisdiction that are in earthquake hazard zones - in 2022	2
Number of Critical Facilities in your Jurisdiction that are in wildland fire hazard zones.	7	7	Number of Critical Facilities in your Jurisdiction that are in wildland fire hazard zones - in 2022	7
Does your jurisdiction plan on participating in the County's on-going plan maintenance program every two years as described in Part I of the plan?	Yes	Yes	If not, how will your jurisdiction do plan maintenance? N/A	
Will a copy of this plan be available for the various planning groups within your jurisdiction for use in future planning and budgeting purposes?				Yes

APPENDIX C – PLAN REVIEW TOOL/CROSSWALK

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: City of Corona	**Title of Plan:** Local Hazard Mitigation Plan	**Date of Plan:** 2/1/2023
Local Point of Contact: Lee Shin	**Address:** 735 Public Safety Way Corona, CA 92880	
Title: Emergency Services Manager		
Agency: Fire Department		
Phone Number: 951-496-1299	**E-Mail:** lee.shin@coronaca.gov	

State Reviewer:	**Title:**	**Date:**

FEMA Reviewer:	**Title:**	**Date:**
Date Received in FEMA Region ***(insert #)***		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan (Section and/or page number)**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Section 2.1	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section 2.2	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section 2.3	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 9.0	X	
A5. Is there discussion of how the community will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section 10.0 Section 8.0	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (Section and/or page number)	Met	Not Met
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating, and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(I))	Section 8.0	X	
ELEMENT A: REQUIRED REVISIONS			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(I))	Section 3.4		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(I))	Section 3.4		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Section 4.4 Section 3.2		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Section 5.1 Figure 4.4.2 pg.42		
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 6.1		
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Section 5.2		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section 7.1		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Section 7.2 Section 7.3		

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (Section and/or page number)	Met	Not Met
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Section 7.2 Section 7.4		
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section 9.0 Section 7.3		
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section 1.4 Section 1.5 Section 1.6		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section 3.5		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Section 3.1 Section 3.2 Section 3.3		
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Plan Adoption/ Resolution Page 4 all plans		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	Plan Adoption/ Resolution Page 4 all plans		
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 2:
PLAN ASSESSMENT

INSTRUCTIONS: The purpose of the Plan Assessment is to offer the local community more comprehensive feedback to the community on the quality and utility of the plan in a narrative format. The audience for the Plan Assessment is not only the plan developer/local community planner, but also elected officials, local departments and agencies, and others involved in implementing the Local Mitigation Plan. The Plan Assessment must be completed by FEMA. The Assessment is an opportunity for FEMA to provide feedback and information to the community on 1) suggested improvements to the Plan; 2) specific sections in the Plan where the community has gone above and beyond minimum requirements; 3) recommendations for plan implementation; and 4) ongoing partnership(s) and information on other FEMA programs, specifically Risk MAP and Hazard Mitigation Assistance programs. The Plan Assessment is divided into two sections:

1. Plan Strengths and Opportunities for Improvement
2. Resources for Implementing Your Approved Plan

Plan Strengths and Opportunities for Improvement is organized according to the plan Elements listed in the Regulation Checklist. Each Element includes a series of italicized bulleted items that are suggested topics for consideration while evaluating plans, but it is not intended to be a comprehensive list. FEMA Mitigation Planners are not required to answer each bullet item and should use them as a guide to paraphrase their own written assessment (2-3 sentences) of each Element.

The Plan Assessment must not reiterate the required revisions from the Regulation Checklist or be regulatory in nature and should be open-ended and provide the community with suggestions for improvements or recommended revisions. The recommended revisions are suggestions for improvement and are not required to be made for the Plan to meet Federal regulatory requirements. The italicized text should be deleted once FEMA has added comments regarding strengths of the plan and potential improvements for future revisions. It is recommended that the Plan Assessment be a short synopsis of the overall strengths and weaknesses of the Plan (no longer than two pages), rather than a complete recap section by section.

Resources for Implementing Your Approved Plan provides a place for FEMA to offer information, data sources and general suggestions on the plan implementation and maintenance process. Information on other possible sources of assistance including, but not limited to, existing publications, grant funding or training opportunities, can be provided. States may add state and local resources, if available.

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

How does the Plan go above and beyond minimum requirements to document the planning process with respect to:

- *Involvement of stakeholders (elected officials/decision makers, plan implementers, business owners, academic institutions, utility companies, water/sanitation districts, etc.);*
- *Involvement of Planning, Emergency Management, Public Works Departments or other planning agencies (i.e., regional planning councils);*
- *Diverse methods of participation (meetings, surveys, online, etc.); and*
- *Reflective of an open and inclusive public involvement process.*

Element B: Hazard Identification and Risk Assessment

In addition to the requirements listed in the Regulation Checklist, 44 CFR 201.6 Local Mitigation Plans identifies additional elements that should be included as part of a plan's risk assessment. The plan should describe vulnerability in terms of:

1) *A general description of land uses and future development trends within the community so that mitigation options can be considered in future land use decisions.*
2) *The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; and*
3) *A description of potential dollar losses to vulnerable structures, and a description of the methodology used to prepare the estimate.*

How does the Plan go above and beyond minimum requirements to document the Hazard Identification and Risk Assessment with respect to:

- *Use of best available data (flood maps, HAZUS, flood studies) to describe significant hazards.*
- *Communication of risk on people, property, and infrastructure to the public (through tables, charts, maps, photos, etc.).*
- *Incorporation of techniques and methodologies to estimate dollar losses to vulnerable structures.*
- *Incorporation of Risk MAP products (i.e., depth grids, Flood Risk Report, Changes Since Last FIRM, Areas of Mitigation Interest, etc.); and*
- *Identification of any data gaps that can be filled as new data became available.*

Element C: Mitigation Strategy

How does the Plan go above and beyond minimum requirements to document the Mitigation Strategy with respect to:

- *Key problems identified in, and linkages to, the vulnerability assessment.*
- *Serving as a blueprint for reducing potential losses identified in the Hazard Identification and Risk Assessment.*
- *Plan content flow from the risk assessment (problem identification) to goal setting to mitigation action development.*
- *An understanding of mitigation principles (diversity of actions that include structural projects, preventative measures, outreach activities, property protection measures, post-disaster actions, etc.).*
- *Specific mitigation actions for each participating jurisdictions that reflects their unique risks and capabilities.*
- *Integration of mitigation actions with existing local authorities, policies, programs, and resources; and*
- *Discussion of existing programs (including the NFIP), plans, and policies that could be used to implement mitigation, as well as document past projects.*

Element D: Plan Update, Evaluation, and Implementation (***Plan Updates Only***)

How does the Plan go above and beyond minimum requirements to document the 5-year Evaluation and Implementation measures with respect to:

- *Status of previously recommended mitigation actions.*
- *Identification of barriers or obstacles to successful implementation or completion of mitigation actions, along with possible solutions for overcoming risk.*
- *Documentation of annual reviews and committee involvement.*
- *Identification of a lead person to take ownership of, and champion the Plan.*
- *Reducing risks from natural hazards and serving as a guide for decisions makers as they commit resources to reducing the effects of natural hazards.*
- *An approach to evaluating future conditions (i.e., socio-economic, environmental, demographic, change in built environment etc.).*
- *Discussion of how changing conditions and opportunities could impact community resilience in the long term; and*
- *Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience.*

B. Resources for Implementing Your Approved Plan

Ideas may be offered on moving the mitigation plan forward and continuing the relationship with key mitigation stakeholders such as the following:

- *What FEMA assistance (funding) programs are available (for example, Hazard Mitigation Assistance (HMA)) to the jurisdiction(s) to assist with implementing the mitigation actions?*
- *What other Federal programs (National Flood Insurance Program (NFIP), Community Rating System (CRS), Risk MAP, etc.) may aid with mitigation activities?*
- *What publications, technical guidance or other resources are available to the jurisdiction(s) relevant to the identified mitigation actions?*
- *Are there upcoming trainings/workshops (Benefit-Cost Analysis (BCA), HMA, etc.) to assist the jurisdictions(s)?*
- *What mitigation actions can be funded by other Federal agencies (for example, U.S. Forest Service, National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA) Smart Growth, Housing and Urban Development (HUD) Sustainable Communities, etc.) and/or state and local agencies?*

SECTION 3:
MULTI-JURISDICTION SUMMARY SHEET (OPTIONAL)

INSTRUCTIONS: For multi-jurisdictional plans, a Multi-jurisdiction Summary Spreadsheet may be completed by listing each participating jurisdiction, which required Elements for each jurisdiction were 'Met' or 'Not Met,' and when the adoption resolutions were received. This Summary Sheet does not imply that a mini plan be developed for each jurisdiction; it should be used as an optional

worksheet to ensure that each jurisdiction participating in the Plan has been documented and has met the requirements for those Elements (A through E).

MULTI-JURISDICTION SUMMARY SHEET													
#	Jurisdiction Name	Jurisdiction Type (city/borough / township/ village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)					
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Require-ments
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

MULTI-JURISDICTION SUMMARY SHEET													
#	Jurisdiction Name	Jurisdiction Type (city/borough / township/ village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)					
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Require-ments
16												
17												
18												
19												
20												

Appendix P – Bedford-Coldwater Groundwater Sustainability Plan

BEDFORD COLDWATER
Groundwater Sustainability Authority



GROUNDWATER SUSTAINABILITY PLAN
BEDFORD-COLDWATER BASIN

| NOVEMBER 2021 |

Stantec

TODD GROUNDWATER

H WATER RESOURCES

BEDFORD COLDWATER
Groundwater Sustainability Authority

GROUNDWATER SUSTAINABILITY PLAN

BEDFORD-COLDWATER BASIN

November 2021

TODD GROUNDWATER

Stantec H&H WATER RESOURCES

Table of Contents

Executive Summary ES-1

1. Introduction 1-1

1.1. Purpose of the Groundwater Sustainability Plan 1-1

1.2. Sustainability Goal 1-3

1.3. Agency Information 1-4

1.3.1. Organization and Management Structure 1-4

1.3.2. Legal Authority 1-5

1.3.3. GSP Implementation Cost Estimate and Schedule 1-5

1.4. GSP Organization 1-6

2. Plan Area 2-1

2.1. Description of the Plan Area 2-1

2.1.1. Geographic Area 2-1

2.1.2. Jurisdictional Agencies 2-1

2.1.3. Disadvantaged Communities 2-2

2.1.4. Water Supply Sources 2-3

2.1.5. Water Use Sectors 2-4

2.1.6. Water Resources Monitoring and Management Programs 2-5

2.1.7. General Plans, Land Use Planning, and Well Permitting 2-10

2.1.8. Notice and Communication 2-12

3. Hydrogeologic Conceptual Model 3-1

3.1. Physical Setting and Topography 3-1

3.2. Surface Water Features 3-1

3.3. Soils 3-2

3.4. Geologic Setting 3-2

3.5. Faults 3-3

3.6. Principal Aquifer 3-4

3.6.1. Description of Principal Aquifer 3-4

3.6.2. Description of Lateral Boundaries 3-4

3.7. Definable Basin Bottom 3-4

3.8. Cross Sections 3-5

3.9. Structures Affecting Groundwater 3-5
3.10. Recharge and Discharge Areas 3-5
3.11. Primary Groundwater Uses 3-6
3.11.1. Bedford Area 3-6
3.11.2. Coldwater Area 3-7
3.12. Data Gaps in the Hydrogeologic Conceptual Model 3-7
4. Current and Historical Groundwater Conditions 4-1
4.1. Groundwater Elevations 4-1
4.1.1. Available Data 4-1
4.1.2. Groundwater Occurrence 4-1
4.1.3. Groundwater Elevations and Trends 4-1
4.1.4. Groundwater Flow 4-2
4.1.5. Vertical Groundwater Gradients 4-3
4.2. Changes In Groundwater Storage 4-3
4.3. Land Subsidence and Potential for Subsidence 4-3
4.3.1. Interferometric Synthetic Aperture Radar (InSAR) 4-5
4.4. Groundwater Quality 4-5
4.4.1. Monitoring Networks 4-6
4.5. Other Studies 4-7
4.5.1. Salt and Nutrient Management Plan 2017 4-7
4.6. Threats to Water Quality 4-7
4.6.1. Regulated Facilities 4-7
4.6.2. Septic Systems 4-7
4.6.3. Non-point Sources 4-8
4.7. Key Constituents of Concern 4-8
4.7.1. Key Constituents in Groundwater 4-8
4.7.2. Total Dissolved Solids (TDS) 4-8
4.7.3. Nitrate as Nitrogen (NO_3 as N) 4-9
4.7.4. Other Constituents 4-9
4.7.5. Vertical Variations in Water Quality 4-10
4.8. Seawater Intrusion Conditions 4-10
4.9. Interconnection of Surface Water and Groundwater 4-10
4.9.1. Stream Flow Measurements 4-10

4.9.2. Depth to Groundwater 4-11
4.9.3. Riparian Vegetation 4-13
4.9.4. Wetlands 4-15
5. Water Budget 5-1
5.1. Water Budget Methodology 5-1
5.2. Dry and Wet Periods 5-1
5.3. Water Balance Analysis Periods 5-2
5.4. Management Areas 5-3
5.4.1. Bedford Management Area 5-3
5.4.2. Coldwater Management Area 5-3
5.5. Methods of Analysis 5-3
5.5.1. Rainfall-Runoff-Recharge Model 5-4
5.5.2. Groundwater Model 5-4
5.5.3. Simulation of Future Conditions 5-6
5.6. Surface Water Balance 5-10
5.6.1. Inflows to Surface Water 5-12
5.6.2. Outflows of Surface Water 5-12
5.7. Groundwater Balance 5-13
5.7.1. Inflows to Groundwater 5-16
5.7.2. Outflows from Groundwater 5-18
5.8. Change in Groundwater Storage 5-19
5.9. Estimate of Sustainable Yield 5-20
6. Sustainable Management Criteria 6-1
6.1. Sustainability Goal 6-2
6.1.1. Description of Sustainability Goal 6-2
6.1.2. Approach to Sustainability Indicators 6-2
6.1.3. Summary of Sustainable Management Criteria 6-3
6.2. Chronic Lowering of Groundwater Levels 6-4
6.2.1. Description of Undesirable Results 6-5
6.2.2. Potential Causes of Undesirable Results 6-6
6.2.3. Definition of Undesirable Results 6-6
6.2.4. Potential Effects on Beneficial Uses and Users 6-7
6.2.5. Sustainable Management Criteria for Groundwater Levels 6-7

6.2.6. Minimum Thresholds 6-9
6.2.7. Measurable Objectives 6-12
6.3. Reduction of Groundwater Storage 6-13
6.3.1. Description of Undesirable Results 6-13
6.3.2. Potential Causes of Undesirable Results 6-14
6.3.3. Definition of Undesirable Results 6-14
6.3.4. Potential Effects on Beneficial Uses and Users 6-14
6.3.5. Sustainable Management Criteria for Groundwater Storage 6-14
6.3.6. Minimum Threshold 6-16
6.3.7. Measurable Objectives 6-18
6.4. Seawater Intrusion 6-19
6.5. Land Subsidence 6-19
6.5.1. Description of Undesirable Results 6-19
6.5.2. Potential Causes of Undesirable Results 6-20
6.5.3. Potential Effects on Beneficial Uses and Users 6-21
6.5.4. Minimum Threshold 6-21
6.5.5. Measurable Objectives 6-23
6.6. Degradation of Water Quality 6-23
6.6.1. Potential Causes of Undesirable Results 6-24
6.6.2. Description of Undesirable Results 6-25
6.6.3. Potential Effects on Beneficial Uses and Users 6-25
6.6.4. Sustainable Management Criteria for Groundwater Quality 6-25
6.6.5. Minimum Thresholds 6-26
6.6.6. Measurable Objectives 6-29
6.7. Depletions of Interconnected Surface Water 6-29
6.7.1. Description of Undesirable Results 6-30
6.7.2. Potential Causes of Undesirable Results 6-30
6.7.3. Definition of Undesirable Results 6-35
6.7.4. Potential Effects on Beneficial Uses and Users 6-35
6.7.5. Sustainable Management Criteria for Interconnected Surface Water 6-36
6.7.6. Minimum Threshold 6-36
6.7.7. Measurable Objective 6-39
6.7.8. Data Gaps 6-39

7. Monitoring Network 7-1
7.1. Description of Monitoring Network 7-1
7.1.1. Chronic Lowering of Groundwater Levels 7-3
7.1.2. Reduction of Groundwater in Storage 7-4
7.1.3. Seawater Intrusion 7-5
7.1.4. Subsidence 7-5
7.1.5. Degraded Water Quality 7-5
7.1.6. Depletion of Interconnected Surface Water 7-6
7.2. Protocols for Data Collection and Monitoring 7-7
7.2.1. Field Methods for Monitoring Well Data 7-8
7.2.2. Field Methods for Groundwater Elevation Monitoring 7-8
7.2.3. Field Methods for Groundwater Quality Monitoring 7-9
7.3. Representative Monitoring 7-10
7.4. Data Management System (DMS) 7-12
7.5. Assessment and Improvement of Monitoring Network 7-12
7.5.1. Identification and Description of Data Gaps 7-12
7.5.2. Description of Steps to Fill Data Gaps 7-13
8. Projects and Management Actions 8-1
8.1. Action 1 – Provide for Collection, Compilation, and Storage of Information Required for Annual Reports and Submit Annual Reports 8-1
8.2. Action 2 – Routinely Record Groundwater Levels and Take Action if Necessary .. 8-3
8.3. Action 3 – Monitor Selected Groundwater Quality Constituents and Coordinate with the Regional Water Quality Control Board as Appropriate 8-3
8.4. Action 4 – Track Trends in Groundwater Levels near Temescal Wash and Take Action as Necessary 8-4
8.5. Action 5 – Review InSAR Data on the DWR Dataviewer Annually and Compile During 5-Year Updates 8-4
8.6. Project 1 – Investigate Groundwater/Surface Water Interaction at Temescal Wash 8-4
8.7. Project 2 – Initiate a Survey of Active Private Wells 8-5
8.8. Project 3 – Evaluation of the Effects of Aggregate Pits on Groundwater Flow and Quality 8-6
9. Plan Implementation 9-1
9.1. Plan Implementation Resources and Responsibilities 9-1
9.2. Plan Implementation Costs 9-2

9.2.1. Operating Expenses 9-2
9.2.2. GSP Implementation Costs 9-3
9.2.3. Funding Methods for Operating Expenses and GSP Implementation Costs.. 9-3
9.3. Annual Reporting 9-4
9.4. New Information and Changes 9-4
9.5. Periodic Evaluations 9-4
9.6. Schedule For Implementation 9-5
10. References 10-7

List of Tables

Table 1-1. GSP Preparation Checklist 1-7
Table 5-1. Water Year Type Classification (Lake Elsinore station) 5-2
Table 5-2. Bedford-Coldwater Basin Land Use in 1990, 2018 and 2068 (acres) 5-9
Table 5-3. Average Annual Surface Water Budgets 5-11
Table 5-4. Average Annual Groundwater Budgets 5-15
Table 5-5. Estimated Sustainable Yield 5-20
Table 6-1. Minimum Thresholds for Groundwater Levels 6-8
Table 6-2. Bedford-Coldwater Water Quality Monitoring Wells 6-25
Table 6-3. Summary of Recent Average Total Dissolved Solids (TDS) and Nitrate Concentrations by Management Area 6-27
Table 7-1. Bedford Coldwater Monitoring Network Summary 7-2
Table 7-2. Wells in the Bedford-Coldwater Groundwater Sustainability Agency Monitoring Network 7-11
Table 7-3. Identification and Description of Data Gaps 7-13
Table 8-1. Action 1 – Provide for Collection, Compilation, and Storage of Information Required for Annual Reports and Submit Annual Reports 8-8
Table 8-2. Action 2 – Routinely Record Groundwater Levels and Take Action if Necessary . 8-9
Table 8-3. Action 3 – Monitor Selected Groundwater Quality Constituents and Coordinate with the Regional Water Quality Control Board as Appropriate 8-10
Table 8-4. Action 4 – Track Trends in Groundwater Levels near Temescal Wash and Take Action as Necessary 8-11
Table 8-5. Action 5 – Review InSAR Data on the SGMA Dataviewer During Updates 8-12
Table 8-6. Project 1 – Investigate Groundwater/Surface Water Interaction at Temescal Wash 8-13

Table 8-7. Project 2 – Initiate a Survey of Private Wells 8-14
Table 8-8. Project 3 – Evaluation of the Effects of Aggregate Pits on Groundwater Flow and Quality 8-15
Table 9-1. Example GSP Implementation Responsibilities 9-2
Table 9-2. GSP Implementation Cost Estimates 9-3

List of Figures

Figure ES-1. Bedford-Coldwater Basin ES-2
Figure ES-2. Bedford-Coldwater Basin Management Areas ES-3
Figure ES-3. Cumulative Storage Change: Bedford Management Area ES-5
Figure ES-4. Cumulative Storage Change: Coldwater Management Area ES-6
Figure 1-1. Bedford-Coldwater Groundwater Basin and GSA, and Adjacent Basins 1-2
Figure 1-2. SGMA Undesirable Results 1-3
Figure 1-3. BCGSA Management Structure 1-5
Figure 2-1. Jurisdictional Boundaries, Bedford-Coldwater Basin 2-14
Figure 2-2. Water Purveyor Boundaries, Bedford-Coldwater Basin 2-15
Figure 2-3. Estimated Density of All Wells 2-16
Figure 2-4. Estimated Density of Domestic Wells 2-17
Figure 2-5. Estimated Density of Production Wells 2-18
Figure 2-6. Estimated Density of Public Wells 2-19
Figure 2-7. Water Infrastructure 2-20
Figure 2-8. Land Use 2014 2-21
Figure 2-9. General Plan Land Use Designations 2-22
Figure 3-1. Basin Topography 3-8
Figure 3-2. Surface Water Bodies Tributary to Basin 3-9
Figure 3-3. Subwatersheds Tributary to Basin 3-10
Figure 3-4. Basin Soil Hydrologic Properties 3-11
Figure 3-5. Surficial Geology 3-12
Figure 3-6. Depth to Bedrock 3-13
Figure 3-7. Cross Section Line Orientations 3-14
Figure 3-8. Cross Section A to A' 3-15
Figure 3-9. Cross Section B to B' 3-16
Figure 3-10. Groundwater Recharge and Discharge 3-17

Figure 4-1. Historically Monitored Wells 4-17
Figure 4-2. Representative Hydrographs Flagler Wells 2 and 2A 4-18
Figure 4-3. Representative Hydrographs Non-Potable Well 1 4-19
Figure 4-4. Representative Hydrographs TVWD Well 4 4-20
Figure 4-5. Representative Hydrographs New Sump 4-21
Figure 4-6. Representative Hydrographs Corona Well 3 4-22
Figure 4-7. Groundwater Elevation Contours, Fall 2015 4-23
Figure 4-8. Groundwater Elevation Contours, Spring 2018 4-24
Figure 4-9. Concepts of Land Subsidence 4-25
Figure 4-10. Basin-Wide Subsidence Estimates from Satellite Measurements 4-26
Figure 4-11. Wells with Water Quality Monitoring Data 4-27
Figure 4-12. Total Dissolved Solids Concentrations in Wells 2011 through 2019 4-28
Figure 4-13. Nitrate as Nitrogen Concentrations in Wells 4-29
Figure 4-14. Local Watersheds and Gauging Stations 4-30
Figure 4-15. Local Streamflow 2013 through 2020 4-31
Figure 4-16. Water Level Monitoring Wells and Riparian Vegetation 4-32
Figure 4-17. Hydrographs for Wells with Shallow Depth to Water 4-33
Figure 4-18. Recent Riparian Vegetation Aerial Imagery 4-34
Figure 4-19. TVWD Wastewater Treatment Plant Discharges, 2011 to 2018 4-35
Figure 4-20. Aerial Photograph of Part of Temescal Wash in 1967 4-36
Figure 4-21. Wetlands in Basin 4-37
Figure 4-22. Coastal California Gnatcatcher Critical Habitat Area 4-38
Figure 5-1. Cumulative Departure of Annual Precipitation 5-23
Figure 5-2. Management Areas 5-24
Figure 5-3. Effect of Climate Change on Precipitation and Evapotranspiration 5-25
Figure 5-4. Land Use in 2068 5-26
Figure 5-5. Surface Water Budgets 1990 through 2018 5-27
Figure 5-6. Annual Groundwater Budgets, 1990 to 2018 5-28
Figure 5-7. Annual Groundwater Budgets, Baseline 5-29
Figure 5-8. Annual Groundwater Budgets, Growth Plus Climate Change 5-30
Figure 5-9. Average Annual Dispersed Recharge 1993 through 2007 5-31
Figure 5-10. Cumulative Storage Changes 1990 to 2068 5-32
Figure 6-1. Water Level Key Wells 6-41

Figure 6-2. Aerial Images of Riparian Vegetation 1994-2018 6-42
Figure 6-3. Annual Groundwater Pumping Near Temescal Wash 6-43
Figure 6-4. Water Levels in Wells Near Temescal Wash 6-44
Figure 6-5. Wastewater Discharges to Temescal Wash 1989-2019 6-45
Figure 7-1. Groundwater Level Wells, Dedicated and Other Monitoring Wells 7-14
Figure 7-2. Water Quality Monitoring Wells 7-15
Figure 9-1. Schedule for GSP Implementation 9-6

Appendices (following text)

Appendix A – Joint Powers Agreement forming the Bedford-Coldwater Groundwater Sustainability Agency

Appendix B – Bedford-Coldwater GSA Notice of Decision to become a Groundwater Sustainability Agency

Appendix C – GSP Elements Guide

Appendix D – BCGSA Stakeholder Outreach Plan

Appendix E – Public Meeting Summaries

Appendix F – Draft GSP Comments and Responses

Appendix G – Bedford-Coldwater GSP Numerical Groundwater Model Documentation Report

Appendix H – Baseline Water Quality Sampling Results

Appendix I – Management Areas Designated in the Bedford Coldwater Subbasin to be Included in the Groundwater Sustainability Plan

Appendix J – Detailed Annual Surface and Groundwater Budgets

Appendix K – Bedford-Coldwater GSP Data Management System Description

Acronyms

Actions	Management Actions
AF	acre-feet
AFY	acre-foot per year
Agreement	Joint Powers Agreement forming the BCGSA
Basin Plan	Water Quality Control Plan for the Santa Ana River Basin
Basin	Bedford-Coldwater Subbasin
BCGSA	Bedford-Coldwater Groundwater Sustainability Agency
bgs	below ground surface
Board	BCGSA Board of Directors

CASGEM	California Statewide Groundwater Elevation Monitoring
CCED	California Conservation Easement Database
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
COC	constituent of concern
Corona	City of Corona
DDW	Division of Drinking Water
DMS	Data Management System
DPR	Department of Pesticide Regulation
DWR	California Department of Water Resources
DWSAP	Drinking Water Source Water Assessment Program
EMWD	Eastern Municipal Water District
ET	evapotranspiration
ET_0	reference evapotranspiration
EVMWD	Elsinore Valley Municipal Water District
FMMP	Farmland Mapping and Monitoring Program
ft	feet
GAMA	Groundwater Ambient Monitoring and Assessment
GDE	groundwater dependent ecosystem
GIS	geographic information system
GMZs	groundwater management zones
GPS	Global Positioning System
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWMP	Groundwater Management Plan
in/yr	inches per year
InSAR	Interferometric Synthetic Aperture Radar
IRWMP	Integrated Regional Water Management Plan
JPA	Joint Powers Authority
km^2	square kilometers
M&I	municipal, commercial, and industrial
MA	Management Area
MCL	Maximum Contaminant Level
Metropolitan	Metropolitan Water District of Southern California
mg/L	milligrams per liter
mi^2	square miles
MO	Measurable Objective
MODFLOW	United States Geological Survey modular finite-difference flow model
MSHCP	Western Riverside County Multiple Species Habitat Conservation Plan
msl	mean sea level
MT	Minimum Threshold
NAD83	North American Datum of 1983

NAVD88	North American Vertical Datum of 1988
NCCAG	Natural Communities Commonly Associated with Groundwater
NCED	National Conservation Easement Database
NDMI	normalized difference moisture index
NDVI	normalized difference vegetation index
NED	National Elevation Dataset
ng/L	nanograms per liter
NO_3	nitrate
NOAA	National Oceanic and Atmospheric Administration
NPS	nonpoint source
NRCS	US Department of Agriculture, Natural Resources Conservation Service
NTU	nephelometric turbidity unit
NWIS	National Water Information System
ORP	oxidation-reduction potential
OWTS	on-site wastewater treatment system
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
ppt	parts per trillion
Projects	projects to support sustainability
QA/QC	quality assurance and quality control
RCRCD	Riverside County Resource Conservation District
RFP	Request for Proposal
RWQCB	Santa Ana Regional Water Quality Control Board
SARHCP	Upper Santa Ana River Habitat Conservation Plan
SCADA	Supervisory Control and Data Acquisition
SFR	Streamflow Routing Package
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
SMCL	Secondary Maximum Contaminant Level
SMP	Surface Mining Permit
SNMP	Salt and Nutrient Management Plan
SSURGO	Soil Survey Geographic Database
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TNC	The Nature Conservancy
TVWD	Temescal Valley Water District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UTV	Upper Temescal Valley
UWMP	Urban Water Management Plan
WMWD	Western Municipal Water District
WRF	Water Reclamation Facility

This page is intentionally blank

EXECUTIVE SUMMARY

The Sustainable Groundwater Management Act (SGMA) requires local agencies in groundwater basins designated as high- or medium-priority to form Groundwater Sustainability Agencies (GSAs) and develop a Groundwater Sustainability Plan (GSP) to plan for achieving and/or maintaining sustainability within 20 years of implementing the plan. The Bedford-Coldwater Groundwater Subbasin (Basin) has been designated by the California Department of Water Resources (DWR) as very low-priority, so the preparation of a GSP is not required. However, the City of Corona (Corona), Temescal Valley Water District (TVWD), and Elsinore Valley Municipal Water District (EVMWD), the three major water purveyors and groundwater users in the Basin, are committed to protecting and maintaining sustainable groundwater conditions in the Basin into the future.

The three agencies signed a Joint Powers Agreement (Agreement) creating a Joint Powers Authority (JPA) and forming the Bedford-Coldwater Groundwater Sustainability Agency (BCGSA). The BCGSA has volunteered to become the GSA for the Bain and prepare and implement this GSP.

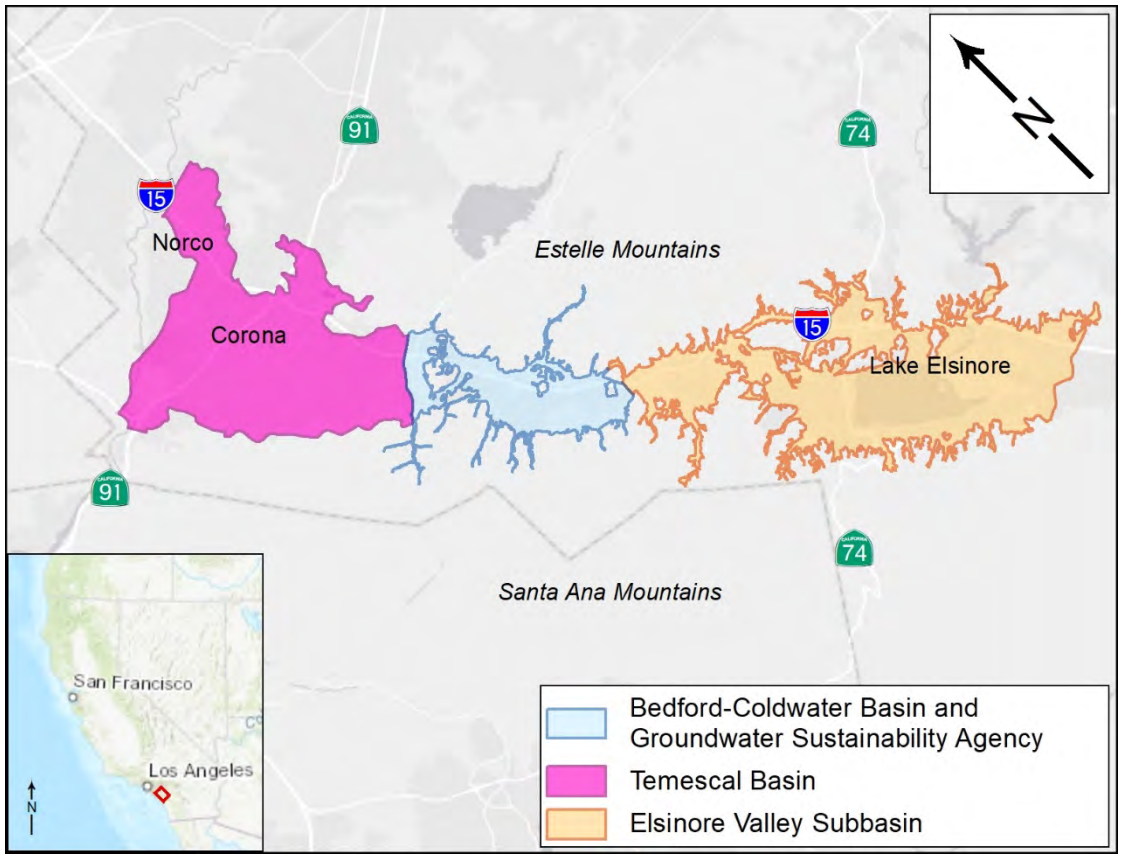
BASIN SETTING

Figure ES-1 shows the Basin located in western Riverside County. **Figure ES-1** also shows the adjacent Temescal Basin to the northwest and Elsinore Valley Subbasin to the south. The Basin is bound on the east and west by consolidated rocks of Estelle Mountain and the Santa Ana Mountains, respectively.

The Bedford-Coldwater Basin is composed of alluvial fan, alluvial valley, axial channel, and wash deposits. These deposits are sourced from the Santa Ana Mountains to the west of the Basin and the Peninsular Ranges to the east of the Basin. The alluvial fan deposits in the Coldwater area extend into the Bedford area and have been disrupted by faulting. Channel deposits along Temescal Wash and local tributaries define the eastern boundary of the Basin. In the northern Bedford area, a variety of Tertiary sedimentary units crop out and the character of these deposits and the groundwater chemistry differs from the alluvial fans to the north in the Temescal Subbasin and those to the south in the Elsinore Groundwater Basin.

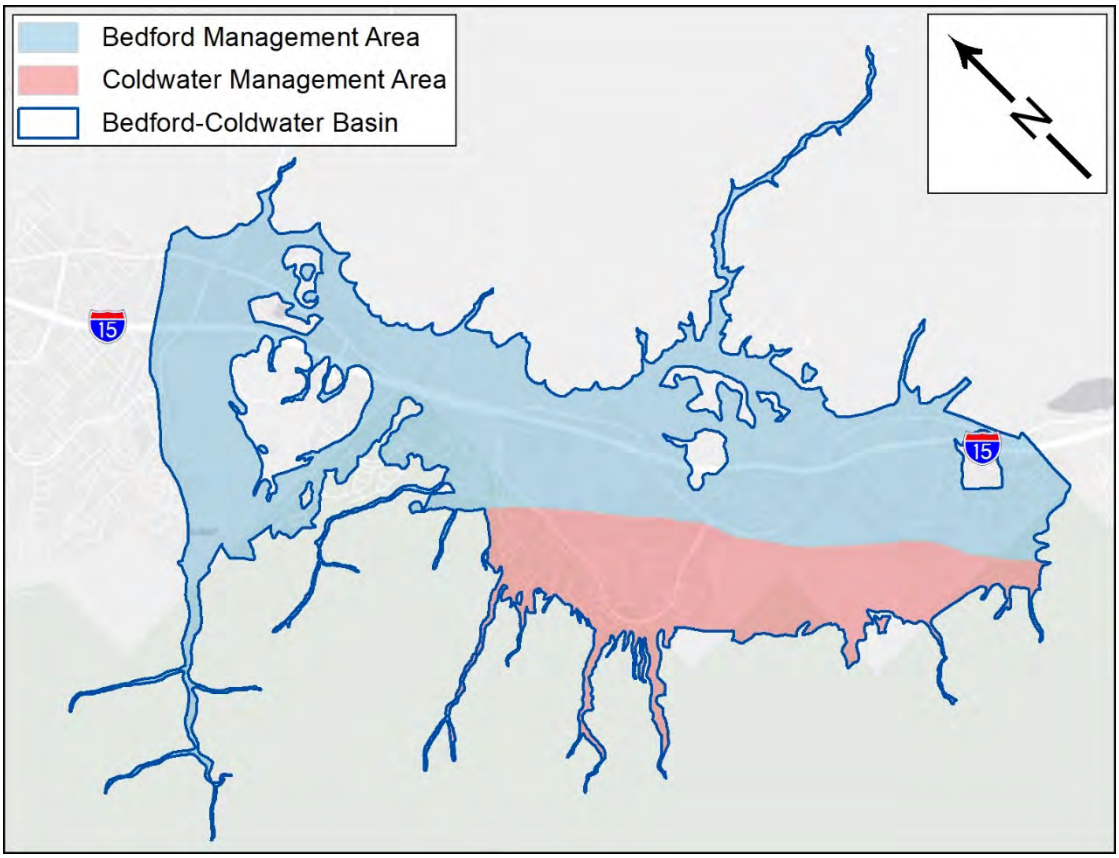
These deposits vary in depth from less than 40 feet up to 500 feet in the Bedford area (eastern portion of the Basin) and up to 800 feet in thickness in the deepest portions of the Coldwater area (western portion of the Basin).

Figure ES-1. Bedford-Coldwater Basin



The Basin is divided into two Management Areas (MAs) designed to facilitate analysis, management, and implementation of the GSP. The MAs are shown on **Figure ES-2**. The Bedford MA occupies roughly the eastern two-thirds of the Basin. It is separated from the Coldwater MA by the Glen Ivy Fault, which is a partial barrier to groundwater flow. The Coldwater MA is the part of the Basin west of the Glen Ivy Fault. Because of downward movement on that side of the fault, Basin thickness is much greater than in the Bedford MA. The partner agencies of the BCGSA are the primary groundwater users in the basin. There are no disadvantaged communities (DACs) or tribal lands in the Basin, and the BCGSA believes there are very few private wells, none of which are used for potable water supply in the Basin.

Figure ES-2. Bedford-Coldwater Basin Management Areas



GROUNDWATER CONDITIONS

Basin groundwater elevations have been relatively stable in recent years. Groundwater elevations in the northern portion of the Bedford MA show a slight decrease during the 2013 through 2015 drought but have begun to recover. Groundwater elevations in the Coldwater MA declined over the last 24 years with significant fluctuations in response to wet and dry cycles. Water levels in the Coldwater area have varied more than 350 feet during this period and there have been multiple major and minor cycles of groundwater elevation decline and recovery. The wide water level fluctuations over time in the Coldwater area likely reflect the relatively small footprint and fault-controlled flow along with the fact that most of the pumping in the Basin occurs in this area. Although long-term declines in groundwater elevations have occurred in Coldwater in the past, recent groundwater elevations have stabilized due in part to shared management of the Basin between the BCGSA agencies.

Total Dissolved Solids (TDS) and nitrate are the primary constituents of concern in the Basin. TDS concentrations are relatively low in the Coldwater MA, naturally higher in Bedford MA, and generally increase downstream. Groundwater in the Basin has been impacted by human activities in the Basin and watershed including agricultural, urban, and industrial land uses.

Nitrate has historically been the most significant constituent of concern in the Basin. Water quality in the Basin is generally within drinking water standards.

WATER SUPPLY

Sources of water supply for agricultural, Municipal and Industrial (M&I), and domestic uses include groundwater, imported water, and recycled water. Metropolitan Water District of Southern California (Metropolitan) is the wholesaler for imported water and its sources of water include the Colorado River and the State Water Project. Both Corona and TVWD receive imported water from Metropolitan for distribution in the Basin. EVMWD also receives imported water from Metropolitan through Western Municipal Water District (WMWD), but only distributes imported water within the Basin when groundwater supply to customers is insufficient.

Groundwater has been an important component of water supply in the Basin for more than 100 years. Until the 1970s, most of the groundwater production in the Basin was for agricultural supply. A few well owners have also produced small amounts of groundwater for domestic use. Production for municipal supply increased in the 1960s and 1970s and continues today.

For more than 50 years, Corona, EVMWD, and TVWD have relied on groundwater from the Basin for municipal uses, and these agencies have long been responsible for managing groundwater conditions in the Basin. Corona and EVMWD have legal agreements for the management of withdrawals from the Coldwater portion of the Basin. Additionally, Corona, in coordination with TVWD, adopted a Groundwater Management Plan (GWMP) in 2008 that covers the Basin.

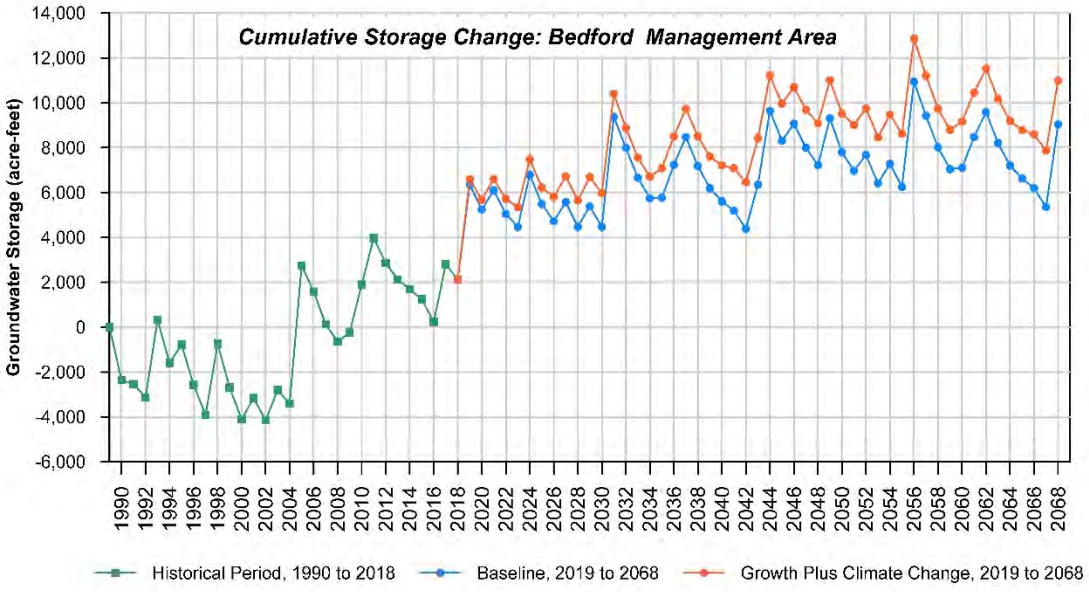
WATER BUDGET

A water balance (or water budget) is a quantitative tabulation of all inflows, outflows, and storage change of a hydrologic system. This GSP contains a detailed water balance for both the groundwater system and surface water system of the Basin. The water budgets were developed for time periods representing historical, current, future no project (baseline), and future growth plus climate change (growth plus climate change) conditions.

In the Bedford MA, the major inflow to the groundwater budget is percolation from streams, especially during wet years. In recent years (2012 to 2018), reclaimed water percolation has become another major inflow. The major outflows include M&I pumping and groundwater discharge to streams. Historically, agricultural pumping also contributed to outflow from the Basin, but this decreased to a negligible amount by 2007. Groundwater storage in the Bedford MA increased slightly during the historical period (**Figure ES-3**), primarily as a result of the decrease in total groundwater pumping. Outflows in the future scenarios (baseline and growth plus climate change) are predicted to increase in response to increased pumping. However, as shown in **Figure ES-3**, the Basin is still expected to have a positive change in storage (more inflow than outflow) in the future, even in growth and climate change

projections. This future increase in storage is due to continued groundwater management and increased imported water use in the Basin.

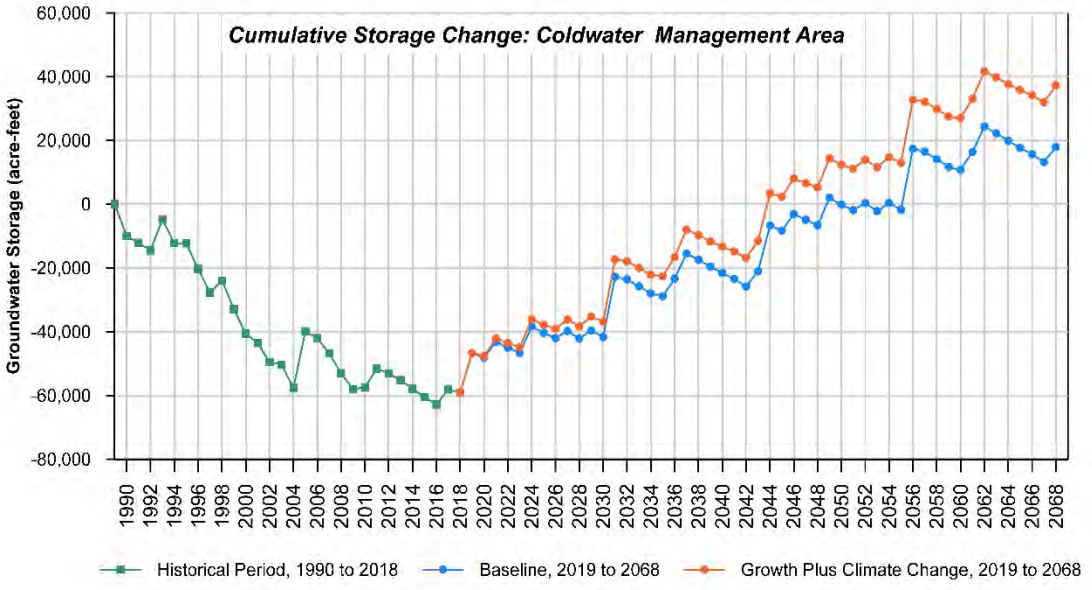
Figure ES-3. Cumulative Storage Change: Bedford Management Area



In the Coldwater MA, percolation from streams occurs as infrequent, episodic events; stream percolation can range from 15,000 acre-feet (AF) in wet years to zero in dry years. M&I pumping has dominated outflows in this MA, although it has decreased from its peak in the late 1990s. Similar to the Bedford MA, agricultural pumping was a significant outflow historically, but decreased to a negligible amount by 2001.

Estimated historical storage in the Coldwater MA declined by a cumulative total of 60,000 AF from 1990 to 2004, as shown in **Figure ES-4**. EVMWD and Corona entered into an agreement to limit pumping in the MA to a periodically re-calculated safe or sustainable yield in 2008. As a result, there was little additional cumulative decline from 2005 to 2018. In contrast, storage in both future scenarios is predicted to increase steadily over the 50 year future simulation periods. Inflows are estimated to exceed outflows in the future because of increased urban recharge and continued limitation of pumping. The rate of storage increase is slightly higher under the growth plus climate change scenario relative to the baseline scenario, which can be attributed to increased urban return flow recharge.

Figure ES-4. Cumulative Storage Change: Coldwater Management Area



SUSTAINABLE MANAGEMENT CRITERIA (SMC)

This GSP defines sustainable management as the use and management of groundwater in a manner that can be maintained without causing *undesirable results*, which are defined as significant and unreasonable effects caused by groundwater conditions occurring throughout the Basin, specifically in consideration of the following sustainability indicators:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply.
- Significant and unreasonable reduction of groundwater storage.
- Significant and unreasonable seawater intrusion. [1]
- Significant and unreasonable land subsidence that substantially interferes with surface land uses.
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

For these sustainability indicators, a GSP must develop quantitative sustainability criteria that allow the GSA to define, measure, and track sustainable management. These criteria include the following:

[1] Seawater intrusion is noted, but no risk of seawater intrusion exists in this inland basin.

- Undesirable Result – significant and unreasonable conditions for any of the six sustainability indicators.
- Minimum Threshold (MT) – numeric value used to define undesirable results for each sustainability indicator.
- Measurable Objective (MO) – specific, quantifiable goal to track the performance of sustainable management.

The sustainability indicators and SMC are clearly defined and provide a quantitative analysis of the Basin's sustainability. As the Basin is currently sustainable, and has been managed sustainably, the following sustainability criteria are defined in to avoid future undesirable results:

- The Minimum Threshold for defining undesirable results relative to chronic lowering of groundwater levels is defined by operational considerations to maintain water levels at or above current pump intakes or screen bottoms (whichever is higher) in municipal water supply wells represented by frequently monitored Key Wells. Undesirable results are indicated when two consecutive exceedances occur in each of two consecutive years, in two-thirds or more of the currently monitored wells in each Management Area.
- The Minimum Threshold for reduction of groundwater storage for all Management Areas is fulfilled by the minimum threshold for groundwater levels as proxy.
- The Minimum Threshold for land subsidence is defined as a cumulative decline equal to or greater than one foot of decline since 2015, which represents current conditions and the SGMA start date. This is equivalent to a rate of decline equal to or greater than 0.2 feet in any five-year period. The extent of cumulative subsidence across the Basin will be monitored and evaluated using Interferometric Synthetic Aperture Radar (InSAR) data available through the SGMA Data Viewer during the 5-year GSP updates. Subsidence as a result of groundwater elevation decline is closely linked to groundwater levels and it is unlikely that significant inelastic subsidence would occur if groundwater levels remain above their minimum thresholds.
- The Minimum Thresholds for degradation of water quality address nitrate and total dissolved solids (TDS) for the entire Basin.
    - The Nitrate Minimum Threshold (in both Management Areas) is defined as 5-year average concentrations of all monitored wells not exceeding the 10 milligrams per liter (mg/L) drinking water maximum contaminant level (MCL) for Nitrate as Nitrogen.
    - The TDS Minimum Threshold (in both Management Areas) is defined as the 5-year average concentrations not exceeding the 1,000 mg/L secondary MCL for TDS.
- The Minimum Threshold for depletion of interconnected surface water is the amount of depletion associated with the lowest water levels recorded during the 2010 to 2015 drought. Specifically, undesirable results would occur if more than half of monitored wells near Temescal Wash had static water levels lower than 35 feet below the adjacent riparian vegetation ground surface elevation for a period of more than one year.

MONITORING NETWORK

The monitoring network for GSP implementation has been established to document groundwater and related surface conditions as relevant to the sustainability indicators, MTs, and MOs. The components of the monitoring network are built from existing programs and will be carried out by the BCGSA.

The BCGSA has actively engaged in assessment and improvement of its monitoring network. This process has been intensified as part of the GSP, given the need to identify data gaps and to assess uncertainty in setting and tracking sustainability criteria. Monitoring improvements such as adding or replacing monitoring infrastructure are part of GSP implementation and will be reviewed and updated for each five-year GSP update.

PROJECTS AND MANAGEMENT ACTIONS

During the preparation of the GSP, the BCGSA identified five specific management actions (Actions) and three projects (Projects) to achieve the sustainability goal. The Actions are generally focused on data collection, storage and reporting of information necessary to monitor sustainability, and assessment of when Actions may be necessary (i.e., when MTs are approached or exceeded). The projects are generally designed to reduce uncertainty in areas where data gaps have been identified during development of the GSP. The Projects and Actions in the GSP are as follows:

- **Action 1** – Provide for Collection, Compilation, and Storage of Information Required for Annual Reports and Submit Annual Reports;
- **Action 2** – Routinely Record Groundwater Levels and Take Action if Necessary;
- **Action 3** – Monitor Selected Groundwater Quality Constituents and Coordinate with the Regional Water Quality Control Board as Appropriate;
- **Action 4** – Track Trends in Groundwater Levels near Temescal Wash and Take Action as Necessary;
- **Action 5** – Review Interferometric Synthetic Aperture Radar (InSAR) Data on the California Department of Water Resources (DWR) Dataviewer During 5-Year Updates;
- **Project 1** – Investigate Groundwater/Surface Water Interaction at Temescal Wash and Install Monitoring Wells;
- **Project 2** – Initiate a Survey of Active Private Wells; and
- **Project 3** – Evaluation of the Effects of Aggregate Pits on Groundwater Flow and Quality.

The Projects and Actions will be implemented by a combination of existing resources from the three agencies within the plan area and contracted resources.

IMPLEMENTATION

The official adoption of the GSP by the BCGSA will initiate Plan implementation. After submittal of the GSP to DWR, and during the DWR review period, the BCGSA will continue to communicate with stakeholders via the BCGSA's website and begin implementing the projects and management actions described in this GSP. The Plan will be implemented to sustainably manage groundwater in the Basin under the authority of the BCGSA and its member agencies.

The BCGSA is required to submit an annual report to DWR by April 1st of each year following adoption of the GSP. The first annual report will be due in April of 2022. The BCGSA has committed to implementing the GSP upon adoption and completing the projects and management actions necessary to monitor and maintain sustainability within the first 5 years of initiation of the GSP.

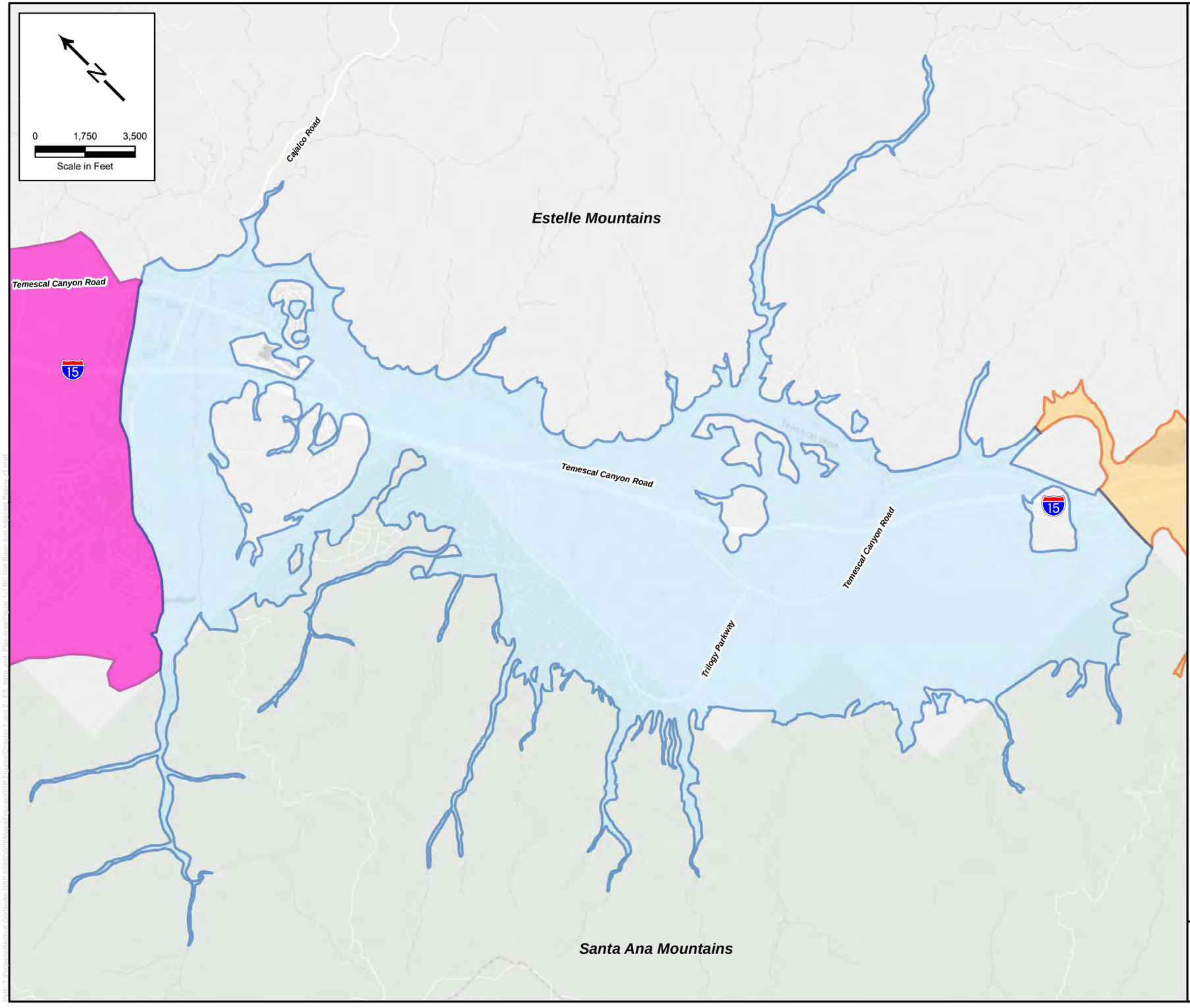
1. INTRODUCTION

The Sustainable Groundwater Management Act (SGMA), effective January 1, 2015, was enacted in California to regulate and sustainably manage groundwater basins throughout the state. SGMA provides a framework to guide local public agencies and newly created Groundwater Sustainability Agencies (GSAs) in the management of their underlying groundwater basins, especially those considered critically affected as defined by the Department of Water Resources (DWR). The Bedford-Coldwater Groundwater Sustainability Agency (BCGSA) has elected to create a Groundwater Sustainability Plan (GSP) to maintain long-term groundwater sustainability in the Bedford-Coldwater Groundwater Subbasin (Basin, **Figure 1-1**) of the Elsinore Groundwater Basin.

1.1. PURPOSE OF THE GROUNDWATER SUSTAINABILITY PLAN

SGMA requires local agencies of all basins designated as high- or medium-priority to develop a GSP to halt groundwater overdraft and achieve sustainability within 20 years of implementing the plan. Although the Basin is designated as very low-priority and does not require a GSP, the BCGSA is committed to protecting and maintaining the current sustainable conditions into the future and has opted to create and implement a GSP.

The purpose of the GSP is to provide basic information on the groundwater conditions in the Basin and to provide a plan or roadmap to maintain sustainability of beneficial use of groundwater in accordance with SGMA. The goal of the GSP is to promote Basin health by maintaining the generally balanced water budget, continue to prevent chronic overdraft, and avoid undesirable results which SGMA has divided into the six categories, represented in **Figure 1-2** below.





Bedford-Coldwater Basin and Groundwater Sustainability Agency

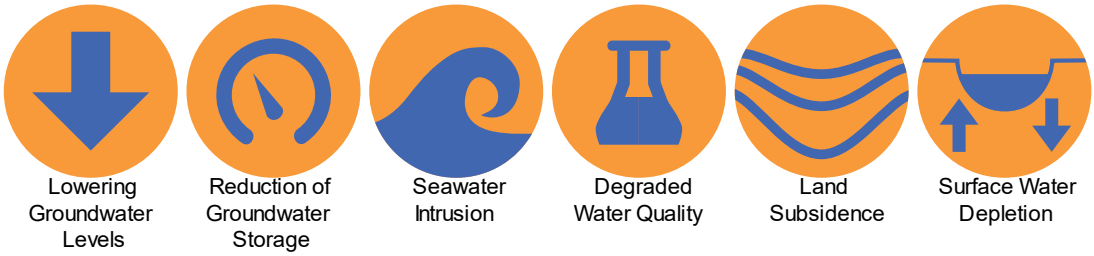
Temescal Basin

Elsinore Valley Basin

TODD GROUNDWATER

Figure 1-1
Bedford-Coldwater Groundwater Basin, GSA, and Adjacent Basins

Figure 1-2. SGMA Undesirable Results



The GSP assesses sustainability related to each of the categories listed above, defines thresholds for maintaining sustainability, outlines groundwater monitoring protocols, best management practices, management actions and projects designed to improve monitoring capabilities and/or to protect and enhance groundwater conditions. The GSP also includes a schedule and cost estimate for plan implementation. Each element of the GSP is designed to promote basin health and achieve and maintain the sustainability goal established for the Basin by the BCGSA.

1.2. SUSTAINABILITY GOAL

The BCGSA prepared this GSP with the goal of sustaining groundwater resources for the current and future beneficial uses of the Bedford-Coldwater Basin in a manner that is adaptive and responsive to the following objectives:

- Provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses;
- Provide reliable storage for water supply resilience during droughts and shortages;
- Protect groundwater quality;
- Support beneficial uses of interconnected surface waters; and
- Support integrated and cooperative water resource management.

This goal is consistent with SGMA and is based on information from the Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget sections of this GSP that:

- Identify beneficial uses of Basin groundwater and document the roles of local water and land use agencies;
- Describe the local hydrogeologic setting, groundwater quality conditions, groundwater levels and storage, and inflows and outflows of the Basin; and
- Document the ongoing water resource monitoring and conjunctive management of groundwater, local surface water, recycled water and especially imported water sources that help protect groundwater quality and maintain water supply.

1.3. AGENCY INFORMATION

This section provides contact information, management structure, and legal authority of the BCGSA.

BCGSA Mailing Address: Bedford-Coldwater Groundwater Sustainability Authority
31315 Chaney Street
Lake Elsinore, CA 92530

1.3.1. Organization and Management Structure

The BCGSA consists of representatives from the three agencies overlying the Basin: The City of Corona (Corona), Elsinore Valley Municipal Water District (EVMWD), and Temescal Valley Water District (TVWD). The BCGSA is governed by a Board of Directors (Board), composed of three governing members, one member appointed by the representatives from each agency. The governing Board members will serve without terms, and at the discretion of the agency which appointed them. The Board designated a consultant to act as the Administrator for the BCGSA and provide administrative services as needed and required by SGMA and the BCGSA until the GSP is adopted. Information about the current BCGSA Board members can be found on the BCGSA website: https://www.bedfordcoldwatergsa.com/about-us/.

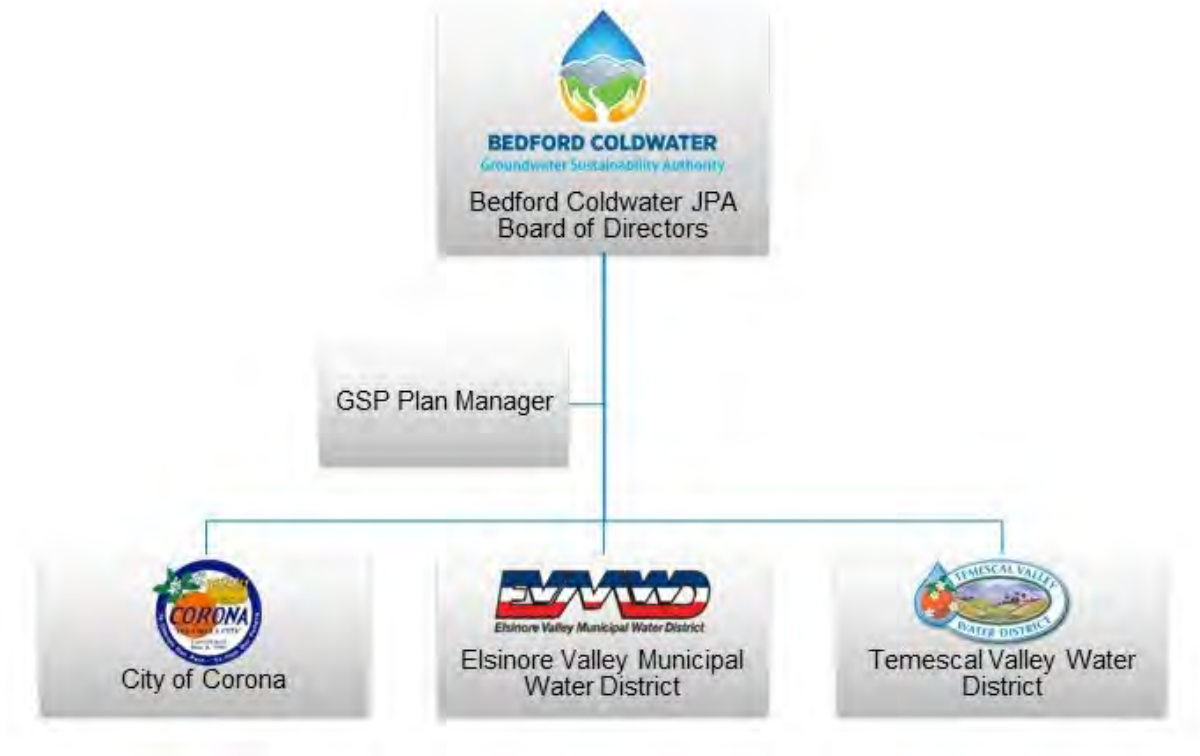
The point of contact for the BCGSA is the Plan Manager, Margie Armstrong. At the time of writing this GSP, the following is the current contact information:

BCGSA Plan Manager: Margie Armstrong
Deputy Treasurer
Bedford-Coldwater Subbasin GSA
31315 Chaney Street
Lake Elsinore, CA 92530

951-674-3146 Ext 8306
margie@evmwd.net
http://www.evmwd.com/

An organizational chart for the BCGSA is presented on **Figure 1-3** below.

Figure 1-3. BCGSA Management Structure



1.3.2. Legal Authority

A Joint Powers Agreement (Agreement) to create a Joint Powers Authority (JPA) for the management of the Basin was entered into as of February 28, 2017 (**Appendix A**). The Agreement to form the BCGSA is by and between Corona, a California General Law City organized and existing under the laws of the State of California, EVMWD, a Municipal Water District organized under Water Code §§ 71000 et seq., and TVWD, a California Water District organized under California Water Code §§ 34000 et seq.. BCGSA signed a resolution to become the GSA for the Basin on March 29, 2017 (**Appendix B**, BCGSA 2017).

1.3.3. GSP Implementation Cost Estimate and Schedule

GSP implementation cost and schedule is described in detail in Section 9, Plan Implementation. Costs associated with implementing the GSP are considered to be either continually ongoing (operating) costs, or GSP implementation costs associated with specific management actions and projects. Annual operating costs in 2021 dollars are expected to be approximately $60,000. Annual implementation of management actions is estimated at approximately $266,000 per year, while total costs for recommended, one-occurrence projects is approximately $990,000 (including the first 5-Year GSP update). Estimated costs for years after the 5-Year GSP update will be reevaluated within the first 5-Year GSP update.

The BCGSA has committed to implementing the GSP upon adoption and completing the projects and management actions necessary to monitor and maintain sustainability within the first 5 years of initiation of the GSP. A preliminary schedule for implementation is provided in Section 9 as **Figure 9-1**.

1.4. GSP ORGANIZATION

This GSP was prepared according to guidance documents provided by DWR (DWR 2016a). The following outlines the GSP contents:

- **Section 1 – Introduction**, purpose of the GSP, sustainability goal, agency information, and GSP organization.
- **Section 2 – Plan Area** description, water use sectors, water supply sources, water resources monitoring and management programs, current general plans, other GSP elements.
- **Section 3 – Hydrogeologic Conceptual Model**, description of the physical basin setting including surface water features, soils, geologic setting, faults, and aquifers, defined basin bottom, recharge and discharge areas, and cross sections.
- **Section 4 – Current and Historical Groundwater Conditions**, discussion of groundwater elevations, land subsidence, groundwater quality and current monitoring, constituents of concern regarding water quality, interconnection of surface water and groundwater and the effects on groundwater dependent ecosystems (GDEs).
- **Section 5 – Water Budget**, discussion of the water budget, groundwater model, surface water and groundwater balance, change in groundwater storage, and estimate of sustainable yield.
- **Section 6 – Sustainable Management Criteria**, sustainability goal, sustainability criteria for the six undesirable results.
- **Section 7 – Monitoring Network**, discussion of the monitoring that will continue to assess sustainability in the future.
- **Section 8 – Projects and Management Actions**, descriptions of projects and management actions for the Basin.
- **Section 9 – Plan Implementation**, estimate of GSP implementation costs, schedule, plan for annual reporting and periodic evaluations.
- **Section 10 – References**

The GSP Preparation Checklist providing the chapter locations for GSP content requirements is provided in **Table 1-1** and the GSP Elements Guide detailing GSP content in comparison to SGMA articles is included in **Appendix C**. Figures in following sections are placed at the end of the section.

Table 1-1. GSP Preparation Checklist

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 3. Technical and Reporting Standards				
352.2		Monitoring Protocols	- Monitoring protocols adopted by the GSA for data collection and management - Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin	Section 7.2
Article 5. Plan Contents, Subarticle 1. Administrative Information				
354.4		General Information	- List of references and technical studies	Section 10
354.6		Agency Information	- GSA mailing address - Organization and management structure - Contact information of Plan Manager - Legal authority of GSA - Estimate of implementation costs	Section 1.3
354.8(a)	10727.2(a)(4)	Map(s)	- Area covered by GSP (Figure 1-1) - Adjudicated areas, other agencies within the basin, and areas covered by an Alternative (Figure 1-1) - Jurisdictional boundaries of federal or State land (Figure 2-1) - Existing land use designations (Figures 2-7, 2-8) - Density of wells per square mile (Figures 2-3 through 2-6)	Section 2
354.8(b)		Description of the Plan Area	- Summary of jurisdictional areas and other features	Section 2.1
354.8(c) 354.8(d) 354.8(e)	10727.2(g)	Water Resource Monitoring and Management Programs	- Description of water resources monitoring and management programs - Description of how the monitoring networks of those plans will be incorporated into the GSP - Description of how those plans may limit operational flexibility in the basin - Description of conjunctive use programs	Section 2.1.4 Section 2.1.4.1 Section 2.1.4.2 Section 2.1.6
354.8(f)	10727.2(g)	Land Use Elements or Topic Categories of Applicable General Plans	- Summary of general plans and other land use plans - Description of how implementation of the GSP may change water demands or affect achievement of sustainability and how the GSP addresses those effects - Description of how implementation of the GSP may affect the water supply assumptions of relevant land use plans - Summary of the process for permitting new or replacement wells in the basin - Information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management	Section 2.1.5 Section 2.1.5.3 Section 2.1.5.4 Section 2.1.5.5 Section 2.1.6
Article 5. Plan Contents, Subarticle 1. Administrative Information (Continued)				
354.8(g)	10727.4	Additional GSP Contents	**Description of Actions related to:** - Control of saline water intrusion - Wellhead protection - Migration of contaminated groundwater - Well abandonment and well destruction program - Replenishment of groundwater extractions - Conjunctive use and underground storage - Well construction policies - Addressing groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects - Efficient water management practices - Relationships with State and federal regulatory agencies - Review of land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity - Impacts on groundwater dependent ecosystems	Section 2.1.6
354.10		Notice and Communication	- Description of beneficial uses and users - List of public meetings - GSP comments and responses - Decision-making process - Public engagement - Encouraging active involvement - Informing the public on GSP implementation progress	Section 2.1.7 Appendix J (pending) Appendix J (pending) Section 1.3.1 Appendix D Section 2.1.7 Section 2.1.7

Table 1-1. GSP Preparation Checklist

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 2. Basin Setting				
354.14		Hydrogeologic Conceptual Model	- Description of the Hydrogeologic Conceptual Model - Two scaled cross-sections - Map(s) of physical characteristics: topographic information, surficial geology, soil characteristics, surface water bodies, source and point of delivery for imported water supplies	Section 3, Figure 3-8 and 3-9
9	10727.2(a)(5)	Map of Recharge Areas	- Map delineating existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas	Figure 3-10
	10727.2(d)(4)	Recharge Areas	- Description of how recharge areas identified in the plan substantially contribute to the replenishment of the basin	Section 3.10
354.16	10727.2(a)(1) 10727.2(a)(2)	Current and Historical Groundwater Conditions	- Groundwater elevation data - Estimate of groundwater storage - Seawater intrusion conditions - Groundwater quality issues - Land subsidence conditions - Identification of interconnected surface water systems - Identification of groundwater-dependent ecosystems	Section 4
354.18	10727.2(a)(3)	Water Budget Information	- Description of inflows, outflows, and change in storage - Quantification of overdraft - Estimate of sustainable yield - Quantification of current, historical, and projected water budgets	Section 5.7, Section 5.8, and Section 5.9
	10727.2(d)(5)	Surface Water Supply	- Description of surface water supply used or available for use for groundwater recharge or in-lieu use	Section 2.1.2.1, Section 3.11, Section 5.6.2
354.20		Management Areas	- Reason for creation of each management area - Minimum thresholds and measurable objectives for each management area - Level of monitoring and analysis - Explanation of how management of management areas will not cause undesirable results outside the management area - Description of management areas	Section 5.4
Article 5. Plan Contents, Subarticle 3. Sustainable Management Criteria				
354.24		Sustainability Goal	- Description of the sustainability goal	Section 6.1.1
354.26		Undesirable Results	- Description of undesirable results - Cause of groundwater conditions that would lead to undesirable results - Criteria used to define undesirable results for each sustainability indicator - Potential effects of undesirable results on beneficial uses and users of groundwater	Section 6.2.1 Section 6.2.2 Section 6.2.3 Section 6.2.4
354.28	10727.2(d)(1) 10727.2(d)(2)	Minimum Thresholds	- Description of each minimum threshold and how they were established for each sustainability indicator - Relationship for each sustainability indicator - Description of how selection of the minimum threshold may affect beneficial uses and users of groundwater - Standards related to sustainability indicators - How each minimum threshold will be quantitatively measured	Sections 6.2 through 6.7
354.30	10727.2(b)(1) 10727.2(b)(2) 10727.2(d)(1) 10727.2(d)(2)	Measureable Objectives	- Description of establishment of the measureable objectives for each sustainability indicator - Description of how a reasonable margin of safety was established for each measureable objective - Description of a reasonable path to achieve and maintain the sustainability goal, including a description of interim milestones	Sections 6.2 through 6.7

Table 1-1. GSP Preparation Checklist

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 4. Monitoring Networks				
354.34	10727.2(d)(1) 10727.2(d)(2) 10727.2(e) 10727.2(f)	Monitoring Networks	- Description of monitoring network - Description of monitoring network objectives - Description of how the monitoring network is designed to: demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features; estimate the change in annual groundwater in storage; monitor seawater intrusion; determine groundwater quality trends; identify the rate and extent of land subsidence; and calculate depletions of surface water caused by groundwater extractions - Description of how the monitoring network provides adequate coverage of Sustainability Indicators - Density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends - Scientific rational (or reason) for site selection - Consistency with data and reporting standards - Corresponding sustainability indicator, minimum threshold, measureable objective, and interim milestone - Location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used - Description of technical standards, data collection methods, and other procedures or protocols to ensure comparable data and methodologies	Section 7.1 Section 7.0
354.36		Representative Monitoring	- Description of representative sites - Demonstration of adequacy of using groundwater elevations as proxy for other sustainability indicators - Adequate evidence demonstrating site reflects general conditions in the area	Section 7.3
354.38		Assessment and Improvement of Monitoring Network	- Review and evaluation of the monitoring network - Identification and description of data gaps - Description of steps to fill data gaps - Description of monitoring frequency and density of sites	Section 7.5 Section 7.5.1 Section 7.5.2 Section 7.1.1
Article 5. Plan Contents, Subarticle 5. Projects and Management Actions				
354.44		Projects and Management Actions	- Description of projects and management actions that will help achieve the basin's sustainability goal - Measureable objective that is expected to benefit from each project and management action - Circumstances for implementation - Public noticing - Permitting and regulatory process - Time-table for initiation and completion, and the accrual of expected benefits - Expected benefits and how they will be evaluated - How the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included. - Legal authority required - Estimated costs and plans to meet those costs - Management of groundwater extractions and recharge	Section 8.0
354.44(b)(2)	10727.2(d)(3)		- Overdraft mitigation projects and management actions	Section 8.2
Article 8. Interagency Agreements				
357.4	10727.6	Coordination Agreements - Shall be submitted to the Department together with the GSPs for the basin and, if approved, shall become part of the GSP for each participating Agency.	**Coordination Agreements shall describe the following:** - A point of contact - Responsibilities of each Agency - Procedures for the timely exchange of information between Agencies - Procedures for resolving conflicts between Agencies - How the Agencies have used the same data and methodologies to coordinate GSPs - How the GSPs implemented together satisfy the requirements of SGMA - Process for submitting all Plans, Plan amendments, supporting information, all monitoring data and other pertinent information, along with annual reports and periodic evaluations - A coordinated data management system for the basin - Coordination agreements shall identify adjudicated areas within the basin, and any local agencies that have adopted an Alternative that has been accepted by the Department	N/A

2. PLAN AREA

The following section, consistent with GSP Regulations §354.8, provides a description of the Plan Area.

The Bedford-Coldwater Subbasin (Basin) has been the focus of historical and ongoing collaborative groundwater basin management among three key agencies: City of Corona (Corona), Elsinore Valley Municipal Water District (EVMWD), and Temescal Valley Water District (TVWD). As noted in Chapter 1 of this Groundwater Sustainability Plan (GSP), the Basin is currently listed by the Department of Water Resources (DWR) as a very low priority groundwater basin. Therefore, preparation of a GSP is not required. The agencies that have been collaborating to manage the Basin, through the Bedford-Coldwater Groundwater Sustainability Agency (BCGSA), have confirmed their collective dedication to management for groundwater sustainability and have decided to prepare a GSP.

2.1. DESCRIPTION OF THE PLAN AREA

The following provides a general description of the Bedford-Coldwater Basin, including local jurisdictions, water resource management and monitoring programs, well permitting procedures, general plans and other land use plans, and additional groundwater management elements.

2.1.1. Geographic Area

Figure 1-1 shows the boundaries of the Plan Area, namely the Bedford-Coldwater Groundwater Subbasin located in western Riverside County. **Figure 1-1** also shows the adjacent Temescal Basin to the northwest (separated by a groundwater divide near Bedford Wash) and Elsinore Valley Subbasin located on the southern boundary. Both the Elsinore Valley Groundwater Sustainability Agency (GSA) and Temescal Subbasin GSA are in the process of developing GSPs for their respective subbasins. Bedford-Coldwater Basin is bound on the east and west by consolidated rocks of Estelle Mountain and the Santa Ana Mountains, respectively. The major drainage is Temescal Wash, traverses the three groundwater basins along its 26-mile course from Lake Elsinore to the Prado Wetlands on the Santa Ana River.

2.1.2. Jurisdictional Agencies

This section identifies agencies with land use management responsibilities. There are no economically distressed areas, disadvantaged communities, or severely disadvantaged communities in the Basin.

County. The Basin is located wholly within Riverside County. Riverside County has jurisdiction for land use planning for unincorporated areas. Riverside County also has responsibility for small water systems in the County that have between 15 and 199 service connections and those serving restaurants, schools, and industry. It also provides limited regulatory oversight to those water systems serving between 5 and 14 service connections. The County oversees

on-site wastewater treatment systems (OWTS) through its Department of Environmental Health. The Department of Environmental Health also evaluates existing residential water wells and makes a determination if the water meets certain minimum standards.

City of Corona. Figure 2-1 shows the boundaries of the other jurisdiction that has land use management responsibilities, the City of Corona. General plan elements relevant to the GSP are discussed in Section 2.1.3. In addition to land use planning, Corona Department of Water and Power is responsible for stormwater management, sewage collection, and production and distribution of potable water for Corona, including the portion within the Basin.

Federal Lands. Federal lands within the Basin include United States Department of Agriculture Forest Service – Cleveland National Forest. The area is managed by the Forest Service.

Tribal Lands. There are no tribal lands in the Basin, however some tribes are included as stakeholders on the list of interested parties. The list of interested parties was developed to encourage public participation from any and all local and regional agencies, entities, and individuals. The list included tribes with land in the region even though they do not have land within the Basin. The BCGSA agencies have a long history of coordination with the regional tribal entities, and they always inform these entities of upcoming planning and/or infrastructure projects. The regional tribal entities take an interest in planning and infrastructure projects within the Basin and surrounding areas because there are important cultural resource sites within these areas. The BCGSA agencies and regional tribal entities coordinate to assess infrastructure project sites prior to groundbreaking to identify and protect potential cultural resources.

California Conservation Easement. According to the California Conservation Easement Database (CCED) there is an area of private land, Lee Lake Easement, with deed-based restrictions to limit land uses to those compatible with its status as open space. Lands under easement may be actively farmed, grazed, forested, or held as nature reserves. Easements are typically held on private lands with no public access. CCED represents California in the National Conservation Easement Database (NCED 2019), a national inventory of lands conserved as easements. NCED is managed by a consortium of non-governmental organizations including: Ducks Unlimited, the Trust for Public Land, Defenders of Wildlife, Conservation Biology Institute, and NatureServe.

Other. There are no state park lands or land owned by the California Department of Fish & Wildlife (CDFW) within the Basin.

2.1.3. Disadvantaged Communities

There are no disadvantaged communities (DACs) or severely disadvantaged communities (SDACs) mapped within the Basin (DWR 2019c).

2.1.4. Water Supply Sources

Sources for water supply for agricultural, Municipal and Industrial (M&I), and domestic uses include groundwater, imported water, and recycled water. Metropolitan Water District of Southern California (Metropolitan) is the wholesaler for imported water and its sources of water include the Colorado River and the State Water Project. Both Corona and TVWD receive imported water from Metropolitan for distribution in the Basin. EVMWD also receives imported water from Metropolitan through Western Municipal Water District (WMWD), but only distributes imported water within the Basin when groundwater supply to domestic users is insufficient.

Water Providers. The BCGSA was created through a Joint Powers Authority agreement between Corona, EVMWD, and TVWD. **Figure 2-2** shows the service areas of these providers. Other small systems are operated by private mutual water companies and some communities do not have water purveyors and systems that provide water service. These small systems and communities—plus rural businesses, schools, parks, and residents—rely on private wells and groundwater.

- **City of Corona.** A portion of the City of Corona overlies the Basin, amounting to 1,213 acres or about 5 percent of the city's area. Corona maintains three treatment facilities and serves water to more than 150,000 residents with water supply from a combination of imported water and groundwater.
- **Temescal Valley Water District (TVWD).** TVWD is the primary purveyor in the BCGSA. TVWD, formed in 1965 as Lee Lake Water District, provides water and wastewater services to the residents of the Temescal Valley in an area covering approximately 6,730 acres.
- **Elsinore Valley Municipal Water District (EVMWD).** EVMWD supplies water to customers within the Basin from a combination of groundwater and imported water supply sources.

Groundwater. Groundwater currently is a source of water supply in the Basin. Corona, EVMWD, and TVWD all pump groundwater from the Basin. Corona and EVMWD distribute this supply to users within and outside the Basin, while TVWD only supplies groundwater to users within the Basin. There are also a few private users that pump groundwater within the Basin. Groundwater produced within the Basin is used to supply municipal, agricultural, mining, recreational, and domestic uses and users throughout the Basin and in the neighboring Temescal and Elsinore Valley Subbasins (DWR 2019a).

Water Supply Wells. Figure 2-3 shows the density of water supply wells in and around the Plan Area; this map is based on the DWR Well Completion Report Map Application tool (DWR 2019b). As indicated, the density of supply wells is generally less than nine wells per square mile. Relatively high densities occur around the northern margins of the Basin, where the Corona and EVMWD wells are located. **Figures 2-4**, **2-5**, and **2-6** show the estimated density of domestic wells, production wells, and public wells. Most of the production wells, as

classified by DWR, are presumably irrigation wells but also include some industrial and commercial wells.

Outside of the three major purveyors, there is only one public water system; Glen Ivy Hot Springs has one well and serves an estimated population of 750 people. The Glen Ivy Hot Springs well is located in the southwestern portion of the Basin (**Figure 2-2**).

The BCGSA is aware that there are a small number of private wells used for non-potable supply in the Basin. However, a systematic well inventory identifying all active private wells has not been completed to date. This has been identified as a data gap in the GSP, as described in Section 6.2.7.1. The GSP also includes a project to address this data gap with a survey and inventory of active private wells throughout the Basin (Project 2, Section 8.7). This project was designed to locate and characterize the construction and use of existing private wells so that they can be included in sustainable management of the Basin.

Imported Water. Corona, TVWD, and EVMWD rely on imported water from Metropolitan. Metropolitan imports water to Southern California from two main sources: the Sacramento and San Joaquin Rivers through the State Water Project and the Colorado River via the Colorado River Aqueduct. Corona receives imported water from Metropolitan through WMWD. Temescal Valley Water District receives State Water Project imported by Metropolitan and treated at the Henry J. Mills Treatment Plant in Riverside. EVMWD also receives imported water from Metropolitan through WMWD, but only distributes to domestic users if groundwater is insufficient. Imported water and other water infrastructure are shown on **Figure 2-7**.

Recycled Water. Water recycling occurs in both Corona and TVWD. Recycled water use is a relatively small but increasing supply. In TVWD, recycled water is distributed to multiple sites within TVWD's service area, including the Retreat Golf Course in the northern portion of the Basin and the Deleo Sports Park along Sycamore Creek in the south Basin (RMC and Woodard & Curran 2017).

2.1.5. Water Use Sectors

Water use sectors are defined in the GSP Regulations as categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation. In the Basin, these are summarized as follows:

- Urban water use sectors are focused in the City of Corona area but extend through the center of the Basin.
- Areas of industrial water use are limited.
- Agricultural land uses comprise limited areas of citrus in the southwestern portion of the Basin (20.5 acres).
- There is no current managed aquifer recharge in the Basin.
- Native vegetation, including rangeland, accounts for the remainder including upland areas and along streams.

2.1.6. Water Resources Monitoring and Management Programs

This section summarizes water resources monitoring and management in the Basin. Corona, EVMWD, and TVWD have entered into a Joint Powers Authority (JPA) agreement for the purpose of forming and executing the responsibilities of the BCGSA in accordance with the Sustainable Groundwater Management Act (SGMA). The BCGSA encompasses the entirety of the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin (Basin 8-004.2, DWR 2016b).

Groundwater has been an important component of water supply in the Basin for more than 100 years. Until the 1970s, most of the groundwater production in the Basin was for agricultural supply (Todd and AKM 2008). A few well owners have also produced small amounts of groundwater for domestic use (Todd and AKM 2008). Production for municipal supply increased in the 1960s and 1970s and continues today.

For more than 50 years, Corona, EVMWD, and TVWD have relied on groundwater from the Basin for municipal use, and these agencies have long been responsible for managing groundwater conditions in the Basin. Corona and EVMWD have longstanding legal agreements for the management of withdrawals from the Coldwater area portion of the Basin. Additionally, Corona, in coordination with TVWD, adopted a Groundwater Management Plan (GWMP) in 2008 that covers the Basin.

In 2008, Corona and EVMWD established a legal agreement for the Coldwater portion of the Basin where most of the pumping occurs. The 2008 agreement is intended to enhance groundwater supply in order to maximize the sustainable use of groundwater. One of the goals of the agreement is to give Corona and EVMWD the ability to estimate annual groundwater production that ensures the sustainability of the Subbasin as a water supply. Historically, Corona and EVMWD account for most of the production in the Basin, with Corona historically pumping about twice as much as EVMWD (Todd and AKM 2008). The agreement is based on this historical distribution of groundwater use and also recognizes the presence of private pumpers in the Basin. This agreement allots four percent of annual groundwater use to private pumpers.

The agreement encourages development of joint groundwater management projects to enhance recharge including the recharge of local surface water by both parties. EVMWD also has surface water rights in the Basin that can be used for recharge enhancement. The 2008 agreement provides a process for allocating production on an annual basis, accounting for production rights and a groundwater storage account. Every five years, the native safe yield is re-evaluated, and each party's share of that yield is adjusted. To date, four annual reports have been completed (WEI 2016 and 2017b).

The only pumpers in the Bedford area of the Basin are the three agencies of the BCGSA.

Corona and TVWD service areas cover almost all of the Basin; those portions outside of these service areas are not within the service area of any local water agency. The BCGSA is coordinating with Riverside County and other agencies for these areas.

2.1.6.1. Water Resource Monitoring

The overall objective of the monitoring networks for this GSP is to yield representative information about water conditions in the Basin as necessary to guide and evaluate GSP implementation. Water resource monitoring programs considered in this section include:

- Climate
- Surface water flows
- Imported water deliveries
- Water recycling
- Land use and cropping
- Wells and groundwater pumping
- Groundwater levels
- Land subsidence
- Water quality

Monitoring programs undertaken by local, state, and federal agencies are summarized below as they are relevant to the GSP.

Climate. Climate data collection stations and records have been reviewed and assessed for the Basin and surrounding areas. Previous investigations (Todd and AKM 2008, SAIC 2007, MWH 2004) have revealed substantial variability in precipitation amounts because of elevation differences between the Temescal Valley and the nearby Santa Ana Mountains. These orographic effects result in significantly more precipitation on the upland areas of the watersheds that contribute to the Basin. However, operational rain gages exist only in EVMWD, Riverside, and at the top of Santiago Peak. Therefore, precipitation on the Basin itself and on the slopes of the Santa Ana Mountains below Santiago Peak must be modeled.

There are three currently active climate monitoring stations near the Basin: the Lake Elsinore station maintained by the National Oceanic Atmospheric Administration (NOAA), the Santiago Peak station maintained by Orange County, and the UC Riverside California Irrigation Management Information System (CIMIS). The Lake Elsinore and UC Riverside stations include daily precipitation and evapotranspiration data; the Santiago Peak station collects monthly precipitation data. Monthly data for the Santiago Peak station are from January 1949 to current, with a slight lag on recent data. The Lake Elsinore station has daily data from January 1961 through current, and monthly data from 1897. The UC Riverside station has daily data from January 1986 through the present.

In addition to station-specific climate records, PRISM Climate Group (PRISM) data are also available. PRISM gathers climate observations from a wide range of monitoring networks, applies sophisticated quality control measures, and develops spatial climate datasets. These datasets incorporate a variety of modeling techniques and are available at multiple resolutions covering the period from 1895 to the present. These datasets include elevation-varying average precipitation isohyets that can be used to estimate or simulate precipitation throughout the watershed contributing to the Basin (PRISM 2018).

Surface water flows. There are three streamflow gage stations near the Basin that are maintained by the United States Geological Survey (USGS 2018). These stations are located on Temescal Creek at about Main Street in Corona (USGS 11072100), Temescal Creek at Corona Lake (USGS 11071900), and San Jacinto River near Elsinore (USGS 11070500). These stations are all active and have records that begin in October 1980, November 2012, and January 1950, respectively.

Imported water deliveries. Imported water data and locations are monitored and available from Corona, EVMWD, and TVWD. Data are available monthly for Corona from 2005 to present, annually for TVWD from 1990 to present, and monthly for EVMWD from 1995 to present.

Recycled water. Corona and TVWD monitor and maintain records of recycled water use records and distribution locations. TVWD supplies non-potable recycled water to Retreat Golf Course on the north end of the Basin and the Deleo Sports Park along Sycamore Creek on the south end.

Wells and groundwater pumping. Groundwater production in the Basin is tracked by the Santa Ana River Watermaster, along with production in the rest of the watershed. WMWD currently coordinates groundwater use data collection.

Groundwater levels. Multiple agencies have historically monitored groundwater levels in the Basin, including Corona, EVMWD, USGS, and DWR.

Land use. Land use map data were collected from DWR, the California Department of Conservation Farmland Mapping and Monitoring Program (FMMP), and Riverside County. The available land use maps are indicated below:

- DWR: 2014 statewide land use mapping specifically developed for SGMA and GSPs.
- FMMP: 1984, 1986, 1988, 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014, and 2016
- Riverside County: 1993 and 2000

Agricultural land is currently limited to approximately 20.5 acres of citrus/subtropical fruits (avocados and others) located on the southwestern edge of the Basin.

Land subsidence. While the potential for subsidence was recognized in the 2008 Groundwater Management Plan, it has not been a known issue in the Basin and ground surface elevations have not been monitored until recently. The TRE Altamira Interferometric Synthetic Aperture Radar (InSAR) Dataset, provided by DWR through the SGMA Data Viewer (DWR 2019c) and showing vertical ground surface displacement from June 2015 to June 2018, indicates that the Basin has been characterized by uplift over that period, likely reflecting tectonic factors. No known available sources of data indicate subsidence in the Basin. Groundwater levels have been managed to stay above historical low levels to minimize the potential for ground settlement.

Water quality. Groundwater quality in the Basin is monitored by the BCGSA agencies and Glen Ivy Hot Springs for compliance with State Water Resources Board Division of Drinking Water (DDW) requirements, and by facilities regulated by the Santa Ana Regional Water Quality Control Board (RWQCB).

Section 7 of this GSP documents the BCGSA monitoring network including how these objectives are met, descriptions of how each sustainability criteria will be monitored, and protocols for measurements.

2.1.6.2. Water Resources Management

This section describes the water resources management plans developed for the Plan Area; note that monitoring is addressed in Section 2.1.4.1.

Groundwater Management Plan, 2008. A GWMP was adopted in 2008 that covers the Basin. The GMP included projects in the Bedford-Coldwater area including the Coldwater Subbasin Enhanced Recharge Project and Lee Lake Water District's (now TVWD) Recharge to Bedford Subbasin. The GMP includes a quantitative water balance for the area, but Bedford-Coldwater was not included in the numerical model developed to evaluate management programs and projects (Todd and AKM 2008).

Numerical Groundwater Modeling. There is no pre-existing numerical model that covers the entire Basin. A model of the Coldwater area was prepared by MWH in 2004 (MWH 2004), and this is the only numerical groundwater model covering any portion of the Basin. This model is documented in the *Coldwater Basin Recharge Feasibility Study* (MWH 2004). Numerical groundwater modeling for the purpose of the GSP is discussed in later chapters of this document.

Integrated Regional Water Management Plan (IRWMP), 2008. The IRWMP is a collaborative effort led by WMWD to identify regional and multi-benefit projects within member agencies service areas. Adopted in 2008, the IRWMP describes the region, provides goals and objectives, and identifies and evaluates projects and programs, including assessment of climate change.

The IRWMP identifies and prioritizes integrated regional projects for the watershed to maximize benefits to the broadest group of stakeholders in the region. Projects in the Bedford-Coldwater area include new water wells for Corona and managed recharge using recycled water infiltration in surface recharge basins or injection wells in the Bedford area (Kennedy/Jenks 2008a and 2008b).

Salt and Nutrient Management Plan (SNMP), 2017. SNMPs are required for groundwater basins throughout California and are intended to help streamline permitting of new recycled water projects while ensuring attainment of water quality objectives and protection of beneficial uses. The Upper Temescal Valley (UTV) SNMP prepared by WEI was a joint management plan, prepared by the EVMWD and the Eastern Municipal Water District (EMWD) (WEI 2017a).

Wastewater services include the treatment of wastewater generated in their respective service areas and the subsequent discharge and reuse of treated wastewater, hereafter referred to as recycled water. The goal of the SNMP was to define management activities to comply with the total dissolved solids (TDS) and nitrate concentration objectives of the groundwater management zones (GMZs) and surface water bodies that are impacted by recycled water discharge and reuse in the UTV Watershed. The UTV SNMP recommends updates to the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) for water quality objectives for the entire upper Temescal Valley but does not provide objectives for individual GMZs. Water quality objectives and ambient water quality numbers were estimated for both TDS and nitrate for the entire UTV SNMP. Ambient water quality will be recomputed periodically.

Recycled Water Plans 2007 through 2016. TVWD prepared a series of plans for its recycled water, including assessment of system-wide impacts to groundwater quality. The planning documents include:

- Recycled Water Master Plan (Lee Lake Water District 2007).
- Water System Master Plan (Lee Lake Water District 2014).
- Temescal Valley Water District Comprehensive Water, Recycled Water, and Wastewater Cost of Service Study Report (Raftelis 2016).

Water Quality Control Plan for the Santa Ana Region. The Basin Plan was approved in 1994 and provides the framework for how surface water and groundwater quality in the Santa Ana Region should be managed to provide the highest water quality reasonably possible. The Basin Plan lists beneficial uses, describes the water quality which must be maintained to allow those uses, provides an implementation plan, details State Water Resources Control Board (SWRCB) and RWQCB plans and polices to protect water quality, and presents surveillance and monitoring programs. The most recent update in 2004 revises groundwater basin boundaries, updates beneficial uses, and presents GMZ water quality objectives.

Urban Water Management Plans (UWMPs). The California Urban Water Management Planning Act requires preparation of UWMPs by urban water providers with 3,000 or more connections. The UWMPs, generally required every five years, provide information on water supply and water demand—past, present, and future—and allow comparisons as a basis for ensuring reliable water supplies. UWMPs examine water supply and demand in normal years and during one-year and multi-year droughts. UWMPS also provide information on per-capita water use, encourage water conservation, and present contingency plans for addressing water shortages. UWMPs have been prepared for Corona, TVWD, and EVMWD (KWC 2016, RMC and Woodard & Curran 2017, MWH 2016).

Despite challenges of drought, climate change, and environmental and legal factors, the three agencies have been able to provide reliable supply. This has been achieved by actively managing the portfolio of water supplies (groundwater, imported water, recycled water), by improving facilities (e.g., water treatment plants), and by promoting conservation.

2.1.7. General Plans, Land Use Planning, and Well Permitting

This section presents elements of General Plans and other land use planning in the Basin as relevant to groundwater sustainability. It summarizes the goals, objectives, policies, and implementation measures as variously described in the General Plans for Riverside County and the City of Corona, which together encompass the Basin. This section also summarizes local well permitting procedures and well ordinances.

2.1.7.1. Land Use

The Basin includes developed urban area, rural residential areas, and limited agriculture.

Figure 2-8 shows land use for 2014 (DWR 2017), which indicates that active agricultural land was limited to 20.5 acres of primarily subtropical orchard in the southwestern Basin.

2.1.7.2. General Plans

Land use planning within the Basin is guided by the General Plans for Riverside County and the City of Corona.

Riverside County General Plan. The Riverside County General Plan, adopted in 2015, incorporates a set of 15 Consensus Planning Principles drafted and endorsed by a coalition of Riverside County stakeholders. The General Plan encourages water use efficiency and requires that new developments *incorporate water conservation techniques, such as groundwater recharge basins, use of porous pavement, drought tolerant landscaping, and water recycling, as appropriate*. Additional policies ensure compliance with water efficient landscape principles, promote water conservation, and encourage the use of recycled water (Riverside County 2015).

Figure 2-9 shows general Land Use Planning Designations of the Riverside County General Plan throughout the Basin. As indicated, broad areas are designated as low and medium density residential with commercial and industrial areas near the freeway.

City of Corona General Plan. The Corona General Plan (EIP Associates 2020) was adopted in 2004 and is scheduled for update beginning in 2019. **Figure 2-9** shows the Corona planning area, including portions of the Basin.

Goals, policies, and implementation measures with relevance to groundwater sustainability include:

- Policy 1.1.4 – Accommodate the types, densities, and mix of land uses that can be adequately supported by transportation and utility infrastructure (water, sewer, etc.) and public services (schools, parks, libraries, etc.)
- Policy 1.5.14 – Require that developers demonstrate water conservation in the landscape design of their proposed projects, such as the use of drought-tolerant species.
- Policy 1.5.16 – Promote the use of recycled water for landscape irrigation, where feasible.

In addition, there are several policies linked to the development of water infrastructure to ensure that water supply and treatment and delivery systems are sustainable and cost efficient. Other policies protect water quality and minimize impact on water resources.

2.1.7.3. General Plan Influences on GSA Ability to Achieve Sustainability

Riverside County. The Riverside County General Plan addresses the importance of groundwater. The policies and implementation of the land use and public facilities/services elements indicate that the County role is to support and encourage local water agencies in ensuring that water supply is available. Similarly, with wastewater issues and protection of water quantity and quality, the County role is limited to encouragement of other agencies, developers, and landowners. The General Plan contains little policy to manage land use within the constraints of available water supply other than to encourage drought resistant plants and the use of recycled water. In the Bedford-Coldwater area, the general plan provides land use designations in the Temescal Canyon Area Plan that were used to estimate future growth.

City of Corona. Corona serves a population that is predicted to increase from 170,100 in 2020 to about 182,800 residents by 2040 (KWC 2016). Some of this growth will be along the southern edge of Corona in the Eagle Creek area within and adjacent to the Basin. The general plan indicates that Metropolitan may build an additional treatment plant in the area to meet increased water demand. Corona land use policies generally are protective of agricultural land and hillsides, and conservation policies address water efficiency, water recycling, sustainability measures, and coordination with other agencies, including TVWD.

The increased development included in the general plans was simulated by the numerical model described in Section 5 and **Appendix G**. Based on these scenarios, the basin remains sustainable even with this projected development.

2.1.7.4. GSP Influences on General Plans

The BCGSA agencies will work together to implement this GSP and rely on their portfolio of water supply to maintain sustainability. While future growth is expected based on the general plans, the agencies are committed to their agreements to limit pumping in Coldwater based on sustainable yield and import additional supplies to Bedford.

City of Corona. Implementation of the GSP will support Corona in providing continued groundwater that may be exported from the Basin to other areas of Corona. In addition, the GSP will ensure good quality water in sufficient quantities to serve its residents into the future, including drought periods.

Riverside County. The Riverside County General Plan generally assumes that local water agencies can ensure adequate high-quality water supplies into the future. The GSP provides additional specific information, documents potential challenges to water supply, and explores undesirable results that may occur with future increases in groundwater demand. Undesirable results will be defined with sustainability criteria, and if identified, will be addressed with management actions. These management actions may have ramifications for County land use planning. For example, GSPs are authorized within the GSP Plan Areas to impose well spacing requirements and control groundwater pumping and control extractions

by regulating, limiting, or suspending extractions from individual groundwater wells. Such regulation may present a constraint on potential land uses.

2.1.7.5. Well Permitting

Groundwater well permitting within the Basin is currently regulated by the Riverside County Department of Environmental Health as described in Riverside County Ordinance No. 682 (as amended through 684.4). The purpose of this ordinance is to provide minimum standards for construction, reconstruction, abandonment, and destruction of all wells in order to: (a) protect underground water resources, and (b) provide safe water to persons within Riverside County pursuant to the authority cited in Chapter 13801(c) of the California Water Code. Wells regulated by Ordinance No. 682 include drinking water (domestic, industrial, community, or springs), agricultural, monitoring, and cathodic protection wells.

This ordinance is similar to the California State Guidelines for new wells under California Water Code Sections 13800 to 13806, which stipulates that local jurisdictions, including counties, cities, and water districts, have authority under the Water Code to adopt local well ordinances that meet or exceed the statewide standards. The Riverside County requirements exceed statewide standards with greater setback requirements from potentially contaminating activities such as septic systems.

The existing well permitting by the Riverside County Department of Environmental Health is the adopted standard for well permitting in this GSP.

2.1.8. Notice and Communication

As described in this section, groundwater is a source of supply in the Basin and supports a range of beneficial uses: agricultural, municipal, rural, and environmental. To some degree in the Basin, all land and property owners, residents, businesses, employees, farmers, and visitors are potentially affected by groundwater use.

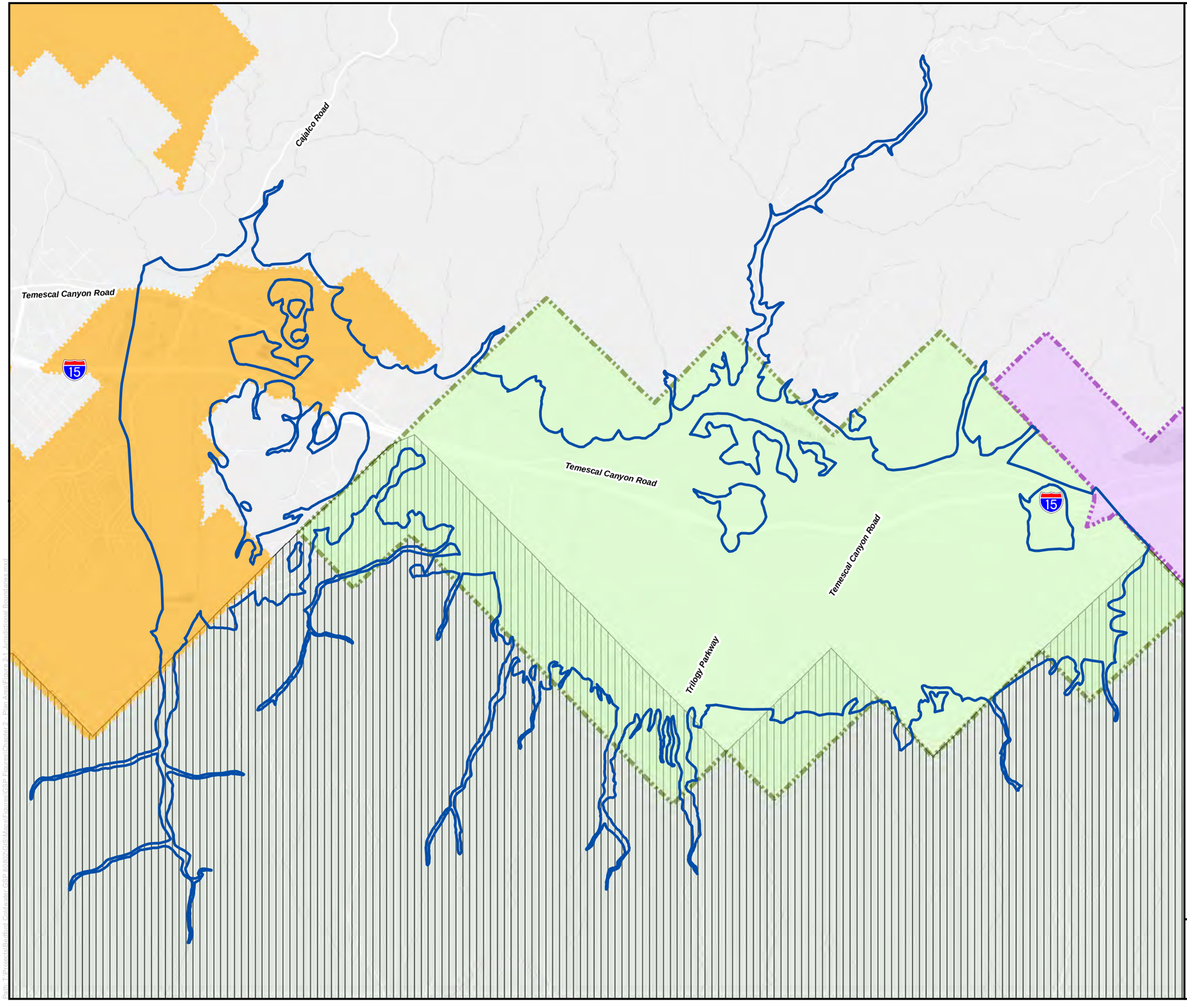
The BCGSA have encouraged public participation in the ongoing planning and development activities supporting the GSP process. Domestic well owners were invited to participate and provide information on their wells, but none responded to the BCGSA data request. The BCGSA solicited information from private well owners during public meetings and through email and postal outreach but received no response. No well owners expressed concern with the GSP development.

Public workshops regarding development of the GSP have been conducted to encourage public participation and to provide educational outreach. Meeting notices have been provided to the list of interested parties that is maintained pursuant to Water Code Section 10723.2. Additionally, GSP development information and meeting notices have been posted to the BCGSA website.

Recognizing the importance of communication, multiple and diverse agencies and interested parties have been identified. These are listed in the BCGSA Stakeholder Outreach Plan, which is included as **Appendix D.**

In addition to quarterly BCGSA Board of Directors meetings open to the public, the BCGSA held two dedicated public meetings presenting information related to and components of the GSP. Summaries of these public meetings are presented in **Appendix E**.

On June 7, 2021, the BCGSA notified stakeholders, including local City and County agencies, of their intent to adopt this GSP after a 90-day review period. One letter with comments on the GSP was received in early September. This letter along with responses from the BCGSA and indications of how the GSP has been modified are included in **Appendix F**.



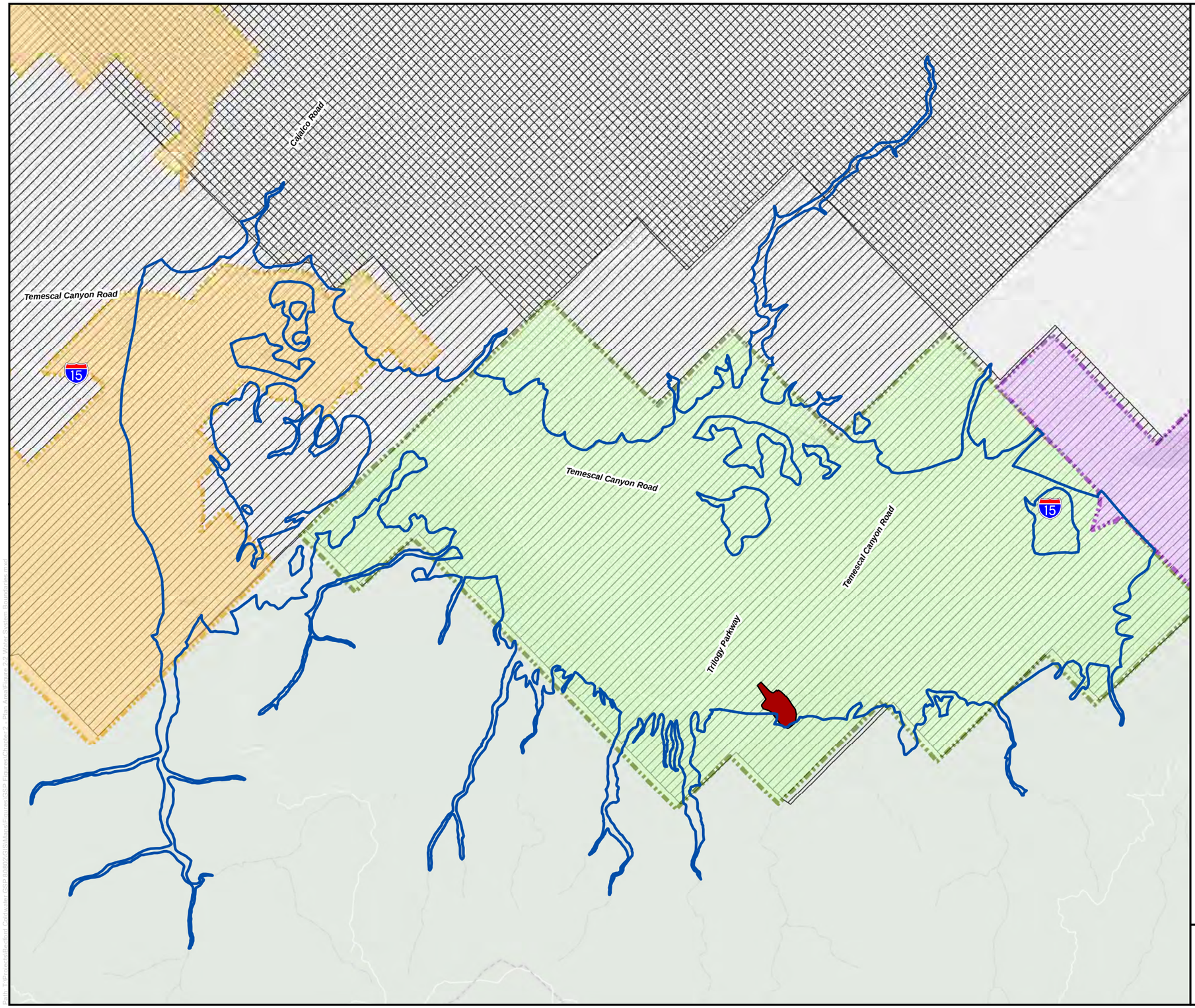
Bedford-Coldwater Basin and Groundwater Sustainability Agency
City of Corona
Elsinore Valley Municipal Water District
Temescal Valley Water District (formerly Lee Lake WD)
US Forest Service Property

N

0 1,750 3,500
Scale in Feet

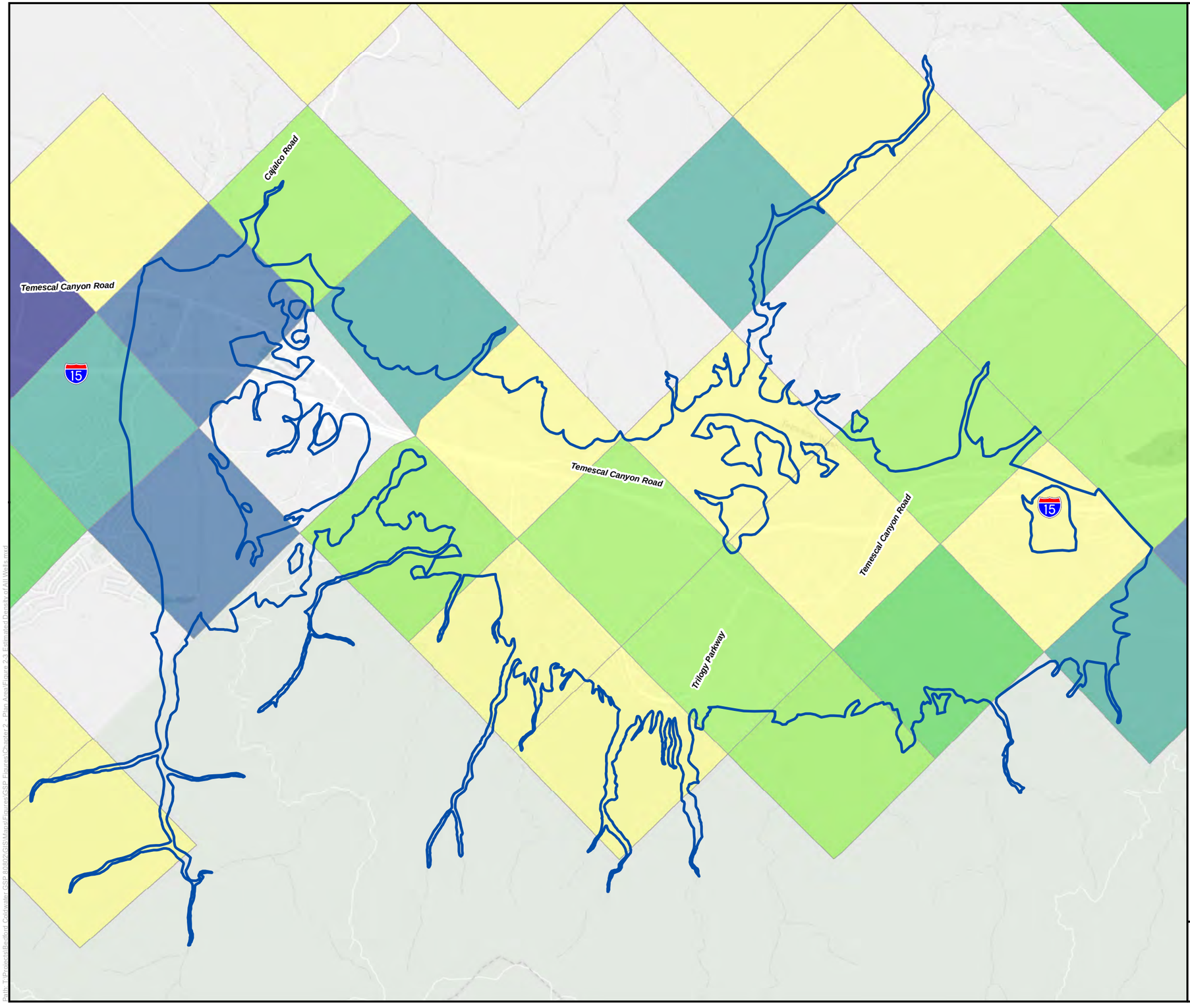
TODD GROUNDWATER

Figure 2-1
Jurisdictional Boundaries
Bedford-Coldwater Basin



TODD GROUNDWATER

Figure 2-2
Water Purveyor Boundaries
Bedford-Coldwater Basin



Estimated Well Density - All Wells

- 1 to 3 Wells Total
- 3 to 6 Wells Total
- 6 to 9 Wells Total
- 9 to 12 Wells Total
- 12 to 15 Wells Total
- 15 to 18 Wells Total
- Bedford-Coldwater Basin

N

0 1,750 3,500

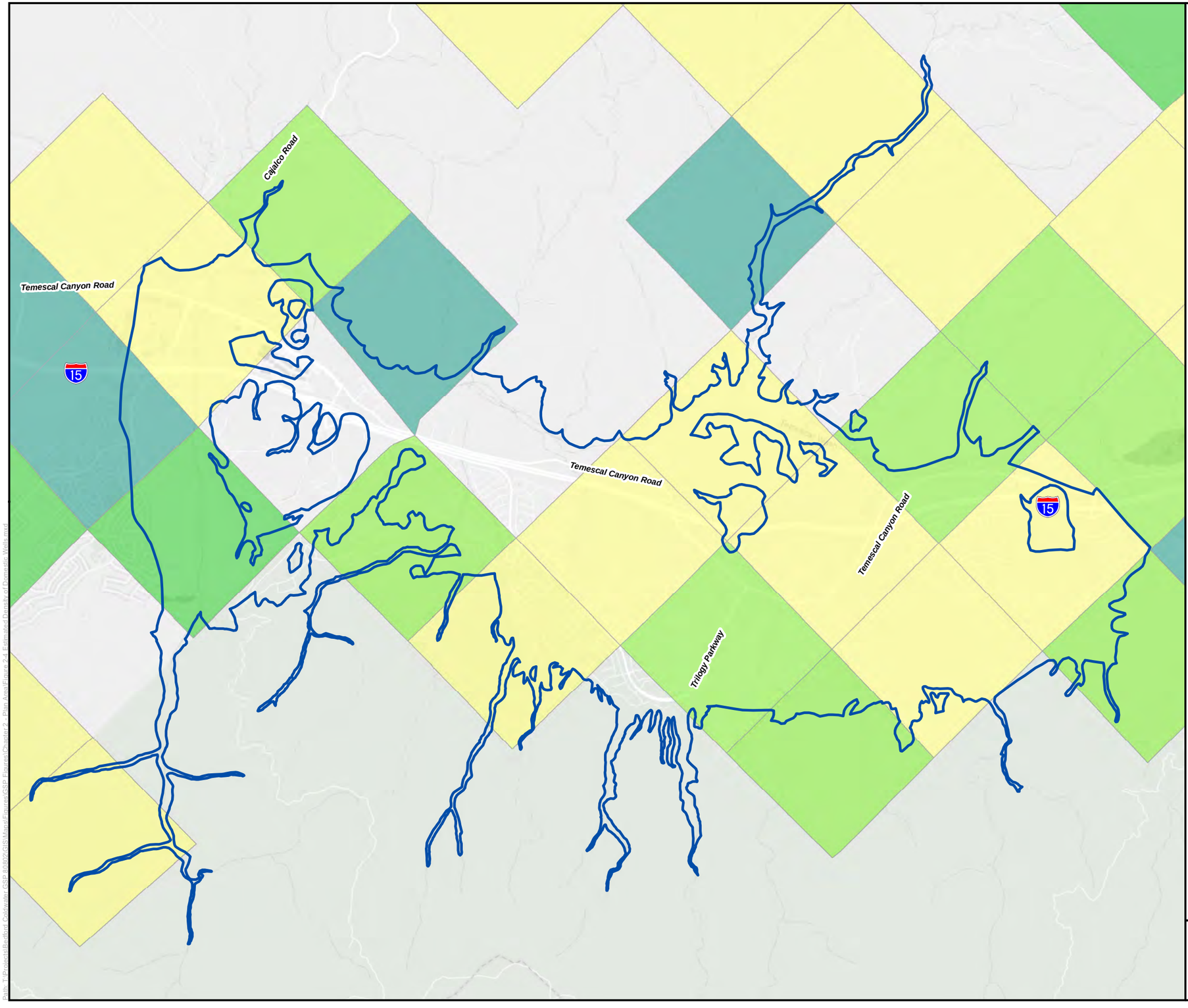
Scale in Feet

* The Public Land Survey System (PLSS) is a way of subdividing and describing land in the United States. PLSS Sections are one-mile square rectangular grids of 640 miles each. All lands in the public domain are subject to subdivision by this rectangular system of surveys, which is regulated by the U.S. Department of the Interior, Bureau of Land Management (BLM).

TODD GROUNDWATER

Figure 2-3
Estimated Density of All Wells
Bedford-Coldwater Basin

Path: T:\Projects\Bedford Coldwater GSP 2020\GIS\mxd\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-3 Estimated Density of All Wells.mxd



Estimated Well Density - Domestic Wells

- 1 to 3 Domestic Wells
- 4 to 6 Domestic Wells
- 6 to 9 Domestic Wells
- 9 to 12 Domestic Wells
- 12 to 15 Domestic Wells
- 15 to 18 Domestic Wells
- Bedford-Coldwater Basin

N

0 1,750 3,500

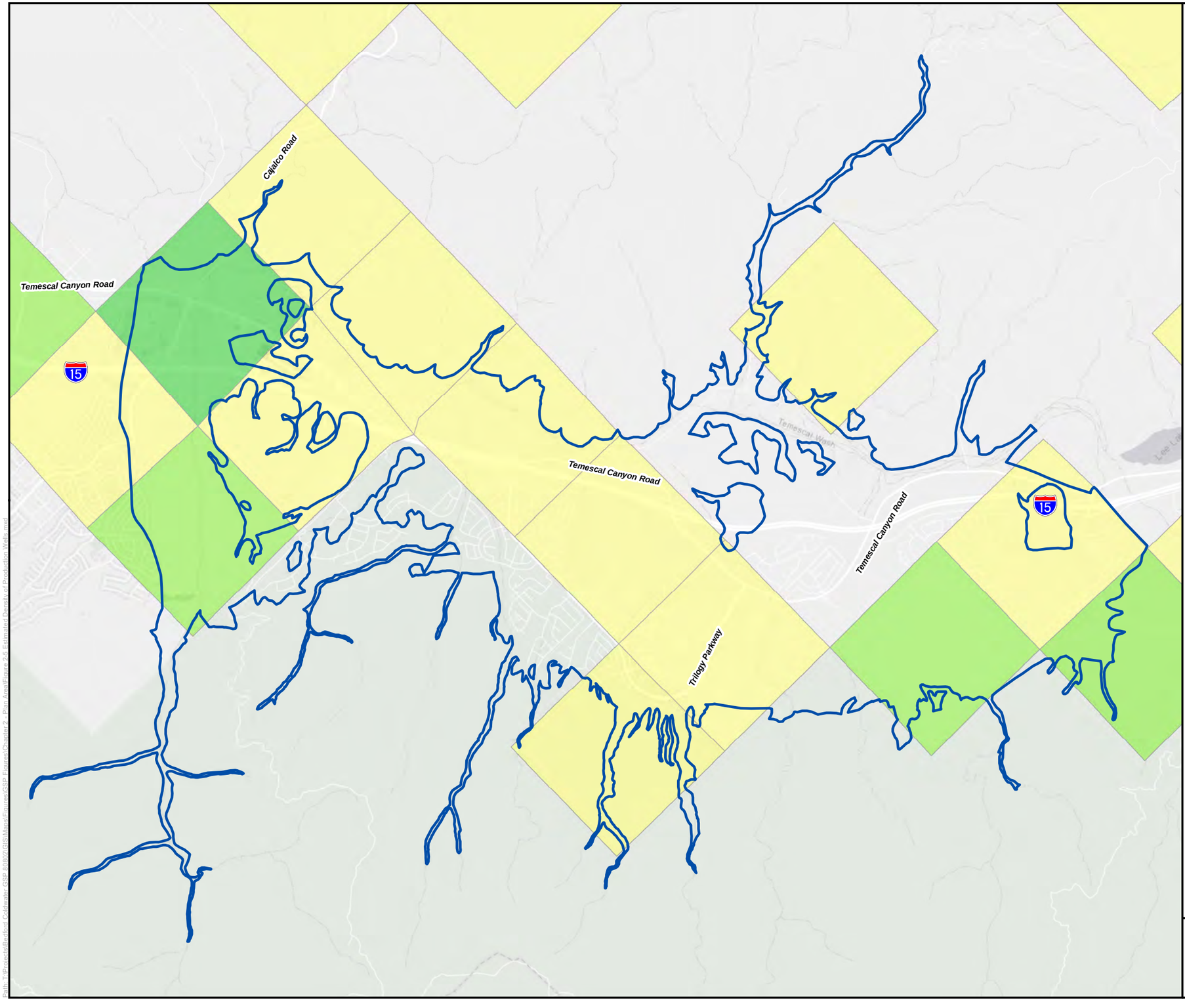
Scale in Feet

* The Public Land Survey System (PLSS) is a way of subdividing and describing land in the United States. PLSS Sections are one-mile square rectangular grids of 640 miles each. All lands in the public domain are subject to subdivision by this rectangular system of surveys, which is regulated by the U.S. Department of the Interior, Bureau of Land Management (BLM).

TODD GROUNDWATER

Figure 2-4
Estimated Density of Domestic Wells
Bedford-Coldwater Basin

Path: T:\Projects\Bedford-Coldwater_GSP\MXD\GSP Figures\Chapter 2 - Plan Area\Fig 2-4 Estimated Density of Domestic Wells.mxd



Estimated Well Density - Production Wells

- 1 to 3 Production Wells
- 3 to 6 Production Wells
- 6 to 9 Production Wells
- 9 to 12 Production Wells
- 12 to 15 Production Wells
- 15 to 18 Production Wells
- Bedford-Coldwater Basin

N

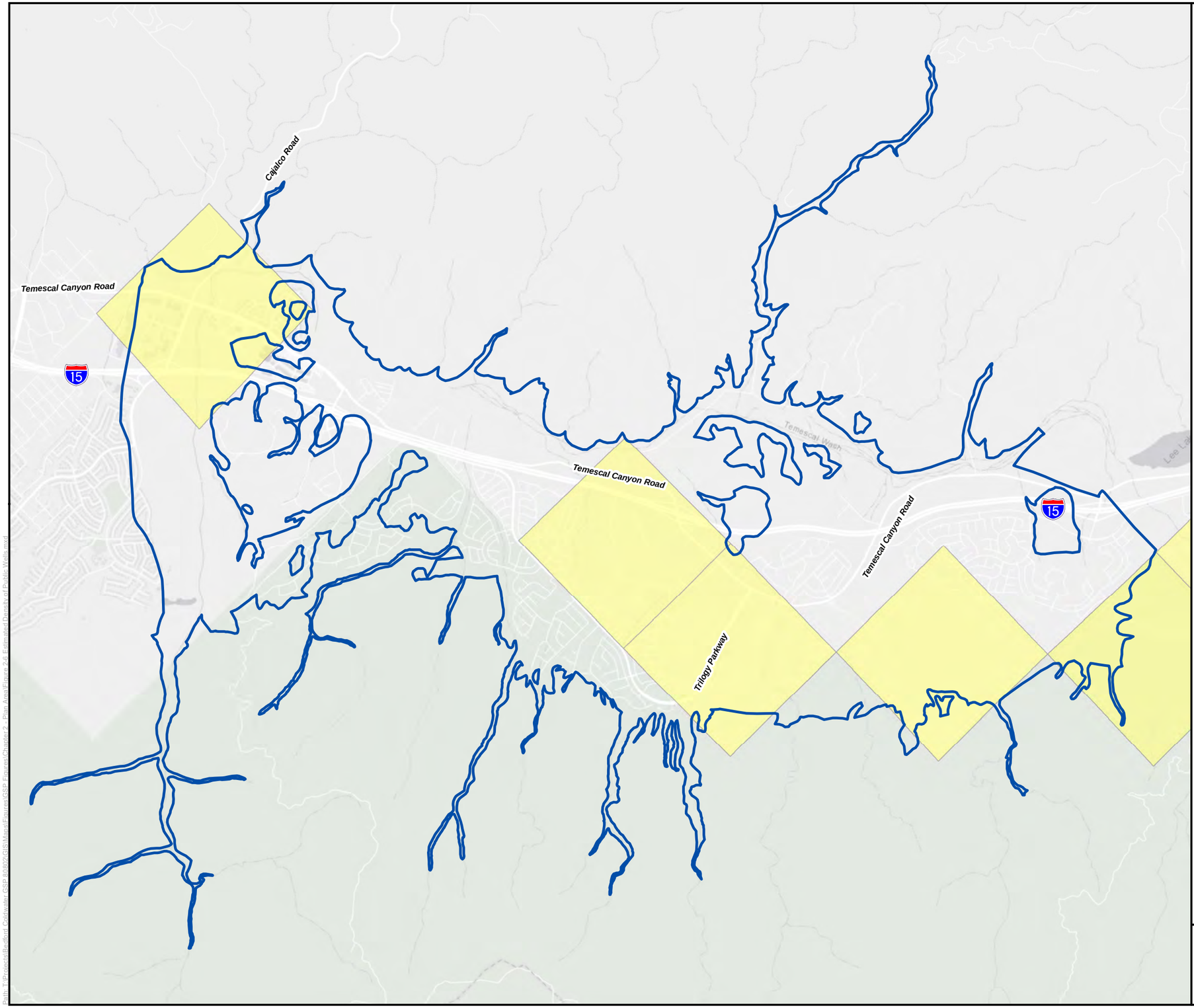
0 1,750 3,500

Scale in Feet

* The Public Land Survey System (PLSS) is a way of subdividing and describing land in the United States. PLSS Sections are one-mile square rectangular grids of 640 miles each. All lands in the public domain are subject to subdivision by this rectangular system of surveys, which is regulated by the U.S. Department of the Interior, Bureau of Land Management (BLM).

TODD GROUNDWATER

Figure 2-5
Estimated Density of Production Wells
Bedford-Coldwater Basin



Estimated Well Density - Public Wells

- 1 to 3 Public Wells
- 3 to 6 Public Wells
- 6 to 9 Public Wells
- 9 to 12 Public Wells
- 12 to 15 Public Wells
- 15 to 18 Public Wells
- Bedford-Coldwater Basin

N

0 1,750 3,500

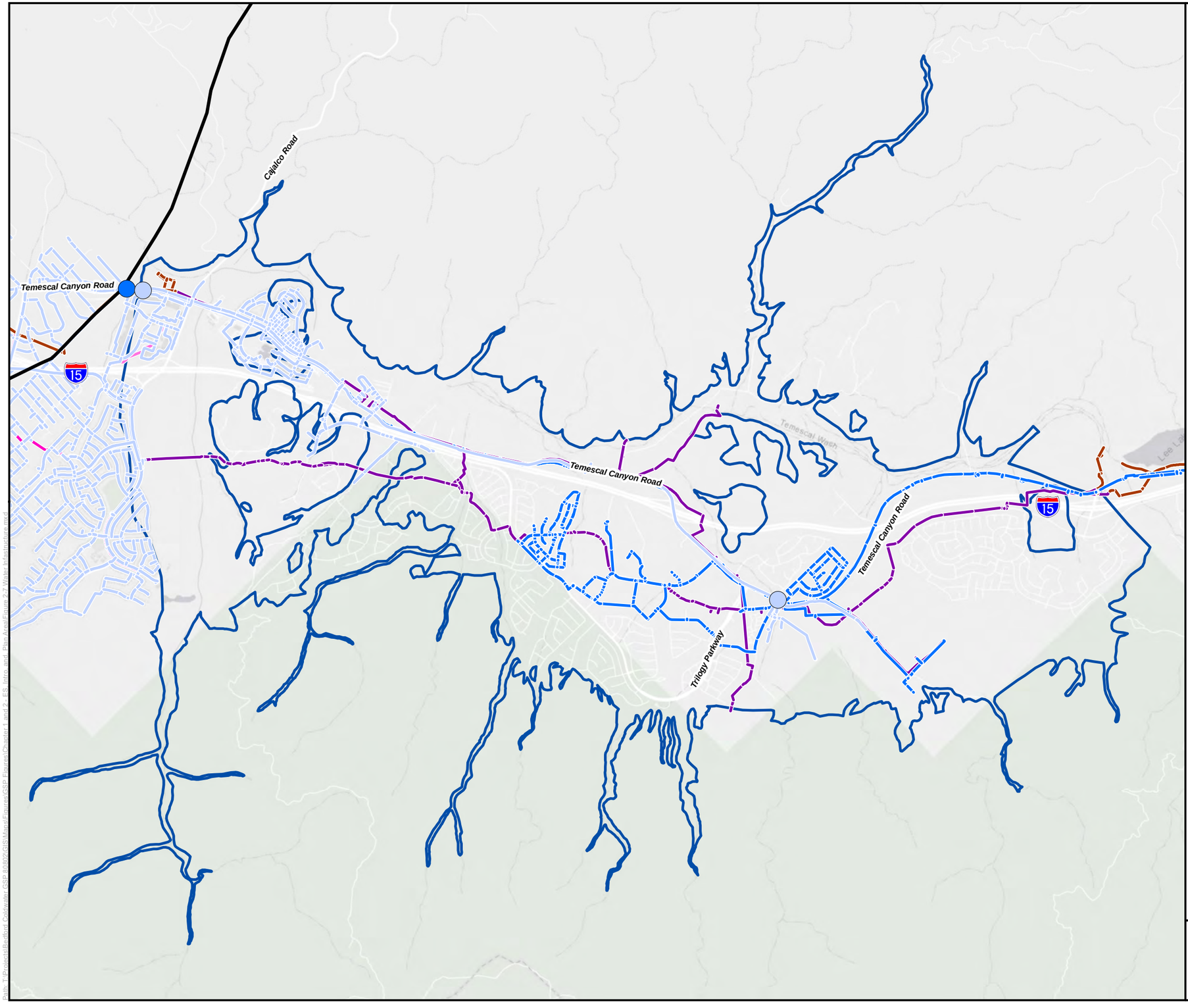
Scale in Feet

* The Public Land Survey System (PLSS) is a way of subdividing and describing land in the United States. PLSS Sections are one-mile square rectangular grids of 640 miles each. All lands in the public domain are subject to subdivision by this rectangular system of surveys, which is regulated by the U.S. Department of the Interior, Bureau of Land Management (BLM).

TODD GROUNDWATER

Figure 2-6
Estimated Density of Public Wells
Bedford-Coldwater Basin

Path: T:\Projects\Bedford Coldwater GSP 20002\GIS\mxd\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-6 Estimated Density of Public Wells.mxd



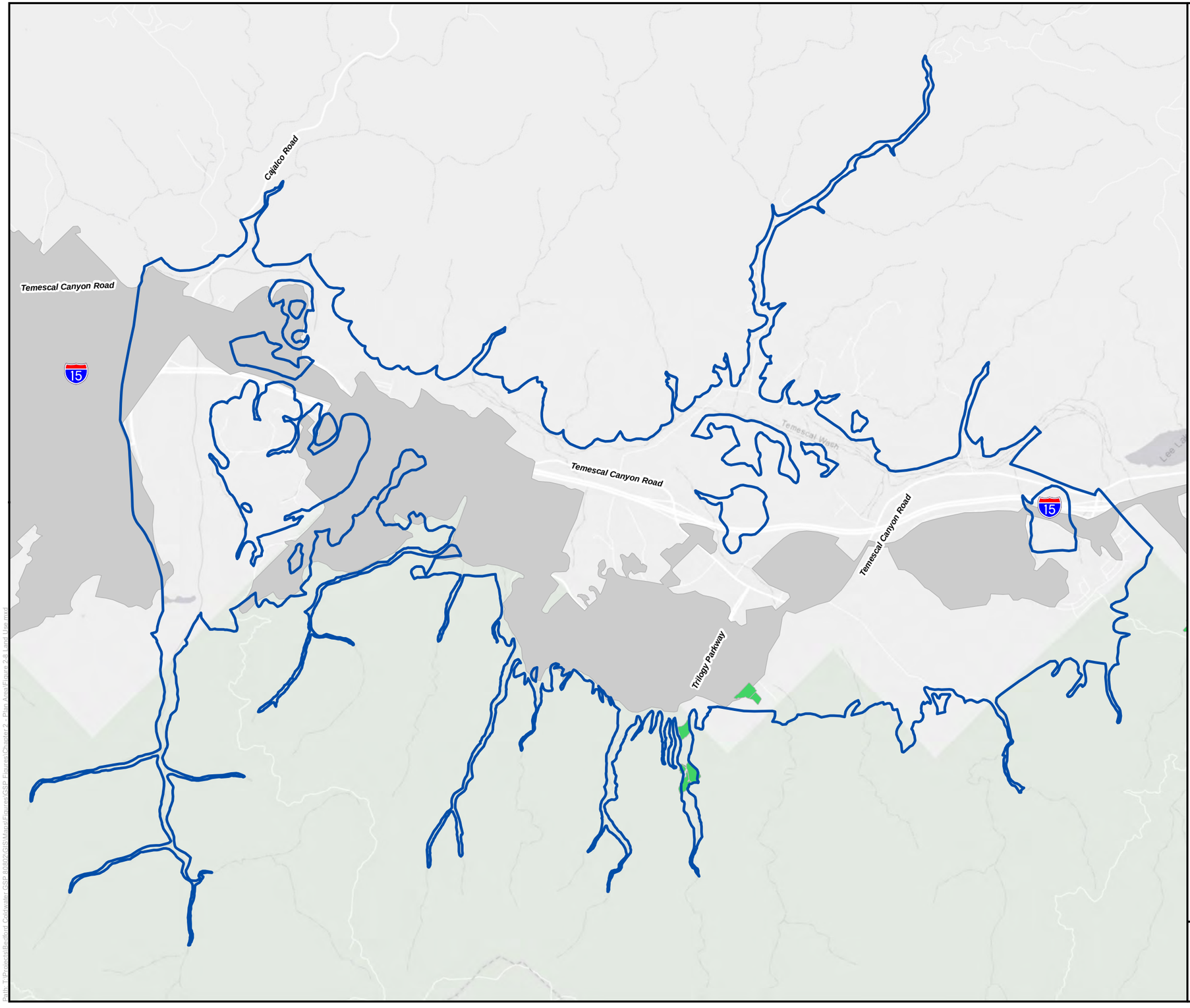
City of Corona Potable Water Intertie
EVMWD Imported Water Connection
Metropolitan Water District Imported Water Pipeline
Corona Potable Water Main Pipeline
EVMWD Potable Main Pipeline
Corona Non-Potable Water Pipeline
EVMWD Non-Potable Water Pipeline
TVWD Non-Potable Water Pipeline
Bedford-Coldwater Basin

N

0 1,750 3,500
Scale in Feet

TODD GROUNDWATER

Figure 2-7
Water Infrastructure
Bedford-Coldwater Basin



Statewide Crop Mapping 2014

DWR Standard Legend (modified for remote sensing)

- R | Rice
- P | Pasture
- G | Grain and Hay Crops
- T | Truck, Nursery, and Berry Crops
- F | Field Crops
- C | Citrus and Subtropical
- D | Deciduous Fruits and Nuts
- V | Vineyard
- Y | Young Perennial
- I | Idle
- NR | Riparian Vegetation
- U | Urban
- Bedford-Coldwater Basin

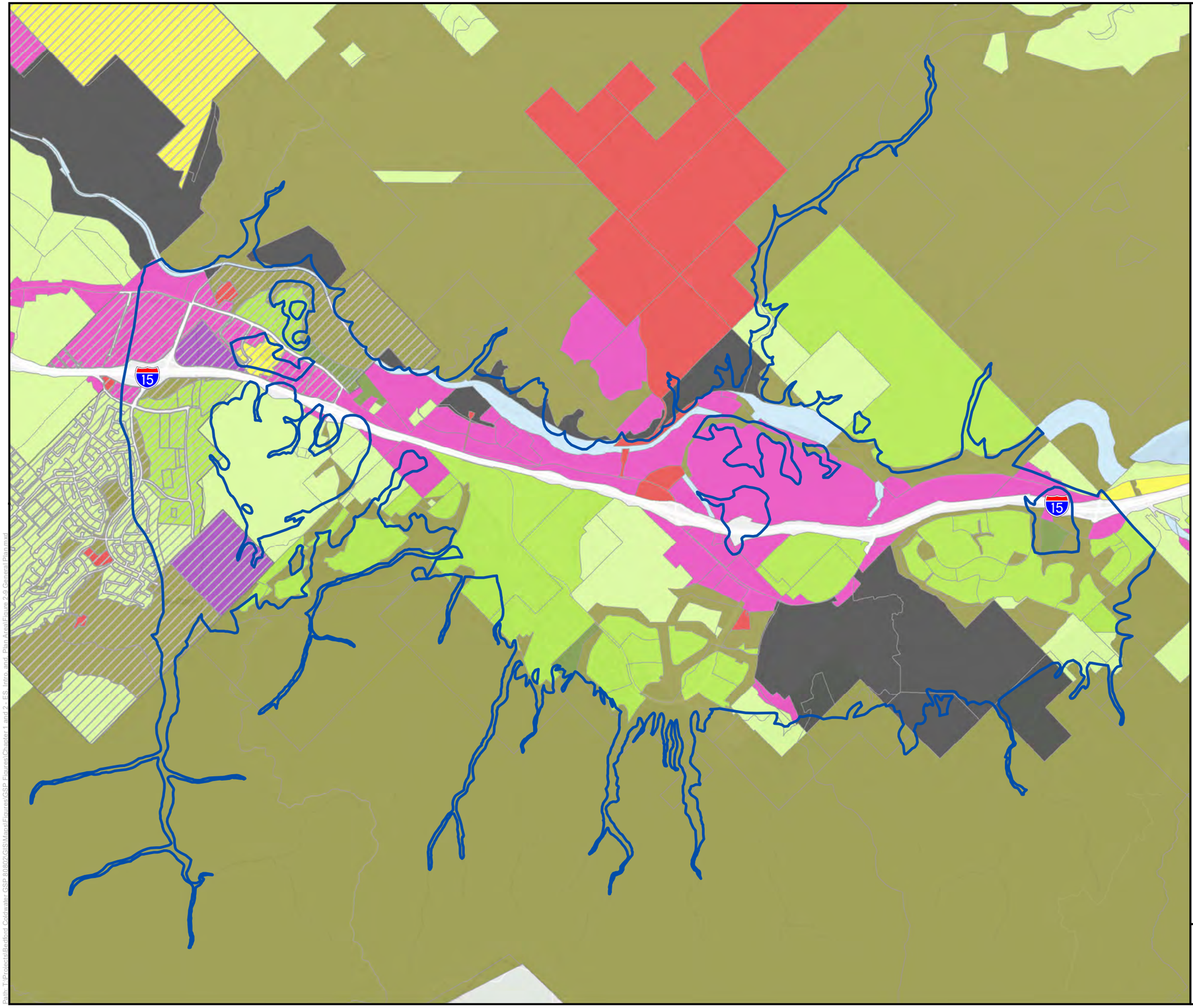
N

0 1,750 3,500

Scale in Feet

TODD GROUNDWATER

Figure 2-8
2014 Land Use
Bedford-Coldwater Basin



Riverside County General Plan Designations

- Very Low to Low Density Residential
- Medium to Medium High Density Residential
- High to Very High Density Residential
- Commercial/Industrial
- Mixed Use
- Public Facilities
- Open Space/Park/Conservation
- Agricultural
- Mineral Resources
- Water

Corona General Plan Designations

- Low to Medium Density Residential
- Medium Density Residential
- High Density Residential
- Commerical/Industrial
- Mixed Use
- Public Facilities
- Open Space/Park/Conservation
- Agricultural

- Bedford-Coldwater Subbasin

N

0 1,750 3,500

Scale in Feet

TODD GROUNDWATER

Figure 2-9
General Plan
Land Use Designations
Bedford-Coldwater Basin

3. HYDROGEOLOGIC CONCEPTUAL MODEL

This chapter describes the hydrogeologic conceptual model of the Bedford-Coldwater Subbasin (Basin), including the basin boundaries, geologic formations and structures, and principal aquifer units. The chapter also addresses the interaction between groundwater and surface water and discusses groundwater recharge and discharge areas. The Hydrogeologic Conceptual Model presented in this chapter is a summary of relevant and important aspects of the Basin hydrogeology that influence groundwater sustainability. While the Chapter 1 Introduction and Chapter 2 Plan Area establish the institutional framework for sustainable management, this chapter, along with Chapter 4 Groundwater Conditions and Chapter 5 Water Budget, sets the physical framework.

The hydrogeologic conceptual model and basin conditions sections serve to document the technical aspects of the Basin's hydrogeology. Later sections including the water budget and sustainability criteria will refer to and rely on the technical material contained here.

3.1. PHYSICAL SETTING AND TOPOGRAPHY

The Basin underlies a portion of the Elsinore Valley in western Riverside County and covers approximately 11 square miles. The Basin is adjacent to two other groundwater basins: the Temescal Subbasin of the Upper Santa Ana Basin to the north and the Elsinore Valley Subbasin of the Elsinore Basin to the south. **Figure 3-1** illustrates the topography of the Basin and surrounding uplands.

Ground surface elevations along the valley floor are generally flat. Elevations range from approximately 1,000 feet above mean sea level (msl) at the northern boundary to approximately 1,200 feet above msl to the south, as shown by 200-foot contours on **Figure 3-1**. The tributary watersheds reach up to more than 5,600 feet msl at the highest peak in the Santa Ana Mountain watersheds west of the Basin. Watersheds east of the Basin are significantly lower in elevation and rise only to about 1,800 feet.

Annual precipitation varies from below 12 inches to more than 26 inches over the Study Area. The long-term average annual rainfall is between 12 and 14 inches per year on the Basin floor and increases to more than 20 inches along the top of the local watersheds in the Santa Ana Mountains to the west.

3.2. SURFACE WATER FEATURES

Figure 3-2 shows surface water features including rivers, streams, springs, seeps, lakes, and ponds. The sub-watershed boundaries that drain into and through the Basin are shown on **Figure 3-3**.

The Basin covers a portion of the Santa Ana River watershed. Main tributaries to the Santa Ana River include Temescal Wash which flows through the Basin from the southeast to northwest and the Bedford Wash flowing toward the northeast along the northern boundary

of the Basin. These waterways are ephemeral and are dry much of the year, flowing mainly during the winter.

3.3. SOILS

Characteristics of soils are important factors in natural and managed groundwater infiltration (recharge) and are therefore an important component of a hydrogeologic system. Soil hydrologic group data from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (NRCS 2019) are shown on **Figure 3-4**. The soil hydrologic group is an assessment of soil infiltration rates determined by the water transmitting properties of the soil, which include hydraulic conductivity and percentage of clays in the soil, relative to sands and gravels. The groups are defined as:

- Group A – High Infiltration Rate: water is transmitted freely through the soil; soils typically less than 10 percent clay and more than 90 percent sand or gravel.
- Group B – Moderate Infiltration Rate: water transmission through the soil is unimpeded; soils typically have between 10 and 20 percent clay and 50 to 90 percent sand.
- Group C – Slow Infiltration Rate: water transmission through the soil is somewhat restricted; soils typically have between 20 and 40 percent clay and less than 50 percent sand.
- Group D – Very Slow Infiltration Rate: water movement through the soil is restricted or very restricted; soils typically have greater than 40 percent clay, less than 50 percent sand.

The hydrologic group of the soil generally correlates with the potential for infiltration of water to the subsurface. However, there is not necessarily a correlation between the soils at the ground surface and the underlying geology or hydrogeology.

3.4. GEOLOGIC SETTING

The Basin is located within one of the structural blocks of the Peninsular Ranges of Southern California. The Basin occurs in a linear low-lying block, referred to as the Elsinore-Temecula trough, between the Santa Ana Mountains on the west and the Perris Plain on the east (Norris and Webb 1990). The trough extends from Corona to the southeast some 30 miles and was formed along an extensive northwest-southeast trending fault zone including the Elsinore, Chino, and related faults. The Elsinore fault zone, including the Glen Ivy Fault, bound the Basin on the west and trend along the mountain front.

As shown on **Figure 3-5**, the oldest rocks in the Study Area crop out in the Santa Ana Mountains. These uplands are composed principally of volcanic (including the Santiago Peak Volcanics) and metamorphic rocks (including the Bedford Canyon Formation) of Jurassic and Cretaceous age. A thin rim of younger sedimentary units of Tertiary age crops out along the mountain front generally lying east of the Glen Ivy Fault within the Elsinore Fault Zone.

This zone of sedimentary units broadens to the north and contains numerous mapped formations of Cretaceous and Tertiary age. The northeastern side of the valley is flanked primarily by granitic rocks of Cretaceous age. Erosion of these units has filled in the trough over time resulting in quaternary-age alluvial fan, channel, and other deposits making up the permeable portions of the groundwater Basin (Todd and AKM 2008).

The Elsinore Fault Zone forms a complex series of pull-apart basins (Morton and Weber 2003). The deep portion of the Basin in the Coldwater area is one of these pull-apart basins. Pull-apart basins are topographic depressions that form at releasing bends or steps in basement strike-slip fault systems. This initial deposition into the Basin is composed of rapid deposition of landslide and debris flow deposits which are extremely poorly sorted with a mixture of clay, sand, gravel, and boulders as seen in deep well logs. Since the movement on the faults is right-lateral, the oldest sediments are located at the lower levels in the northern part of the Basin. As the pull-apart basin formed, progressively younger sediments have been deposited from north to south. Because of this type of deposition, the lower units of the pull-apart basin can be heterogeneous.

3.5. FAULTS

The Glen Ivy fault zone separates the Bedford area from the Coldwater area, having significant impact on the depth of the basin and thickness of alluvial units. The Coldwater area of the Basin is located within a pull-apart basin between the Glen Ivy fault and the Elsinore Fault Zone located at the base of the Santa Ana Mountains. Within the basin, the Glen Ivy faults truncate and offset the alluvial units by up to 250 feet. This offset is inferred from well logs that extend to bedrock near the fault (Todd and AKM 2008 and WEI 2015b).

The Glen Ivy fault limits deep groundwater flow, resulting in a limitation of the hydraulic connection between the Coldwater and Bedford areas. At depth, the offset geologic units place the alluvial deposits in the Coldwater area against the Tertiary Bedford Canyon Formation. When groundwater levels in the Coldwater area are low, there is reduced groundwater flow across the fault. This is especially apparent during the recent periods when the groundwater levels in the Coldwater area were especially low. During these low water periods in the Coldwater area, groundwater levels are higher across the fault in the Bedford area resulting in minor inflows from Bedford into the Coldwater area. This is shown in some recent groundwater level data and supported by the groundwater modeling (**Appendix G**). However, at shallower depths, the fault offset is across alluvial deposits. During periods, or areas, when groundwater levels in the Coldwater area are high, groundwater elevation data suggests these areas appear to be well-connected when groundwater elevations in the Basin are high (Todd and AKM 2008), indicating more compartmentalization with depth. However, there is insufficient groundwater elevation monitoring information to assess the extent of this potential barrier to flow and it is therefore not considered a complete barrier to groundwater flow in the Basin.

3.6. PRINCIPAL AQUIFER

The following is a summary of the principal aquifer in the Basin, including the source and character of the sediments, lateral boundaries, and faults that potentially affect groundwater flow through the principal aquifer.

3.6.1. Description of Principal Aquifer

The principal aquifer of the Bedford-Coldwater Basin is composed of alluvium, including alluvial fan, alluvial valley, axial channel, and wash deposits. These deposits are sourced from the Santa Ana Mountains to the west of the Basin and the Peninsular Ranges to the east of the Basin. The Bedford Canyon Formation (a slightly metamorphosed sedimentary formation composed of interlayered argillite, slate, graywacke, conglomeratic graywacke, impure quartzite, and small masses of limestone and quartz-rich metasandstone) and adjacent granitic rocks are the primary source materials for these alluvial deposits. The alluvial fan deposits in the Coldwater area extend into the Bedford area and appear to have been disrupted by faulting (**Figure 3-5**). Channel deposits along Temescal Wash and local tributaries define the eastern boundary of the Basin. In the northern Bedford area, a variety of Tertiary sedimentary units crop out including the Silverado (Paleocene), Vaqueros (Miocene), Topanga (Miocene), and Puente (Miocene) formations (**Figure 3-5**). The alluvial aquifer materials in this portion of the Basin are sourced from these Tertiary sedimentary units. As such, the character of the deposits and the groundwater chemistry differ from the alluvial fans in the Coldwater area and those to the north in the Temescal Subbasin and south in the Elsinore Groundwater Basin.

Both older and recent alluvial fans have been deposited along the mountain front on the western edge of the Basin. These fans have prograded across both the Coldwater and Bedford areas from west to east. Although these deposits are relatively thick, the entire unit is heterogeneous. Sand lenses within the fan deposits collectively form the Alluvial Fan Aquifers. These aquifers from less than 40 feet up to 500 feet in the Bedford area (eastern portion of the Basin) and up to 800 feet in thickness in the deepest portions of the Coldwater area (western portion of the Basin) (Todd and AKM 2008).

3.6.2. Description of Lateral Boundaries

The bedrock units of the uplands provide distinct lateral boundaries for the basin and its alluvial units. Basin alluvium is thin in some areas, which in itself impedes groundwater flow. This is especially relevant at the northern and southern boundaries of the Basin.

3.7. DEFINABLE BASIN BOTTOM

The Basin bottom is defined by bedrock, which is shallow around the perimeter and deep in the center. Depth to bedrock ranges in depth from 10 feet to over 700 feet (Todd and AKM 2008 and WEI 2015b). The depth to the bottom of the alluvial materials in the Basin and the contact with the bedrock bottom of the Basin are shown in the contours presented in **Figure**

3-6. Aquifer thickness is greatest in the Coldwater portion of the Basin west of the Glen Ivy fault, as shown in **Figures 3-6** and **3-8**.

3.8. CROSS SECTIONS

Figure 3-7 is a map showing locations of two cross sections, **Figures 3-8** and **3-9**. The two hydrogeologic cross sections were constructed to identify hydrogeologic structures affecting groundwater, to characterize the thickness and distribution of aquifer sediments within the Basin, and to confirm aquifer descriptions presented above.

The cross sections and depth to bedrock map were prepared using available information from existing datasets and sources including the following:

- Surficial geology in geographic information system (GIS) coverage format (USGS 2004 and 2006).
- Fault locations and orientations (USGS 2004 and 2006).
- Lithologic and well construction logs from local agencies.
- Drillers Log files from California Department of Water Resources (DWR).
- National Elevation Dataset (NED) ground surface digital elevation model data for Riverside County (USGS 2019).

The two cross sections (**Figures 3-8** and **3-9)** show the bedrock profile, location of faults, nature and maximum thickness of the alluvial fan aquifers and the relationship with the Temescal Wash deposits. Locations and general construction of wells also are shown. As indicated, alluvial sediments are more than 800 feet thick in the Coldwater area and up to 500 feet thick in the Bedford area, with the thickest section occurring near the Glen Ivy Fault. The cross sections are consistent with and support the conceptual model described above and the depth to bedrock (**Figure 3-6**).

3.9. STRUCTURES AFFECTING GROUNDWATER

The Basin is defined by the lateral extents of the alluvial material in the pull-apart basin described above. This material is bounded by bedrock in the Santa Ana Mountains on the west and the Peninsular Ranges to the east. The southern and northern boundaries of the Basin are formed by areas of thin alluvial material over shallow bedrock in narrow valleys (Todd and AKM 2008 and WEI 2015b). Within the Basin the groundwater is affected by faulting in the Elsinore Fault Zone, primarily the Glen Ivy fault as described in Section 3.5 above.

3.10. RECHARGE AND DISCHARGE AREAS

Areas of major recharge and discharge are shown in **Figure 3-10**. Recharge to the Basin occurs primarily from infiltration of runoff, and to a lesser extent from deep percolation of precipitation and urban return flows, wastewater recharge, and subsurface inflow from outside the Basin.

Most of the Basin recharge comes from the infiltration of runoff from precipitation in the Santa Ana Mountains west of the Basin and the Peninsular Ranges east of the Basin. Large amounts of runoff from the mountains flow into unlined channels and the shallow subsurface at the edges of the Basin and then on into and through the Basin. The amount of water available for recharge varies annually with changes in rainfall and runoff. Runoff into the Basin is subject to evapotranspiration, infiltration, and continued surface flow to and in the Temescal Wash. The watersheds contributing to the Basin include multiple drainages, all of which flow across the Basin in generally east-west orientations. Wet years generate large amounts of water that exceed the recharge capacity of the Basin (Todd and AKM 2008).

Deep percolation of precipitation is the process by which precipitation enters groundwater. Recharge to groundwater from deep percolation occurs throughout the Basin (Todd and AKM 2008).

Return flows are those portions of applied water (e.g., landscape irrigation) that are not consumed by evapotranspiration and returned to the groundwater system through deep percolation or infiltration. Return flows associated with urban, industrial, and agricultural water uses all have the potential to contribute to recharge to the Basin (Todd and AKM 2008).

Recharge associated with wastewater occurs with discharges from the wastewater treatment facilities within and upstream from the Basin (TVWD water reclamation facility [WRF] and Corona WRF-3, and Horsethief Canyon WRF, respectively; see **Figure 4-14** for locations) and from on-site wastewater treatment systems (OWTS). Subsurface inflow occurs along the Basin boundaries both through bedrock inflow along the western and eastern Basin boundaries and from the Elsinore Subbasin to the south, but these are not considered to be a significant source of recharge to the Basin (Todd and AKM 2008).

Discharge from the Basin is almost entirely from groundwater pumping (see well locations on Figure 3-1), evapotranspiration, and mining operations (quarries on **Figure 3-10**). There is some limited discharge across the northern Basin boundary with the Temescal Subbasin of the Upper Santa Ana River Basin, but the thin alluvial material in this area limits the volume and timing of subsurface outflow along this boundary (Todd and AKM 2008 and **Appendix G**).

3.11. PRIMARY GROUNDWATER USES

The primary groundwater uses in the Basin are municipal pumping, with limited private pumping for small water system, commercial, and residential users. Groundwater use estimates are included in Section 5, Water Budget.

3.11.1. Bedford Area

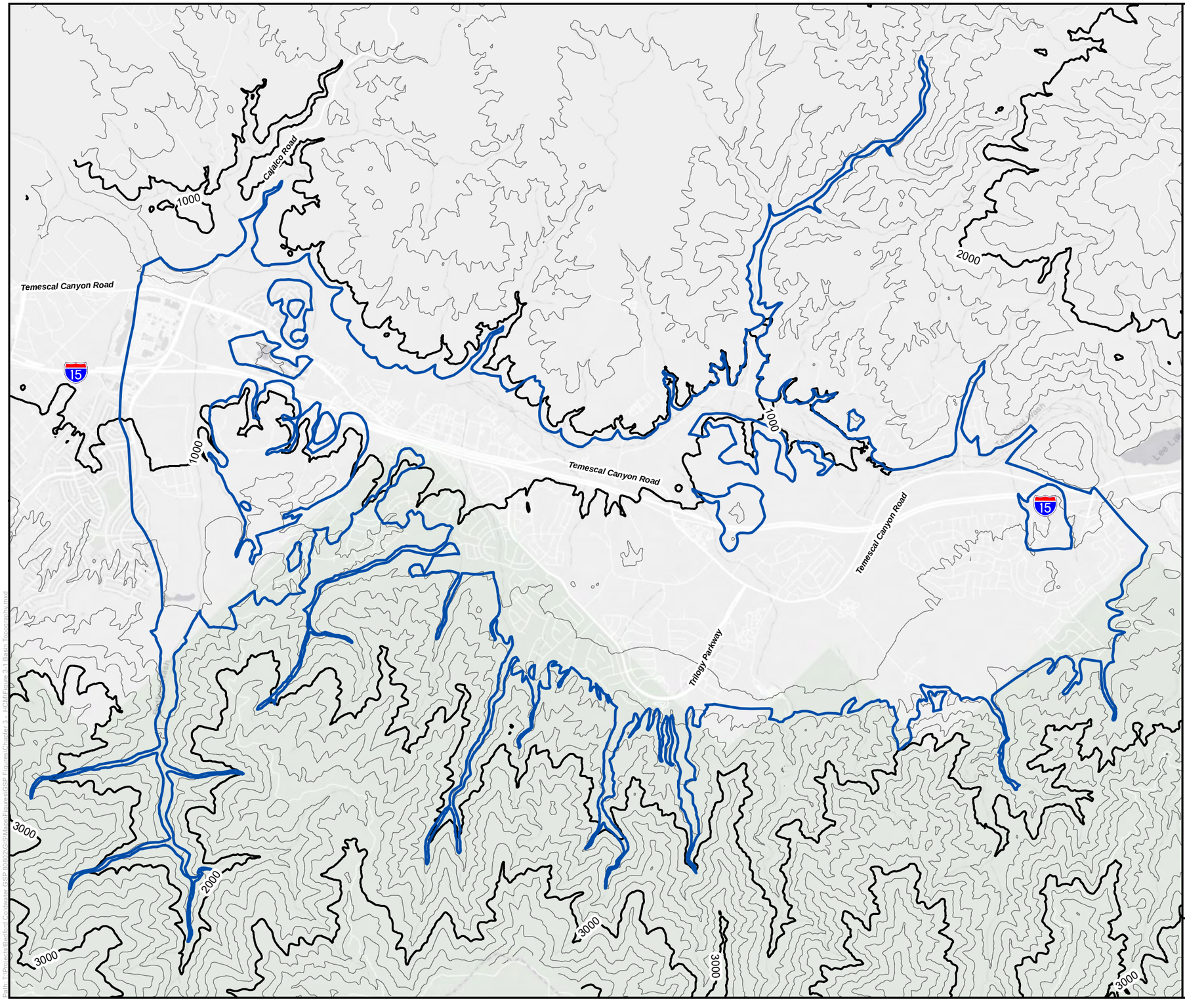
Groundwater in the principal aquifer in the Bedford area is primarily used for non-potable municipal and irrigation water supply. There are no known potable water supply wells in the Bedford area.

3.11.2. Coldwater Area

The principal aquifer in the Coldwater area is mostly used for municipal water supply. Most of the pumping in this area is from wells owned and operated by the BCGSA agencies, with some additional pumping by small community water system and small commercial users. Non-potable pumping has occurred historically in this area to support agricultural, recreational, small residential, and industrial water uses.

3.12. DATA GAPS IN THE HYDROGEOLOGIC CONCEPTUAL MODEL

The hydrogeologic conceptual model has not identified data gaps in available information that affect the assessment of sustainability in the Basin.



1,000 foot Ground Surface Elevation Contour

200 foot Ground Surface Elevation Contour

Bedford-Coldwater Basin

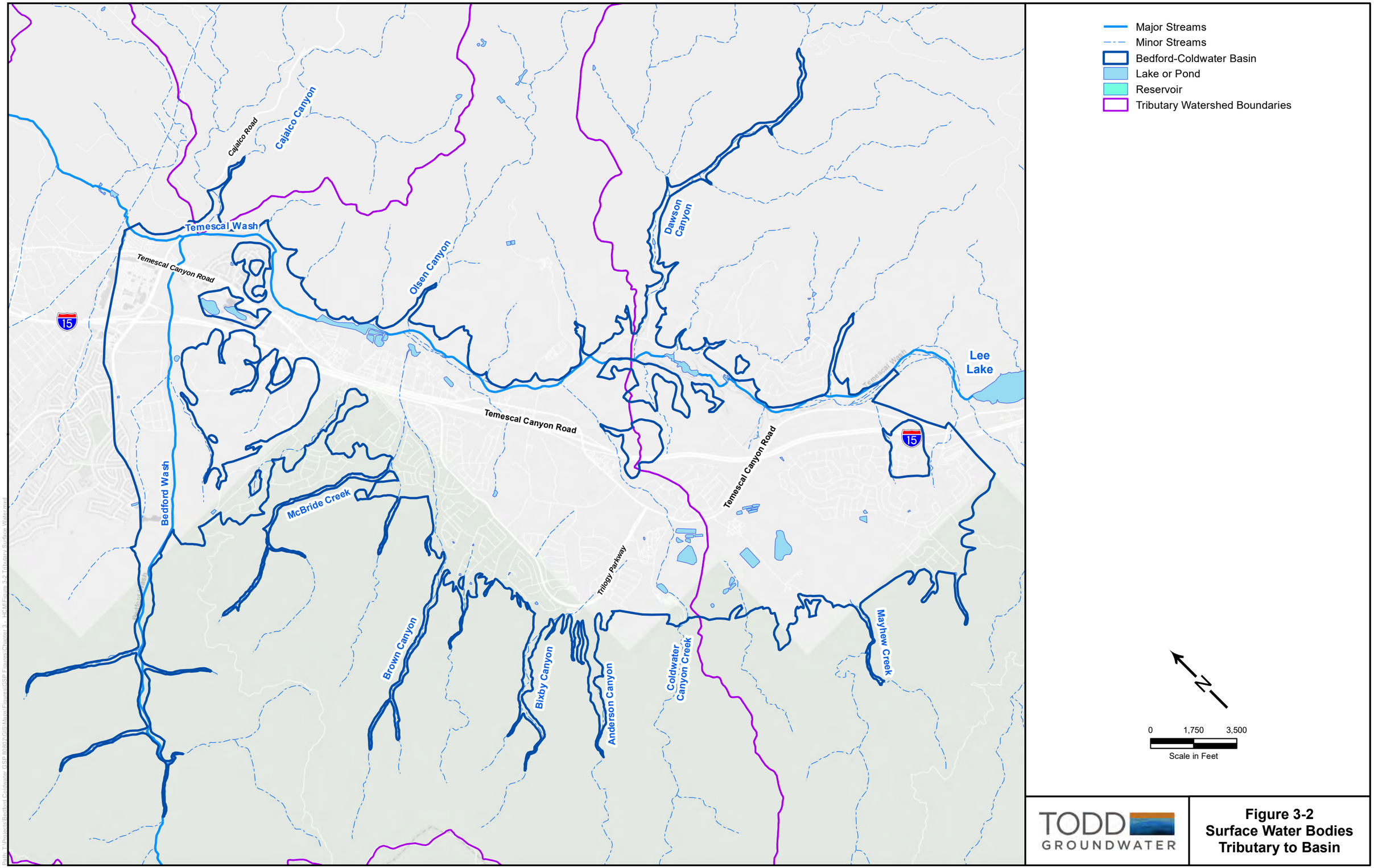
N

0 1,750 3,500

Scale in Feet

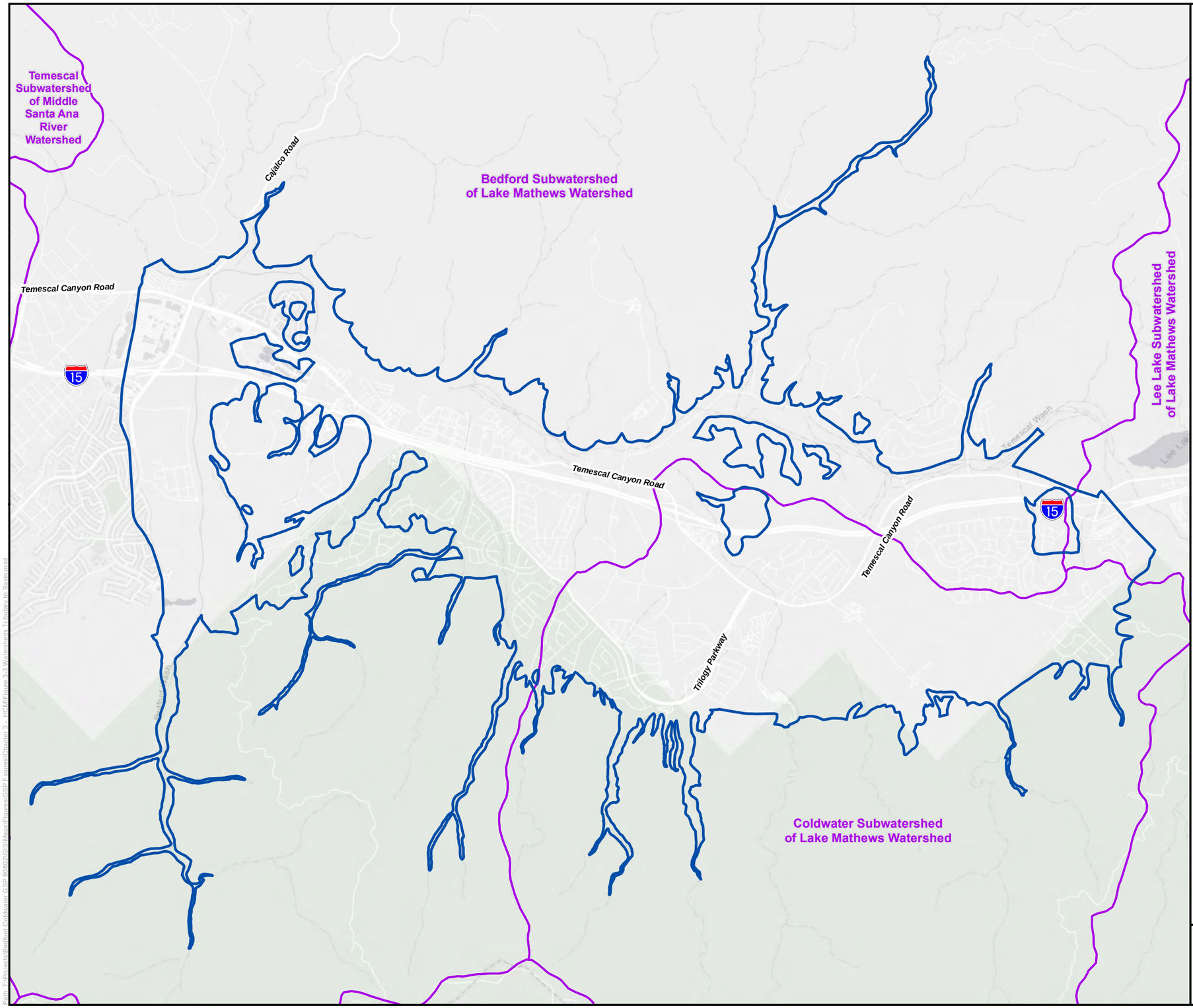
TODD GROUNDWATER

Figure 3-1
Basin Topography



TODD GROUNDWATER

Figure 3-2
Surface Water Bodies Tributary to Basin



Bedford-Coldwater Basin

Tributary Subwatershed Boundaries

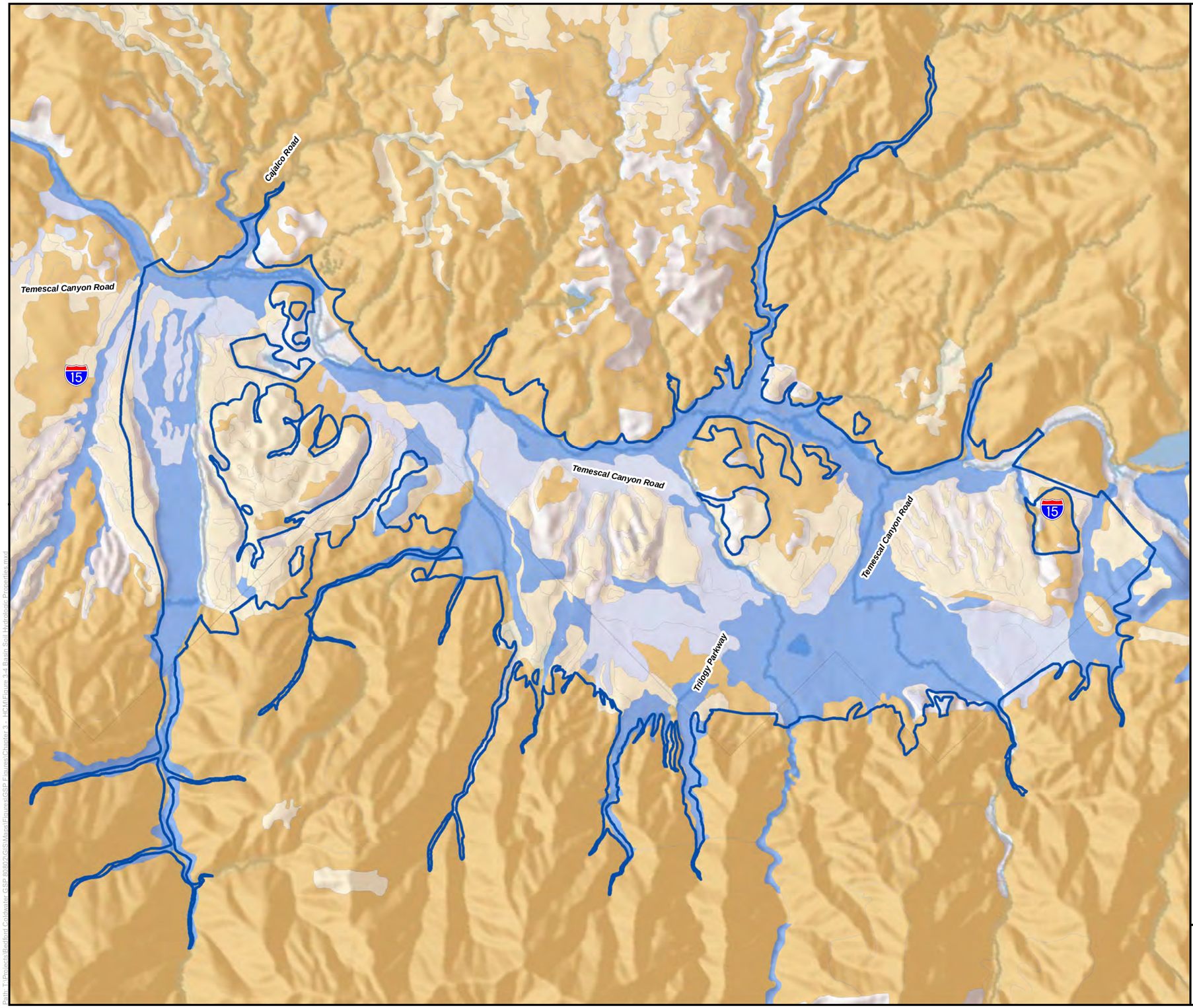
N

0 1,750 3,500

Scale in Feet

TODD GROUNDWATER

Figure 3-3
Subwatersheds Tributary to Basin



Soil Hydrologic Group

- A: High Infiltration Rate
- B: Moderate Infiltration Rate
- C: Slow Infiltration Rate
- D: Very Slow Infiltration Rate
- No Data
- Bedford-Coldwater Basin

N

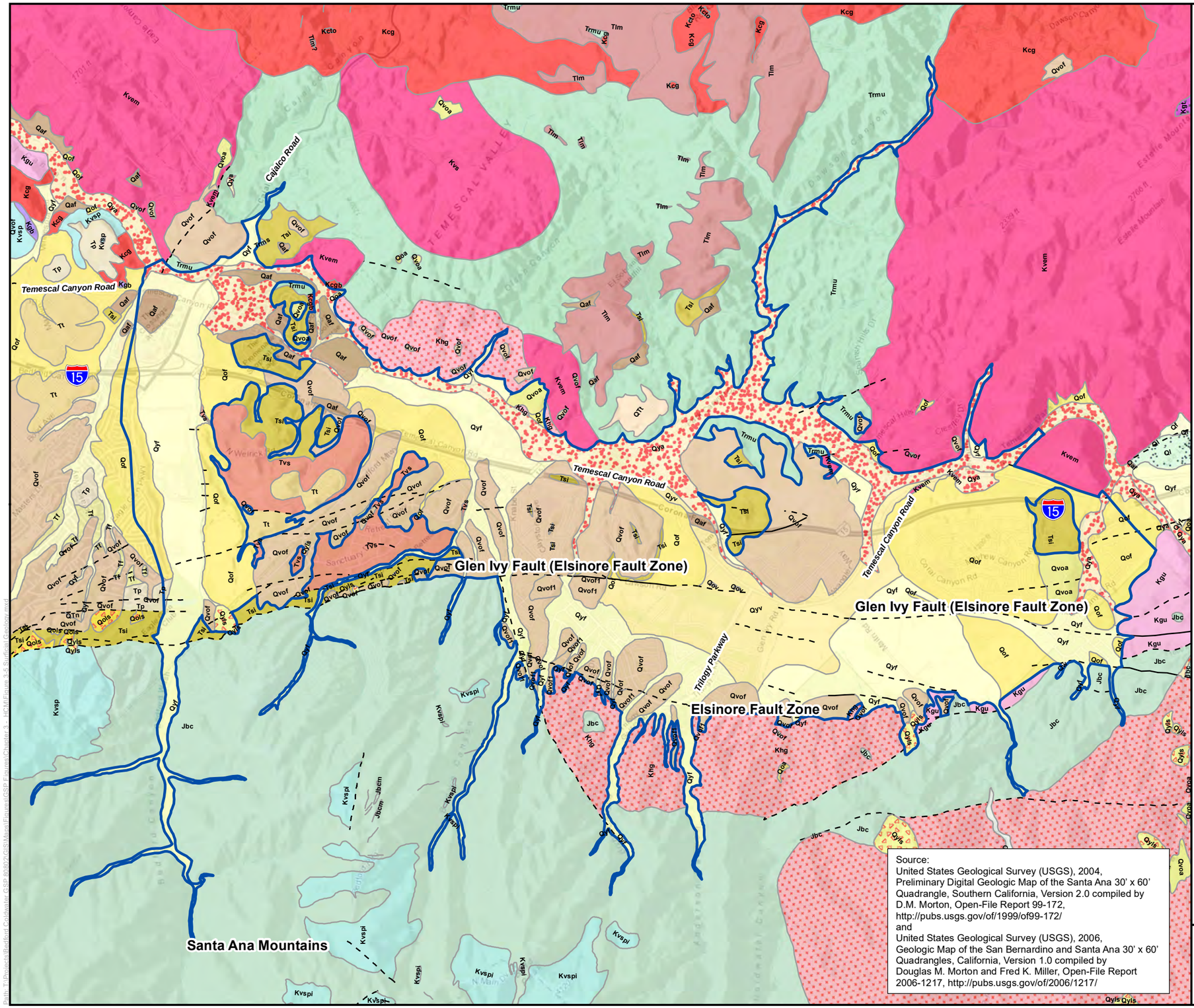
0 1,750 3,500

Scale in Feet

Source:
Natural Resources Conservation Service (NRCS), 2019, SSURGO soil survey online map database available at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx last accessed September 2019.

TODD GROUNDWATER

Figure 3-4
Basin Soil Hydrologic Properties



- Bedford-Coldwater Basin
- Fault Location, dashed where uncertain
- Qaf, Artificial fill
- Qw, Very young wash deposits
- Qf, Very young alluvial-fan deposits
- Ql, Very young lacustrine deposits
- Qyw, Young wash deposits
- Qyf/Qyf1, Young alluvial-fan deposits
- Qya, Young axial-channel deposits
- Qyv, Young alluvial-valley deposits
- Qyls, Young landslide deposits
- Qof, Old alluvial-fan deposits
- Qoa, Old axial-channel deposits
- Qov, Old alluvial-valley deposits
- Qols, Old landslide deposits
- Qvof, Very old alluvial-fan deposits
- Qvoa, Very old axial-channel deposits
- QTt, Conglomerate of Temescal area
- QTn, Sedimentary rocks of Norco area
- Tf, Fernando Formation
- Tp, Puente Formation
- Tlm, Lake Mathews Formation
- Tcgr, Rhyolite-clast conglomerate of Lake Mathews area
- Tt, Topanga Group
- Tvs/Tvss, Vaqueros and Sespe Formations, undifferentiated
- Tsi, Silverado Formation
- Kgg/Kgt/Kgtf/Kgti/Kgh/Kgh/Kght, Gavilan Ring Complex
- Katg, Granodiorite of Arroyo del Toro Pluton
- Kcto/Kcg/Kcgd/Kct/Kcgq/Kcgb, Cajalco Pluton
- Kgu, Granite, undifferentiated
- Kgb, Gabbro, undifferentiated
- Khg, Heterogeneous granitic rocks
- Kvsp/Kvspi, Santiago Peak Volcanics
- Kvem/Kvr/Ksv/Kvs, Estelle Mountain volcanics of Herzig
- Jbc/Jbcm, Bedford Canyon Formation
- Trms/Trmu, Rocks of Menifee Valley

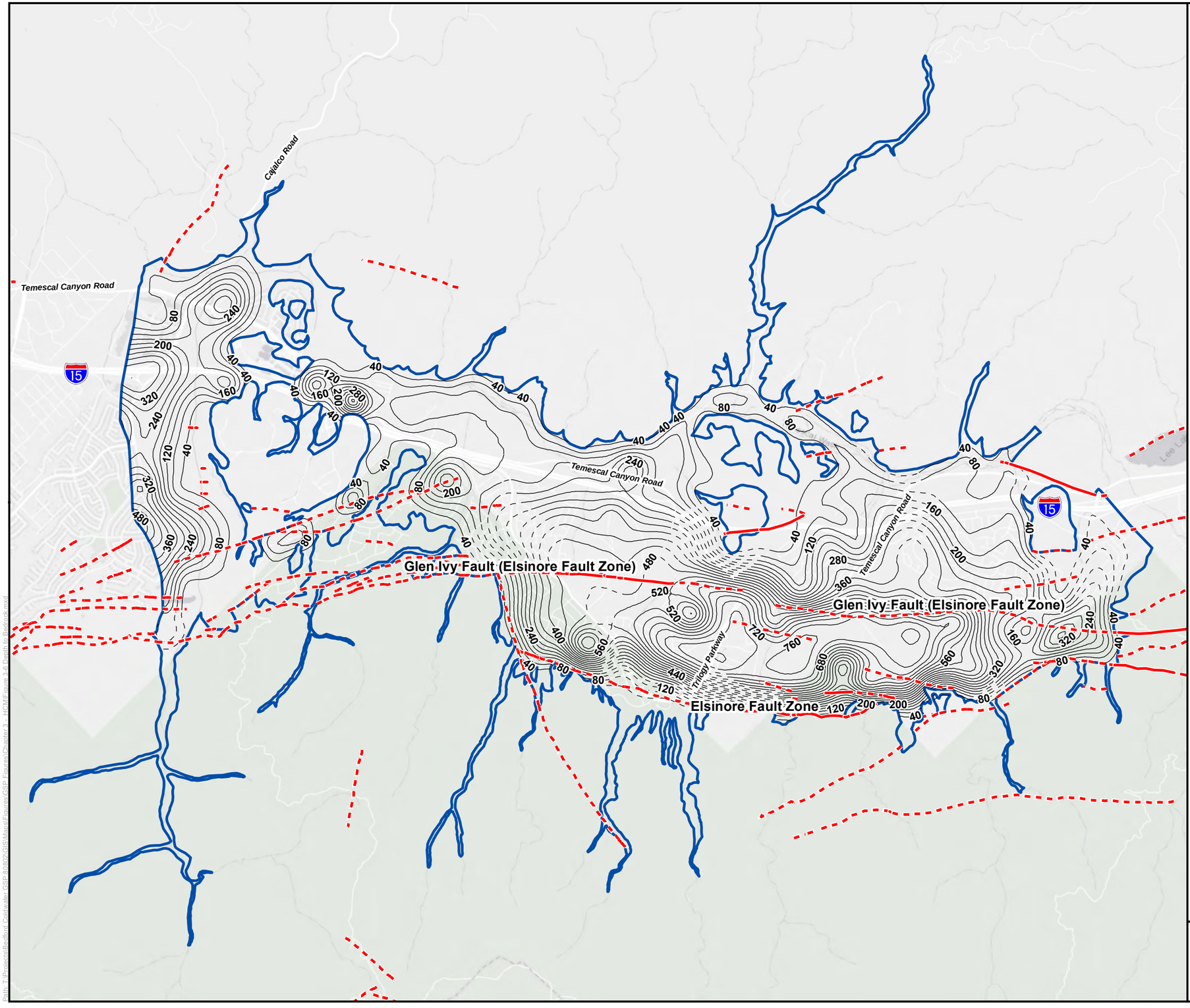
N

0 1,750 3,500

Scale in Feet

TODD GROUNDWATER

Figure 3-5
Surficial Geology



40-foot Depth to Bedrock Contour, dashed where uncertain due to insufficient data

Fault Location, dashed where uncertain

Bedford-Coldwater Basin

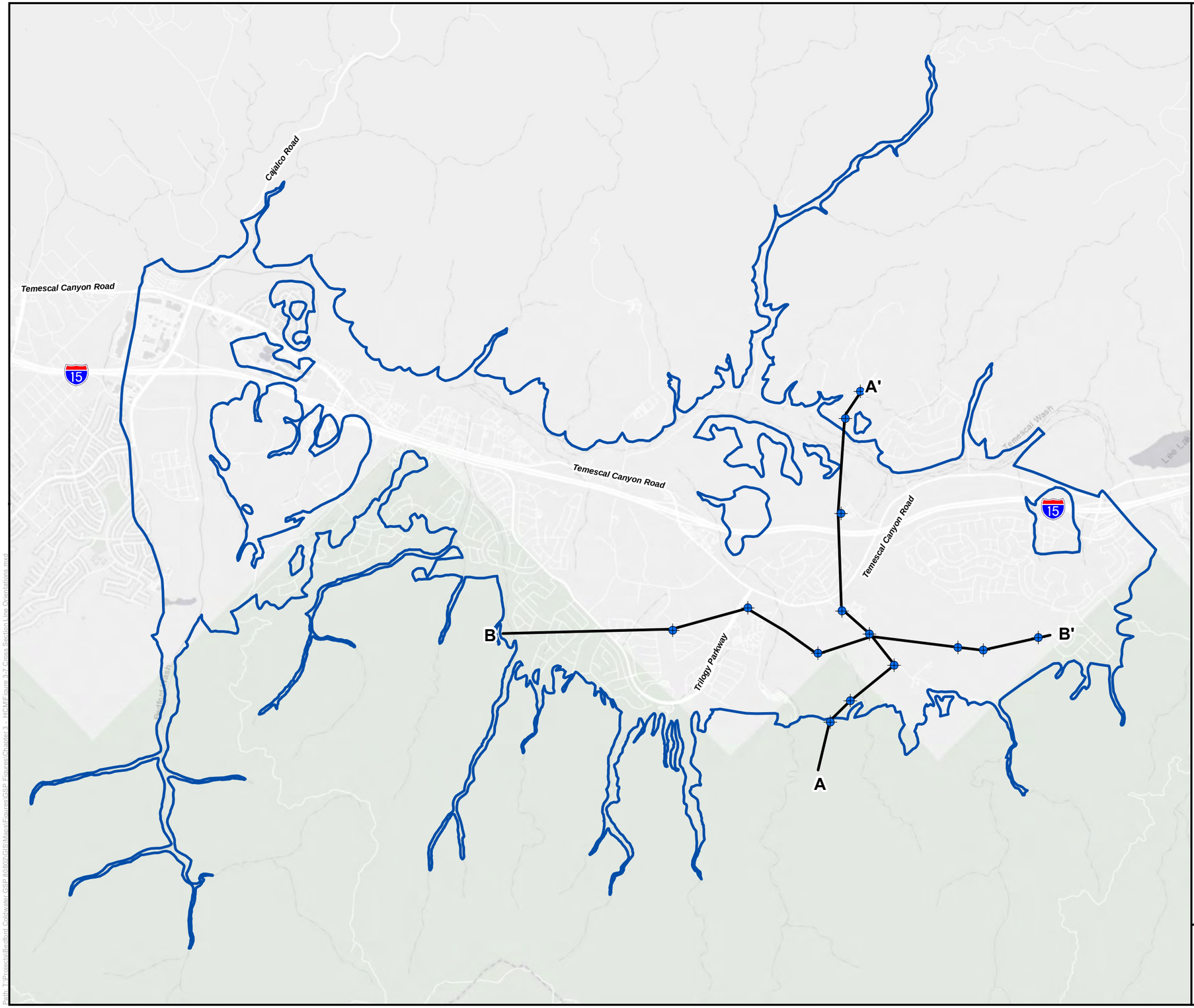
N

0 1,750 3,500

Scale in Feet

TODD GROUNDWATER

Figure 3-6
Depth to Bedrock



Wells on Cross Sections
Cross Section Line Orientation
Bedford-Coldwater Basin

N

0 1,750 3,500
Scale in Feet

TODD GROUNDWATER

Figure 3-7
Cross Section Line Orientation

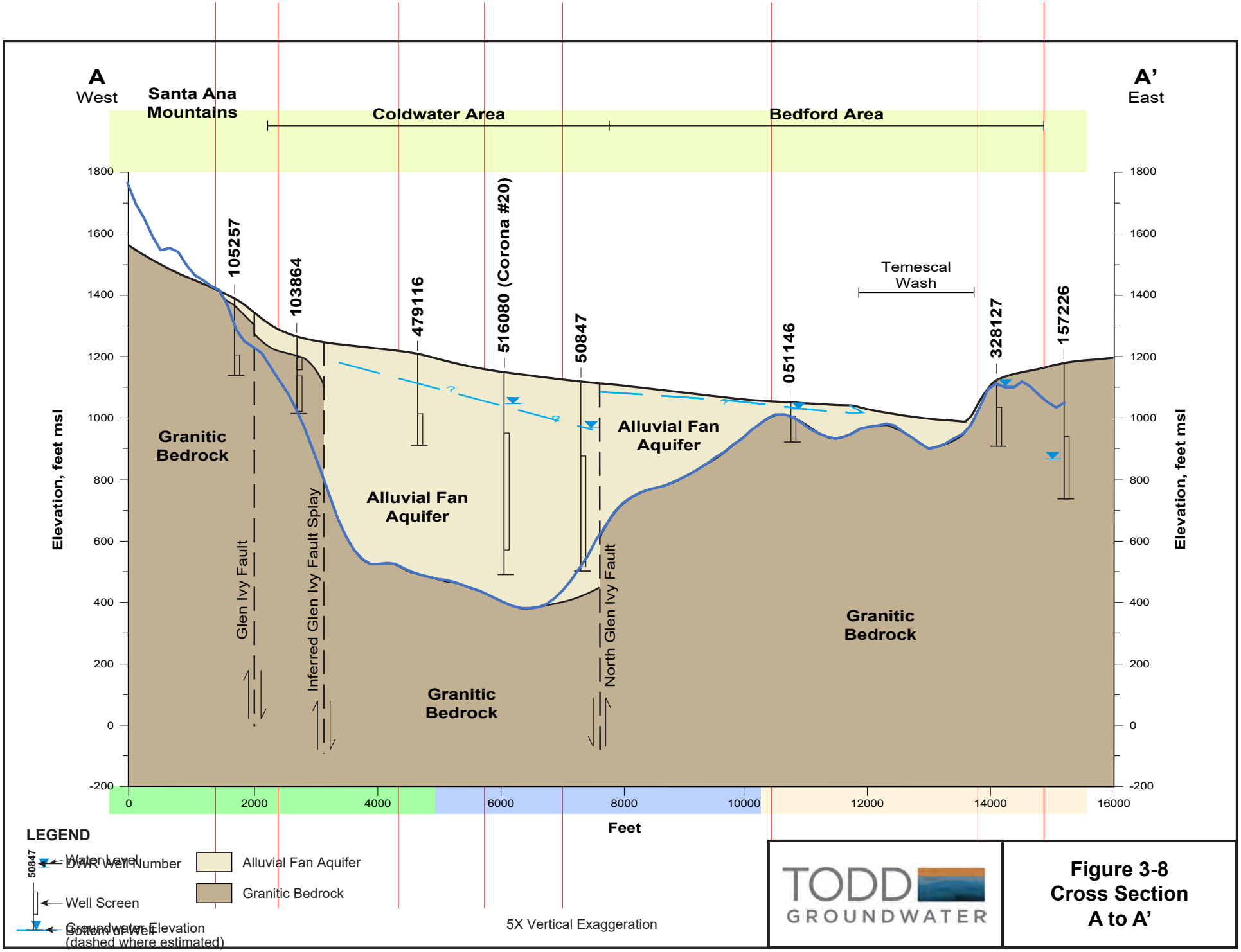
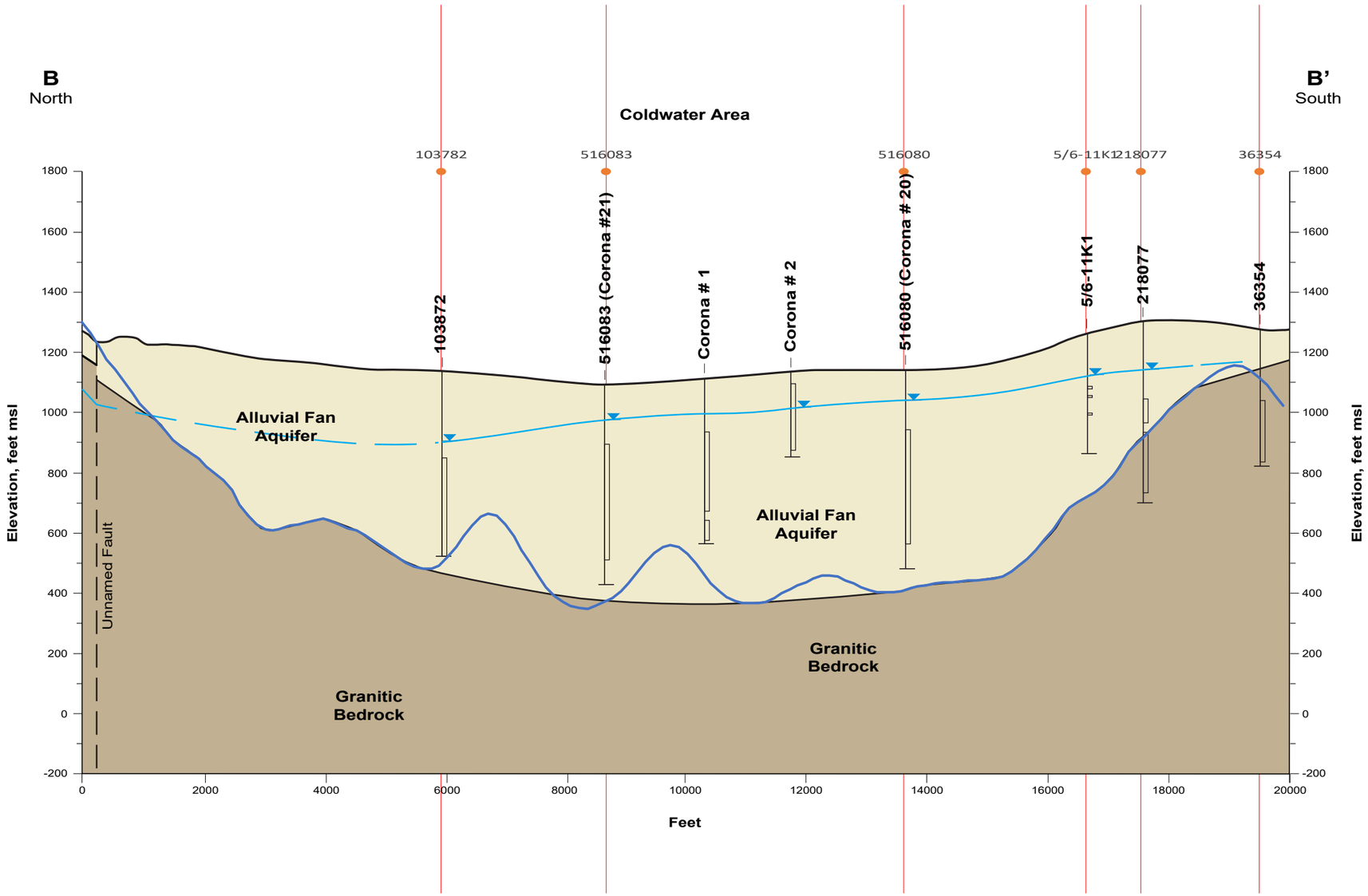


Figure 3-8
Cross Section
A to A'



LEGEND

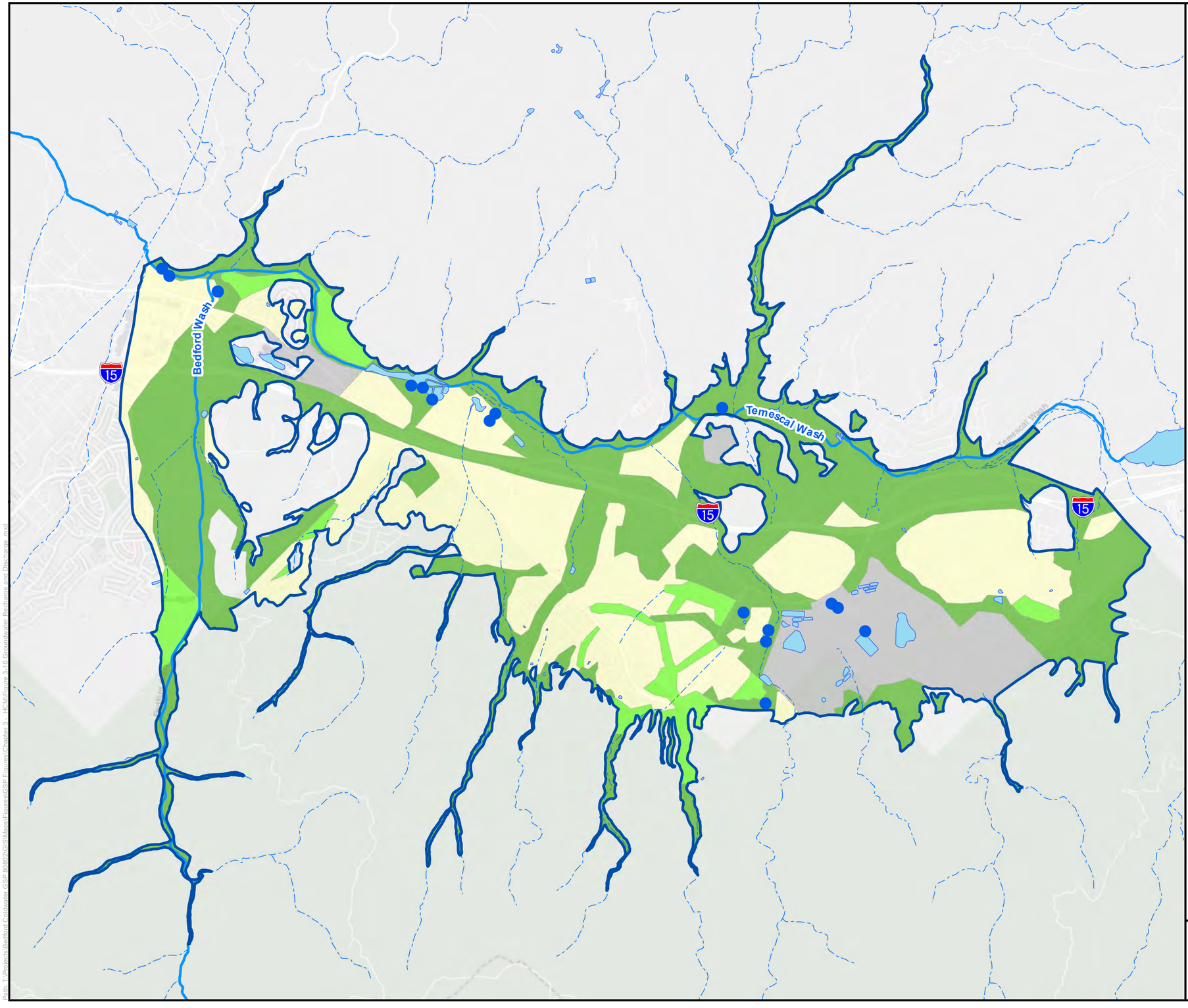
36354 ← Water Level
DWR Well Number
Well Screen
Groundwater Elevation (dashed where estimated)
Bottom of Well

Alluvial Fan Aquifer
Granitic Bedrock

5X Vertical Exaggeration

TODD GROUNDWATER

Figure 3-9
Cross Section
B to B'



Known Production Wells
Bedford-Coldwater Basin
Lake or Pond
Major Streams
Minor Streams
Urban Recharge
Irrigated Area Recharge
Unirrigated Area Recharge
Quarries

N

0 1,750 3,500
Scale in Feet

TODD GROUNDWATER

Figure 3-10
Groundwater Recharge and Discharge

4. CURRENT AND HISTORICAL GROUNDWATER CONDITIONS

The Sustainable Groundwater Management Act (SGMA) requires definition of various study periods for current, historical, and projected future conditions. Current conditions, by SGMA definition, include those occurring after January 1, 2015 and accordingly, historical conditions occurred before that date. A historical period must include at least 10 years.

The study period 1990 through 2018 is based on the cumulative departure from mean precipitation at Santiago Peak, Lake Elsinore, and Riverside climate monitoring stations. This period is representative and includes droughts and wet years, with an average annual rainfall of 12.97 inches, comparable to the long-term average of 12.9 inches (1875 to 2017). Accordingly, groundwater conditions over time are described through 2018.

Groundwater conditions are described in terms of the six sustainability indicators identified in SGMA; these include:

- Groundwater elevations.
- Groundwater storage.
- Potential subsidence.
- Groundwater quality.
- Seawater intrusion (which is not likely to occur in this inland basin).
- Interconnected surface water and groundwater dependent ecosystems.

4.1. GROUNDWATER ELEVATIONS

4.1.1. Available Data

Groundwater elevation records were collected from multiple sources, including previous investigations, City of Corona, United States Geological Survey (USGS) National Water Information System (NWIS), California Department of Water Resources (DWR), and California Statewide Groundwater Elevations Monitoring (CASGEM). Data from these sources were collected, reviewed, and compiled into a single unified groundwater elevation dataset. The wells with water level measurement records are shown on **Figure 4-1**.

4.1.2. Groundwater Occurrence

As summarized in Chapter 3, groundwater is present in one principal aquifer. Groundwater in the Bedford-Coldwater Subbasin (Basin) occurs under unconfined conditions and there are no data to suggest distinct vertical zones or to provide zone-specific groundwater elevation hydrographs or maps.

4.1.3. Groundwater Elevations and Trends

Hydrographs showing groundwater elevation trends over time were prepared for all 28 wells with elevation data in the Basin; these hydrographs then were reviewed to identify wells with

long term data that could be used to present representative hydrographs. The selection of representative wells was based on a quantitative approach that considered hydrographs with long records characteristic of an area and distribution of wells across the Basin. All available groundwater elevation data were plotted as hydrographs and well locations were plotted on a basin-scale map. All wells with water level data are shown in **Figure 4-1**. Long term changes in groundwater elevations in the Basin are illustrated in representative hydrographs shown in **Figures 4-2 through 4-6** and show conditions since January 1990, where available, thus showing the study period for the Groundwater Sustainability Plan (GSP).

Representative wells with long term hydrographs were selected based the following criteria:

- Location – Wells were prioritized considering broad distribution across the Basin and availability of other wells nearby.
- Ongoing and/or recent monitoring – Wells were selected that are part of the active monitoring network or have recent data.
- Trends – Each hydrograph was assessed for continuity of monitoring, representation of local or regional trends, and presence of outliers or unrealistic data.

The northern hydrograph wells in **Figure 4-2** through **4-5** all reflect stable groundwater level conditions. These four wells show a slight decrease during the 2013 through 2015 drought but the net change is only 20 to 30 feet. The southernmost well, Corona 3 on **Figure 4-6** shows conditions in the Coldwater area where there is more variation than other areas of the Basin. As shown on the hydrograph, water levels have declined over the last 24 years with significant fluctuations in response to wet and dry cycles. Water levels in the Coldwater area have varied more than 350 feet over the last 30 years with multiple major and minor cycles of groundwater elevation decline and recovery, as illustrated on the hydrograph. Some of the short-term fluctuations may have been influenced by incomplete recovery of pumping water levels in the well. The wide water level fluctuations over time in the Coldwater area likely reflect the relatively small footprint and fault-controlled flow along with the fact that most of the pumping in the Basin occurs in this area. Although long-term declines in groundwater elevations have occurred in Coldwater in the past, recent groundwater elevations have stabilized due in part to shared management of the Basin between the three Bedford-Coldwater Groundwater Sustainability Agency (BCGSA) agencies.

Recent water levels in the Coldwater area are just below 800 feet msl (as shown on **Figure 4-6**) and reflect a recovery of approximately 60 feet from the historical low reached in late 2010. This recovery is due, in part, to a production agreement between the City of Corona (Corona) and Elsinore Valley Municipal Water District (EVMWD) for the Coldwater portion of the Basin, where most of the pumping occurs.

4.1.4. Groundwater Flow

Figures 4-7 and 4-8 are groundwater elevation contour maps constructed to examine current groundwater flow conditions and using data from fall 2015 and spring 2018, respectively. Contours were developed based on available groundwater elevation data for all wells and information from the numerical groundwater model (**Appendix G**). The fall 2015 groundwater

elevation contours (**Figure 4-7**) show flow generally from south to north in the Basin and from the northwest to the northeast in the north of the Basin. A slight water table depression occurs in the Coldwater area around the active production wells. Water levels in the Bedford area near the Glen Ivy fault were higher than those across the fault in the Coldwater area, indicating flow from Bedford to Coldwater. The groundwater elevations in this period represent relatively dry conditions at the end of the most recent drought period. Spring 2018 groundwater elevation contours (**Figure 4-8**) also show flow generally south to north with easterly flow in the north of the Basin and a small depression in the Coldwater area. Spring 2018 followed a period of relatively wet conditions. However, water levels in the Basin were very similar to those during the fall 2015 dry conditions. This includes the depression in the Coldwater area and the indication of flow from Bedford to Coldwater across the Glen Ivy Fault. Both fall 2015 and spring 2018 contours show that groundwater elevations are relatively consistent.

4.1.5. Vertical Groundwater Gradients

The current monitoring network for groundwater elevations provides little information about vertical head (groundwater elevation) gradients within the Basin. Available data are almost entirely from water supply wells, which are typically screened between 200 and 500 feet below ground surface (bgs). The potentiometric head at the depth of the well screens can be different from the true water table, which is the first zone of saturation reached when drilling down from the ground surface.

4.2. CHANGES IN GROUNDWATER STORAGE

Change in storage estimates based on evaluation of groundwater elevation changes and water budget inflow and outflow have completed for the portions of the Basin in past studies (MWH 2004, SAIC 2007, WEI 2015a, 2015b, 2016, 2017b, and 2019). Such storage change estimates are based on available groundwater elevation data that are limited geographically and temporally and thus include uncertainty. In addition, the storativity, or storage coefficient (the volume of water released from storage per unit decline in hydraulic head), is largely unknown across the Basin. The volume of groundwater storage change over time can be calculated by multiplying the groundwater elevation changes during a period by the storage coefficient. Storage coefficient value and storage change estimates for the Basin have been developed through calibration of the numerical model, as described in **Appendix G**. Therefore, the numerical model is the best tool for estimating groundwater storage changes. The resulting change in storage estimates are presented in the Water Budget chapter.

4.3. LAND SUBSIDENCE AND POTENTIAL FOR SUBSIDENCE

Land subsidence is the differential lowering of the ground surface, which can damage structures and facilities. This may be caused by regional tectonism or by declines in groundwater elevations due to pumping. The latter process is relevant to the GSP. While subsidence has not been a known issue in the Basin, groundwater elevation declines in the

subsurface, resulting in dewatering and compaction of predominantly fine-grained deposits (such as clay and silt) can cause the overlying ground surface to subside.

This process is illustrated by two conceptual diagrams shown on **Figure 4-9**. The upper diagram depicts an alluvial groundwater basin with a regional clay layer and numerous smaller discontinuous clay layers. Groundwater elevation declines associated with pumping cause a decrease in water pressure in the pore space (pore pressure) of the aquifer system. Because the water pressure in the pores helps support the weight of the overlying aquifer, the pore pressure decrease causes more weight of the overlying aquifer to be transferred to the grains within the structure of the sediment layer. If the weight borne by the sediment grains exceeds the structural strength of the sediment layer, then the aquifer system begins to deform. This deformation consists of re-arrangement and compaction of fine-grained units[2], as illustrated on the lower diagram of **Figure 4-9**. The tabular nature of the fine-grained sediments allows for preferred alignment and compaction. As the sediments compact, the ground surface can sink, as illustrated by the right-hand column on the lower diagram of **Figure 4-9**.

Land subsidence due to groundwater withdrawals can be temporary (elastic) or permanent (inelastic). Elastic deformation occurs when sediments compress as pore pressures decrease but expand by an equal amount as pore pressures increase. A decrease in groundwater elevations from groundwater pumping causes a small elastic compaction in both coarse-and fine-grained sediments; however, this compaction recovers as the effective stress returns to its initial value. Because elastic deformation is relatively minor and fully recoverable, it is not considered an impact.

Inelastic deformation occurs when the magnitude of the greatest pressure that has acted on the clay layer since its deposition (preconsolidation stress) is exceeded. This occurs when groundwater elevations in the aquifer reach a historically low groundwater elevation. During inelastic deformation, or compaction, the sediment grains rearrange into a tighter configuration as pore pressures are reduced. This causes the volume of the sediment layer to reduce, which causes the land surface to subside. Inelastic deformation is permanent because it does not recover as pore pressures increase. Clay particles are often planar in form and more subject to permanent realignment (and inelastic subsidence). In general, coarse-grained deposits (e.g., sand and gravels) have sufficient intergranular strength and do not undergo inelastic deformation within the range of pore pressure changes encountered from groundwater pumping. The volume of compaction is equal to the volume of groundwater that is expelled from the pore space, resulting in a loss of storage capacity. This loss of storage capacity is permanent but may not be substantial because clay layers do not typically store significant amounts of usable groundwater. Inelastic compaction, however, may decrease the vertical permeability of the clay resulting in minor changes in vertical flow.

[2] Although extraction of groundwater by pumping wells causes a more complex deformation of the aquifer system than discussed herein, the simplistic concept of vertical compaction is often used to illustrate the land subsidence process (LSCE et al. 2014).

The following potential impacts can be associated with land subsidence due to groundwater withdrawals (modified from LSCE et al. 2014):

- Damage to infrastructure including foundations, roads, bridges, or pipelines,
- Loss of conveyance in canals, streams, or channels,
- Diminished effectiveness of levees,
- Collapsed or damaged well casings, and
- Land fissures.

4.3.1. Interferometric Synthetic Aperture Radar (InSAR)

InSAR data are provided by DWR on its SGMA Data Viewer (DWR 2020) and document vertical displacement of the land surface across a broad area of California from June 13, 2015 to September 19, 2019. The accuracy of the InSAR ground surface elevation change estimates is reported to be ±16 millimeters (mm), or ±0.052 feet (ft) (Towill 2020). The TRE Altamira InSAR Dataset, shown on **Figure 4-10** shows mapping within the Basin for land surface deformation between 2015 and 2019.

The TRE Altamira InSAR data on **Figure 4-10** uses a range of 0.05 to -0.05 ft to display the estimated ground surface elevation change in the Basin. The maximum estimated ground surface elevation rise in the Basin between 2015 and 2019 is 0.02 ft and the maximum decline is -0.05 ft. These estimated changes are less than the reported accuracy for InSAR. Thus, based on the InSAR estimates there has effectively been no change in ground surface elevation within the Basin in the 2015 to 2019 period. Given these data and the understanding of the hydrogeological conceptual model, there is no evidence of subsidence at this time.

4.4. GROUNDWATER QUALITY

The natural quality (chemistry) of groundwater is generally controlled by the interaction between rainwater and rocks/soil of the vadose zone and aquifers (Drever 1988). As rainfall infiltrates through the soil column, changes in water chemistry occur as anions and cations are dissolved into the water. These changes are influenced by soil and rock types, weathering, organic matter, and geochemical processes occurring in the subsurface. Once in the groundwater system, changing geochemical environments continue to alter groundwater quality. A long contact time between the water and sediments may allow for more dissolution and more concentrated groundwater (Drever 1988). The natural groundwater quality in a basin is the net result of these complex subsurface processes that have occurred over time.

General mineral quality of groundwater is naturally poor, especially in the Bedford area, as indicated by relatively high concentrations of total dissolved solids and sulfate. This reflects in part the occurrence in the northern Bedford area of Tertiary sedimentary units, in contrast to the alluvial fans of the Coldwater area. The Corona Groundwater Management Plan evaluated the geochemistry of the Basin, and compared the Coldwater area to the Bedford area (Todd and AKM 2008). This evaluation showed the Coldwater area had a relatively high calcium-to-sodium ratio compared to groundwater in the Bedford area and downgradient

Temescal Basin. This relationship showed a difference in the source material in the aquifer in these two locations. The aquifer material in the Coldwater area is sourced from the granitic units in the Santa Ana Mountains, while the material in the Bedford area is sourced from the Tertiary sedimentary units that outcrop within that area and east of the Basin.

Groundwater quality can vary in the Basin; some areas have good water quality while other areas have high mineral concentrations, generally presenting as elevated total dissolved solids (TDS). High TDS concentration in groundwater can be naturally occurring and also the result of anthropogenic sources such as urban runoff, historical agricultural activities, and treated wastewater discharge. Nitrate was historically elevated in parts of the Basin, but recent concentrations have been relatively low. Natural nitrate levels in groundwater are generally very low, and elevated concentrations are associated with agricultural activities, septic systems, landscape fertilization, and wastewater treatment facility discharges.

Groundwater in the Basin has been impacted by human activities including agricultural, urban, and industrial land uses. State agencies with regulatory oversight for water quality in the Basin include the Santa Ana Regional Water Quality Control Board (RWQCB) and the State Water Resources Control Board (SWRCB) – Division of Drinking Water (DDW).

4.4.1. Monitoring Networks

State Water Board GAMA Program

The State Water Board Groundwater Ambient Monitoring and Assessment (GAMA) Program (SWRCB 2019) is the primary source of groundwater quality data in the Basin. The GAMA program has water quality data from 27 wells. Only six of these wells have recent water quality data (data collected since January 2015).

Division of Drinking Water (DDW)

There are four drinking water systems (Corona, EVMWD, Temescal Valley Water District [TVWD], and Glen Ivy Golf Club), with a total of eight well locations in the Basin. These stations report water quality data to the DDW. Each system monitors and reports water quality parameters to DDW and is required to participate in the Drinking Water Source Water Assessment Program (DWSAP) to ensure wells are not subject to local contamination.

Other Agencies

The RWQCB regulates one site in the Basin, Villa Park Trucking. Groundwater quality data were collected from one well on site from 1997 to 2007. In addition, DWR monitored 17 wells in the Basin from 1955 to 1988 and the USGS monitored two wells from 2006 to 2011.

Wells with water quality data from all available sources are shown on **Figure 4-11**.

4.5. OTHER STUDIES

4.5.1. Salt and Nutrient Management Plan 2017

The RWQCB manages salinity in the Santa Ana River Basin, in part by regulating the discharge and reuse of recycled water. TDS and nitrate concentration limitations for recycled water discharge and reuse are set by the RWQCB based on the Wasteload Allocation for surface waters in the Santa Ana River Watershed and the antidegradation objectives and ambient TDS and nitrate concentrations of the receiving groundwater management zone (GMZs), as defined in the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan). While there were two GMZs in the Basin (Bedford and Coldwater), Bedford was combined into the Upper Temescal Valley GMZ.

Consistent with the 2013 SWRCB Recycled Water Policy, a Salt and Nutrient Management Plan (SNMP) was developed for the Upper Temescal Valley, including the Bedford area, in 2017 (WEI 2017a). The purpose of the SNMP was to identify sources of salts and nutrients (current and future) as context for assessing potential impacts of recycled water projects and to plan for management of salt and nutrient sources to ensure that groundwater is safe for drinking and all other beneficial uses. Beneficial uses of water and respective water quality objectives are defined by the RWQCB in the Basin Plan. The report found that TDS concentrations were highly variable across space and time, ranging from a low of 240 milligrams per liter (mg/L) to a high of 1,500 mg/L, and there was no significant long-term trend of water quality degradation or improvement. Similar to TDS, nitrate concentrations are also highly variable; however, there does appear to be a decrease in concentrations over time, which is probably due to the reduction in irrigated agriculture land uses and hence a reduction in added nitrogen in the form of fertilizers.

The SNMP recommended TDS and nitrate antidegradation objectives for the Upper Temescal Valley GMZ consistent with the 2004 Basin Plan. These proposed objectives for TDS and Nitrate as N are 820 mg/L and 7.9 mg/L, respectively (WEI 2017a). These objectives (pertinent to Bedford area) are lower (stricter) than drinking water standards.

4.6. THREATS TO WATER QUALITY

4.6.1. Regulated Facilities

The RWQCB regulates one site in the Basin, Villa Park Trucking. Groundwater quality data were collected from one well on site from 1997 to 2007, and the site has since been closed.

4.6.2. Septic Systems

Some limited areas of the Basin are not served by municipal sewer and rely on on-site wastewater treatment (OWTS or septic systems). These represent sources of salt and nutrient loading to groundwater, as well as potential sources of other contaminants. Riverside County Department of Environmental Health is the permitting agency for septic systems and wells in

the County. The Riverside County Department of Environmental Health maintains an inventory of septic system installations but does not track which remain active. While it is known how many of these septic systems exist, the number is assumed minimal; most of the BCGSA area is sewered.

4.6.3. Non-point Sources

Nonpoint source (NPS) pollution is defined by the SWRCB as contamination that *does not originate from regulated point sources and comes from many diffuse sources*. NPS could occur when rainfall carries contaminants to surface water ways or percolates contaminants to groundwater. One example relevant to the Basin is loading to groundwater of nitrate from agricultural or landscaping land applications.

4.7. KEY CONSTITUENTS OF CONCERN

TDS and nitrate are the primary indicators for salt and nutrient loading and thus are key constituents of concern (COCs) for Basin management.

TDS data are available for both inflows and outflows from the Basin. There are elevated natural background TDS concentrations in groundwater. In addition, TDS can be an indicator of anthropogenic impacts (e.g., infiltration of urban runoff, agricultural return flows, and wastewater disposal).

Nitrate is the primary form of nitrogen detected in groundwater and natural nitrate levels in groundwater are generally very low. Elevated concentrations of nitrate in groundwater are associated with agricultural activities, septic systems, landscape fertilization, and wastewater treatment facility discharges. The maximum contaminant level (MCL) for nitrate (as nitrogen) is 10 mg/L. Nitrate data are available for Basin inflows and outflows, and as documented in the SNMP (WEI 2017a), elevated nitrate concentrations have been recognized. The SNMP analysis of nitrate loading found that most areas had predicted small increasing trends in nitrate in groundwater. However, no wells exceed the MCL for nitrate.

4.7.1. Key Constituents in Groundwater

TDS and nitrate are the constituents of concern in the Basin. Current average conditions (2010 through 2019) show average recent concentrations of TDS of 674 mg/L and nitrate as nitrogen concentrations of 2.75 mg/L. The values represent the average concentrations of these constituents in all drinking water and ambient groundwater monitoring events between 2010 and 2019; water quality samples from regulated facilities were not included in the analysis. These average conditions serve as a snapshot and allow a comparison of water quality conditions across the Basin.

4.7.2. Total Dissolved Solids (TDS)

As indicated above, average recent TDS concentrations in the Basin are just below the secondary MCL for drinking water (500 mg/L). Recent maximum TDS concentrations from all

wells are shown on **Figure 4-12**. While recent concentrations are generally lower than 500 mg/L several historical water quality analyses from wells had higher concentrations of TDS (e.g., exceeding 500 mg/L). Based on data collected by the BCGSA agencies and Glen Ivy (a small water system) from 2010 through 2019, TDS ranges from 210 milligrams per liter (mg/L) to 1,110 mg/L. The recommended TDS secondary maximum contaminant level (SMCL) for aesthetics is 500 mg/L.

4.7.3. Nitrate as Nitrogen (NO_3 as N)

The average recent nitrate as nitrogen concentration (2.75 mg/L) is low relative to the MCL of 10 mg/L. **Figure 4-13** shows the maximum nitrate as nitrogen concentrations at each well in the Basin. Several wells in the northern portion of the Basin show elevated historical nitrate concentration of up to 24.8 mg/L. However, no current nitrate detections exceed the MCL of 10 mg/L for nitrate as nitrogen. Nitrate has multiple and widespread sources including fertilizer application (agricultural and landscaping) and wastewater disposal (both municipal and domestic). Given that these sources are on or near the ground surface, shallow groundwater typically is characterized by higher concentrations than deep groundwater.

4.7.4. Other Constituents

In 2021, the BCGSA performed a round of baseline water quality sampling for the GSP. This sampling was designed to serve as a snapshot of ambient water quality for 48 constituents, including perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA). Eight wells were sampled, three in Bedford and two in Coldwater; the results of this sampling event are included in **Appendix H**. PFOS and PFOA were detectable with maximum concentration of 14 nanograms per liter (ng/L) and 25 ng/L respectively. The PFOS concentration is slightly above the response limit of 10 ng/L parts per trillion (ppt) but the PFOA concentration is below the 40 ng/L for PFOS (SWRCB 2020). The response limit for both PFOS and PFOA are based on a running four quarter average, so are not triggered by one sample.

Available water quality data indicate slightly elevated sulfate concentrations in the Basin. While historical sulfate concentrations ranged from 4 to 339 mg/L, recent samples collected in 2021 show sulfate concentrations from 110 to 270 mg/L. Concentrations in two Bedford wells were above the SMCL for sulfate of 250 mg/L but all wells were below the primary (health related) MCL of 500 mg/L. Sulfate will continue to be monitored as part of the BCGSA's monitoring program, it was not selected as a constituent of concern. The causes of elevated sulfate may be anthropogenic or naturally occurring. The anthropogenic sources of sulfate are likely from historical agricultural practices that are similar to nitrate and the natural occurrence due to geologic environment are similar to TDS. Therefore, TDS and nitrate are sufficient proxies for sulfate.

Other constituents that could impact beneficial uses or users, including arsenic, were not detected. While recent water quality data are limited, there is no indication of other constituents of concern. The BCGSA will continue to monitor water supply wells for Title 22 constituents to ensure adequate water quality in the Basin.

4.7.5. Vertical Variations in Water Quality

Water quality monitoring programs in the Basin do not show a distinct difference of water quality in depth, in part because most of the ambient monitoring wells have long screened intervals or are collected from wells with unknown construction.

4.8. SEAWATER INTRUSION CONDITIONS

The Basin is located approximately 25 miles inland from the Pacific Ocean. Lowest elevations (at the northern boundary of the Basin) are above about 1,000 feet. No risk of seawater intrusion exists in the Basin given its location.

4.9. INTERCONNECTION OF SURFACE WATER AND GROUNDWATER

Interconnection of groundwater and surface water occurs wherever the water table intersects the land surface and groundwater discharges into a stream channel or spring. These stream reaches gain flow from groundwater and are classified as gaining reaches. Conversely, connection can occur along stream reaches where water percolates from the stream into the groundwater system (losing reaches), provided that the regional water table is close enough to the stream bed elevation that the subsurface materials are fully saturated along the flow path.

Groundwater pumping near interconnected surface waterways or springs can decrease surface flow by increasing the rate of percolation from the stream or intercepting groundwater that would have discharged to the stream or spring. If a gaining stream is the natural discharge point for a groundwater basin, pumping anywhere in the basin can potentially decrease the outflow, particularly over long time periods such as multi-year droughts.

Because of the long dry season that characterizes the Mediterranean climate in Riverside County, vegetation exploits any near-surface water sources, including the water table along perennial stream channels, the wet soil areas around springs, and areas where the water table is within the rooting depth of the plants. Plants that draw water directly from the water table are called phreatophytes. They are able to continue growing vigorously during the dry season and typically stand out in summer and fall aerial photographs as patches of vegetation that are denser, taller, and brighter green than the adjacent vegetation.

4.9.1. Stream Flow Measurements

Three USGS streamflow gaging stations provide a general characterization of the stream flow regime in Temescal Wash and its tributaries. Their locations are shown in **Figure 4-14**, and daily flows during water years 2013 through 2020 are shown in **Figure 4-15**. Temescal Creek at Corona Lake (USGS 11071900) is located at the outlet of Lee Lake at the upstream end of the Basin. Flow at that location is primarily ephemeral, occurring only during and immediately following rainstorm events. No flow was recorded for three consecutive years during the

recent drought. However, the gage also records recycled water discharges from Eastern Municipal Water District (EMWD), which historically have often been large enough to flow down Temescal Wash as far as Lee Lake. Those discharges were more common prior to the period of gaged flows but still occur in wet years when EMWD is unable to use or store all of its recycled water.

The gauge on Coldwater Canyon Creek has only been in operation for one year, and it is the only record of flow in any drainage on the eastern slopes of the Santa Ana Mountains. The flow regime includes high peaks during storm events and small but persistent base flow supported by drainage of groundwater from fractured bedrock in the watershed. These small flows rapidly percolate where the creek enters the Basin and do not reach Temescal Wash. All of the tributary watersheds on the west side of the Basin likely have similar flow regimes. The gauge above Main Street in Corona experiences many more peak flow events. Most of these additional flow events probably derive from impervious runoff in the surrounding urban area. A steady base flow of about 2 cubic feet per second (cfs) is not groundwater discharge, but so-called nuisance water (for example, sprinkler overspray onto paving, or pipe leaks) plus discharge from the wastewater treatment plant upstream of the gauge.

A review of 27 high-resolution aerial photographs (Google Earth 2021) between 1994 and 2020 did not reveal any reaches of Temescal wash that appeared to have groundwater discharge; that is, flowing or ponded reaches in an otherwise dry channel during the dry season. Thus, the reach of Temescal Wash that passes through the Bedford-Coldwater Basin does not appear to gain flow from groundwater seepage into the channel, at least during the dry season. Water levels in wells near the creek further suggest that the water table is usually below the creek bed elevation. Data showing depth to the water table are discussed in the next section.

4.9.2. Depth to Groundwater

Depth to groundwater provides a general indication of locations where gaining streams and riparian vegetation are likely to be present. However, available data are of limited use for this purpose due to insufficient geographic and vertical coverage. Available data are almost entirely from water supply wells, which are typically screened deep in the aquifer. The groundwater elevation (potentiometric head) at the depth of the well screen can be different from the true water table, which is the first zone of saturation reached when drilling down from the ground surface. Because recharge occurs at the land surface and pumping occurs at depth, deep alluvial basins such as this one typically have large downward head gradients within the aquifer system. Thus, water level information from wells can potentially underestimate the locations where the water table is shallow enough to support phreatophytic riparian vegetation.

Creeks and rivers that lose water commonly form a mound in the water table near the creek or river. The height and width of the mound depends on the transmissivity of the shallowest aquifer. As an example, in other basins where this condition is observed, groundwater elevations in a shallow well adjacent to the Arroyo Seco in the Salinas Valley California rose 5 to 10 feet more than groundwater elevations in wells 1,000 feet away when the river started

flowing (Feeney 1994). A groundwater ridge up to 12 feet high develops beneath Putah Creek in Yolo County California during the flow season, but the width of this ridge was estimated to be only a few hundred feet (Thomasson et al. 1960). These examples suggest that shallow wells within 100 to 200 feet of a stream channel would be needed to confirm the presence of hydraulic connection between surface water and groundwater in the Bedford-Coldwater Basin.

Groundwater does not discharge into streams unless the water table is equal to or higher than the elevation of the stream bed. In addition, the water table does not provide water to phreatophytic vegetation unless it is at least as high as the base of the root zone. The depth of the root zone is uncertain, partly because the relatively few studies of rooting depth have produced inconsistent results and partly because rooting depth for some riparian species is facultative. This means that the plants will grow deeper roots if the water table declines. Many species (including cottonwood and willow) germinate on moist soils along the edge of a creek in spring. As the stream surface recedes during the first summer, the seedlings survive if the roots grow at the same rate as the water-level decline. Over a period of years, roots grow deeper as the land surface accretes from sediment deposition and/or the creek channel meanders away from the young tree or shrub.

Available water level data from wells were reviewed to identify parts of the Basin where the water table elevation might possibly be high enough to be reached by phreatophyte roots. For screening purposes, a depth to water of less than 30 feet in wells was selected as a threshold for identifying possible phreatophyte areas. This depth allows for 10 to 15 feet of root depth, 5 feet of elevation difference between the water level in the well and the overlying true water table, and 15 feet of elevation difference between well heads and the bottoms of nearby creek channels.

A second limitation of available groundwater elevation data is the sparse geographic distribution of wells with measurements. Fortunately, many wells in the Basin with water-level data are located along Temescal Wash. **Figure 4-16** shows a map of the eleven wells with relatively long-term water-level records. They are clustered into five areas. The only location where the typical spring depth to water was less than 30 feet was at the north end of the Basin, near the Flagler and Corona Non-Potable wells. Hydrographs of water levels in those wells are shown in **Figure 4-17**. Typical spring depths to water in the five wells in that area ranged from 15 to 27 feet. Slightly farther upstream—at the TVWD wells—typical depths to water were slightly greater than 30 feet. Depth to water increases rapidly to the west of Temescal Wash. At the Corona and Station 71 wells, the typical depth to water was 80 to 200 feet.

In summary, groundwater levels in the Basin appear to be too low to normally maintain a hydraulic connection with the Temescal Wash channel. Therefore, groundwater pumping does not deplete flow in Temescal Wash. Groundwater levels might be high enough to support phreatophytic riparian vegetation with roots extending 10-15 feet below the elevation of the creek bed.

4.9.3. Riparian Vegetation

Vegetation data provide mixed evidence that the water table near some reaches of Temescal Wash is shallow enough to supply water to phreatophytes. Where tree and shrub roots are able to reach the water table, riparian vegetation is typically denser and greener than along reaches where vegetation is supplied only by residual soil moisture from the preceding wet season. Patches of dense riparian vegetation visible in multiple Google Earth (2021) aerial photographs from 1994-2014 are indicated by a crosshatch pattern in **Figure 4-16**. However, older and more recent aerial photographs indicate that the vegetation has not been a permanent feature of the landscape. The figure also shows the distribution of vegetation classified as Natural Communities Commonly Associated with Groundwater (NCCAG) by The Nature Conservancy in cooperation with DWR. Based on multiple historical vegetation surveys from the early 2000s, the Nature Conservancy prepared detailed statewide mapping of NCCAG vegetation that is accessible on-line (DWR et al. 2020). The extent of NCCAG vegetation is much greater than the extent of dense riparian vegetation and includes vegetation where the water table is certainly deeper than the root zone (such as near the Corona wells). Thus, some of the vegetation in the NCCAG polygons is probably not relying on groundwater. Furthermore, some of the plant species included in the NCCAG mapping are facultative phreatophytes, which means they will exploit a water table if it is within a reachable depth but otherwise survive on soil moisture (typically with smaller stature and greater spacing between plants). These species include red willow (*Salix* laevigata), which is the most common species mapped along Temescal Wash.

An additional test for groundwater dependence of riparian vegetation was to compare changes in groundwater elevation with changes in vegetation health during the 2012 to 2015 drought. Vegetation health can be detected by changes in the way the plant canopy absorbs and reflects light. The spectral characteristics of satellite imagery can be processed to obtain two metrics commonly used to characterize vegetation health: the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Moisture Index (NDMI). Both are calculated as ratios of selected visible and infrared light wavelengths. The Nature Conservancy developed a second on-line mapping tool called GDE Pulse that provides annual dry-season averages of NDVI and NDMI for each mapped NCCAG polygon for 1985-2018 to assist with the identification of groundwater dependent ecosystems (GDEs) (TNC 2020). In **Figure 4-16**, the polygons are color-coded by the change in NDMI from 2012 to 2015, with positive values in increasingly dark shades of green and negative values in increasingly dark shades of red. Negative values indicate stress due to desiccation. The NDVI patterns were similar to the NDMI patterns.

Inconsistencies are immediately apparent. One would expect all of the polygons to have experienced moisture stress during the drought, but about one-third of them experienced little stress. In some cases, an unstressed polygon adjoins a highly stressed polygon, which would be unlikely if declining groundwater levels were the cause of the stress. In spite of these inconsistencies, the dominant pattern was a decrease in NDMI. This was notably the case for the red willow patch that occupies roughly the northern third of the Temescal Wash reach in the Basin.

Further evidence of drought stress can be seen directly in aerial photographs. **Figure 4-18** shows Google Earth (2021) photos of a reach adjacent to the golf course located about 1,000 feet upstream of the Corona Non-Potable wells. Photographs of the same location in 2012, 2014 and 2016 are shown. There was little apparent change from 2012 to 2014, but by 2016 many of the trees along the central channel appeared to be dead.

Water levels in wells with relatively shallow depth to water declined 15 to 25 feet during 2012 to 2015, albeit unevenly in some wells. Thus, the declining NDMI values and substantial vegetation mortality both occurred during the same period that groundwater levels declined. Notably, most of the water-level decline was between 2014 and 2016, which was the period when most of the vegetation mortality occurred. The correlation between groundwater levels and vegetation health does not necessarily prove causality, because other sources of water also became more scarce, including rainfall, irrigation return flow and wastewater discharges to Temescal Wash upstream of the site in the photograph. Rainfall at Elsinore during water years 2013 through 2016 averaged 5.96 inches, or 56 percent of the long-term average. The greater abundance of brown areas on the golf course fairways in 2016 relative to 2014 and 2012 suggest that irrigation had been curtailed due to the drought. The TVWD wastewater treatment plant located two miles upstream of the photo site, at the upstream end of the patch of dense riparian vegetation, normally discharges about 15 acre-feet per month (equivalent to 0.25 cfs) of treated wastewater to Temescal Wash, as shown in **Figure 4-19**. Those discharges were discontinued from November 2012 through at least November 2018 except for one three-month period in winter 2015. The normal discharge could supply roughly one-third of the summer evapotranspiration (ET) demand of the entire reach of vegetation between the discharge point and the end of the Basin.

Older historical aerial photographs show that dense riparian vegetation was not always present prior to the 1990s (that is, prior to the Google Earth imagery). **Figure 4-20** shows aerial photographs taken in 1967 of a 2-mile reach of Temescal Wash in the northern part of the Bedford-Coldwater Basin. It includes the area shown in **Figure 4-18** (green rectangle). There was almost no dense riparian vegetation anywhere along the Wash in 1967. Two factors probably contributed to the lack of vegetation. First, precipitation had been consistently below average since 1947 (see additional discussion in **Chapter 5**). Second, groundwater pumping was higher in those days to support irrigation of citrus groves (some of which are visible in the photograph). Pumping from the Bedford area averaged 3,000 acre-feet per year (AFY) during 1947 to 1967 (WEI 2015b) versus 1,800 AFY during 2015 to 2019. Both of these factors probably contributed to low surface flow and low groundwater levels, which together killed any prior dense riparian vegetation or prevented such vegetation from becoming established.

In summary, the extent, density and health of riparian vegetation has been variable historically. Vegetation appears to become denser and lusher when surface flow is more abundant and groundwater levels are consistently shallow, and it dies back during droughts and when groundwater levels are low. At any given time, the extent to which riparian vegetation along some reaches of Temescal Wash is phreatophytic and therefore affected by groundwater levels is unclear. The presence of groundwater elevations that are probably

within reach of phreatophyte roots, the presence of patches of dense riparian tree canopy, and the co-occurrence of groundwater declines and vegetation stress and mortality within the past decade all suggest that some vegetation is dependent on groundwater. However, other drought-related decreases in water availability could have contributed to the observed impacts on vegetation. Additional information regarding the true water table depth in the riparian zone and a more comprehensive evaluation of rainfall, irrigation, and wastewater discharge time series is needed to confirm the degree of vegetation dependence on groundwater levels.

4.9.4. Wetlands

The NCCAG vegetation mapping tool also includes a wetlands map, which is reproduced here with simplified mapping categories in **Figure 4-21**. In the Bedford-Coldwater Basin, almost all of the wetland polygons are within the Temescal Wash channel and accounted for in the preceding discussion of riparian vegetation. The wetland categories for those polygons are mostly marsh (palustrine) or riverine and characterized as seasonally flooded. Vegetation along the low-flow channel is classified as permanently or semi-permanently flooded, which a brief inspection of aerial photographs shows is clearly incorrect. A handful of small wetland polygons were mapped in upland areas west of Temescal Wash. Most are high up in the stream canyons where perennial stream flow or shallow groundwater is sustained by small amounts of groundwater inflow from the bedrock tributary areas and not affected by pumping in the main part of the Basin. Several patches totaling 1.4 acres are midway between the wash and western Basin boundary, where regional groundwater levels are many tens of feet below the ground surface. The seasonal flooding or saturation that supports the wetland-type vegetation almost certainly derives from pooled rainfall runoff or interflow rather than discharge of regional groundwater.

The Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) was reviewed for additional information regarding plant species that might be affected by groundwater (Western Riverside County Regional Conservation Authority 2020). Two large regions mapped as *narrow endemic plants* and *criteria area species* partially overlap the Basin. However, those categories together contain 16 upland plant species that are unaffected by groundwater.

Therefore, the few small areas mapped as wetlands outside the Temescal Wash channel would not be affected by pumping and groundwater levels.

4.9.4.1. Animals Dependent on Groundwater

Animals that depend on groundwater include fish and other aquatic organisms that rely on groundwater-supported stream flow and amphibious or terrestrial animals that lay their eggs in water. Management of habitat for animals typically focuses on species that are listed as threatened or endangered under the state or federal Endangered Species Acts. That convention is followed here. Flow in Temescal Wash is too ephemeral to support migration of anadromous fish (such as steelhead trout), and the watershed upstream of the Basin does not have stream reaches with perennial cool water suitable for spawning and rearing.

The MSHCP includes mapped areas that are potential habitat for several animal species. The western edge of a very large habitat area for burrowing owl overlaps the eastern edge of the Basin. However, the owl is an upland species that is not dependent on riparian or wetland vegetation.

The coastal California gnatcatcher is a bird species federally listed as threatened. Critical habitat areas delineated by the U.S. Fish and Wildlife Service that are in or near the Basin are shown in **Figure 4-22**. The habitat polygons are all in upland areas, but a few of them overlap tributary streams underlain by narrow, shallow alluvial bodies that extend outward from the main Basin area. Groundwater in those tributary creek valleys is sustained by gradual discharge from fractured bedrock in the watershed areas, and there is little or no local groundwater pumping. To the extent that vegetation along the tributary stream valleys provides gnatcatcher habitat, it would be unaffected by pumping in the main Basin area.

In summary, there do not appear to be any listed animal species that would potentially be impacted by groundwater pumping or water levels. More common species that use riparian shrubs and trees along Temescal Wash could potentially be impacted during droughts if lowered groundwater levels cause vegetation die-back or mortality.

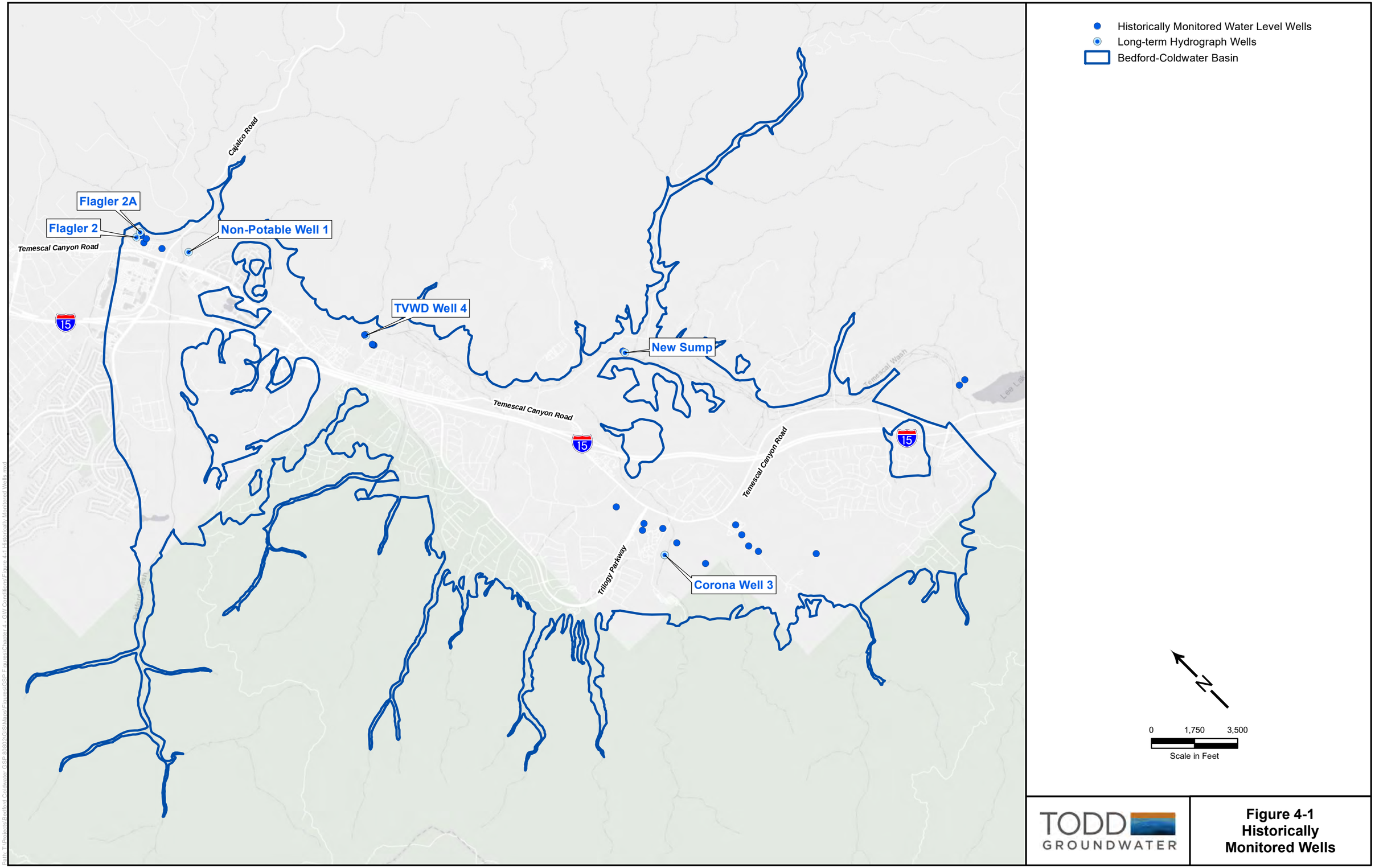
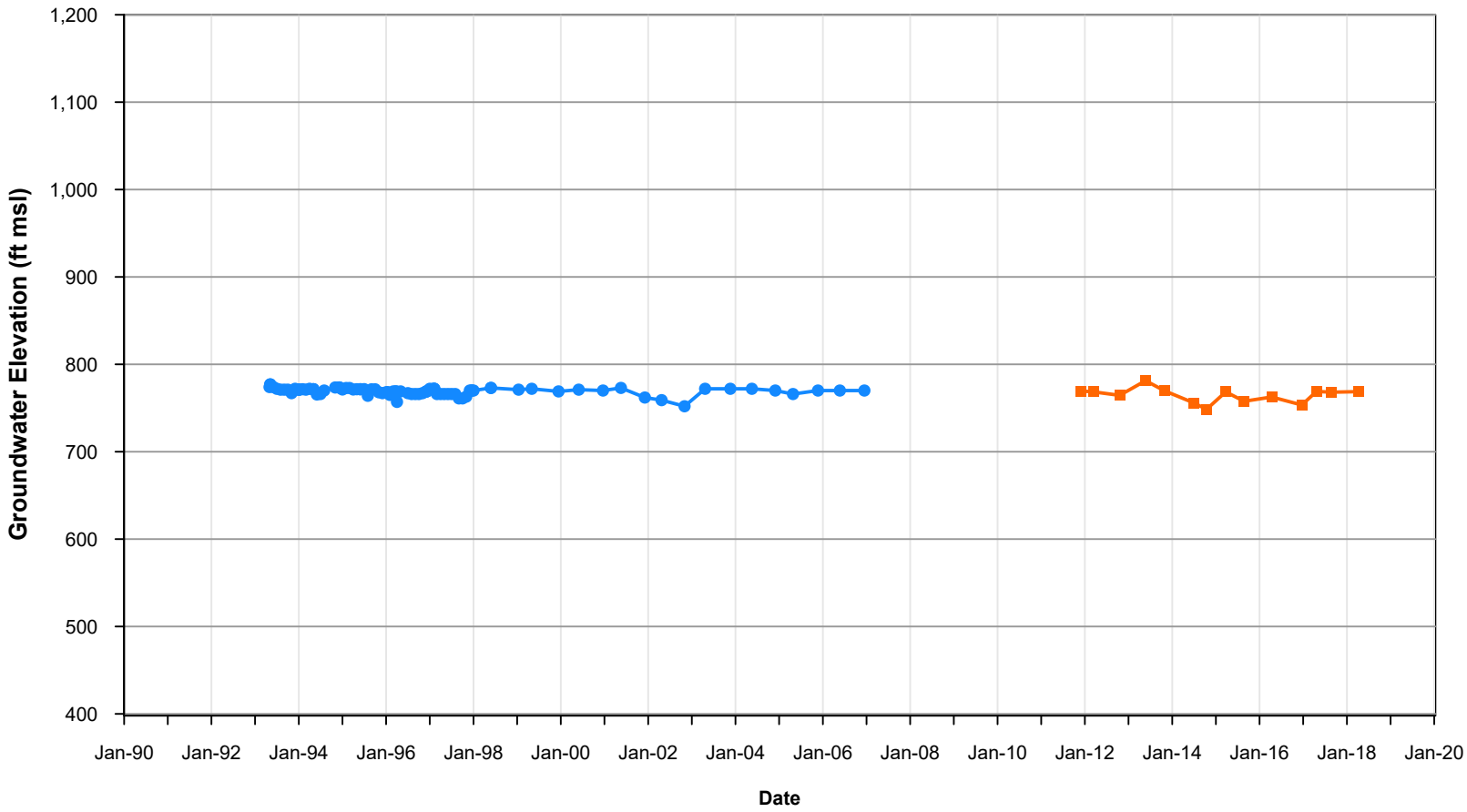


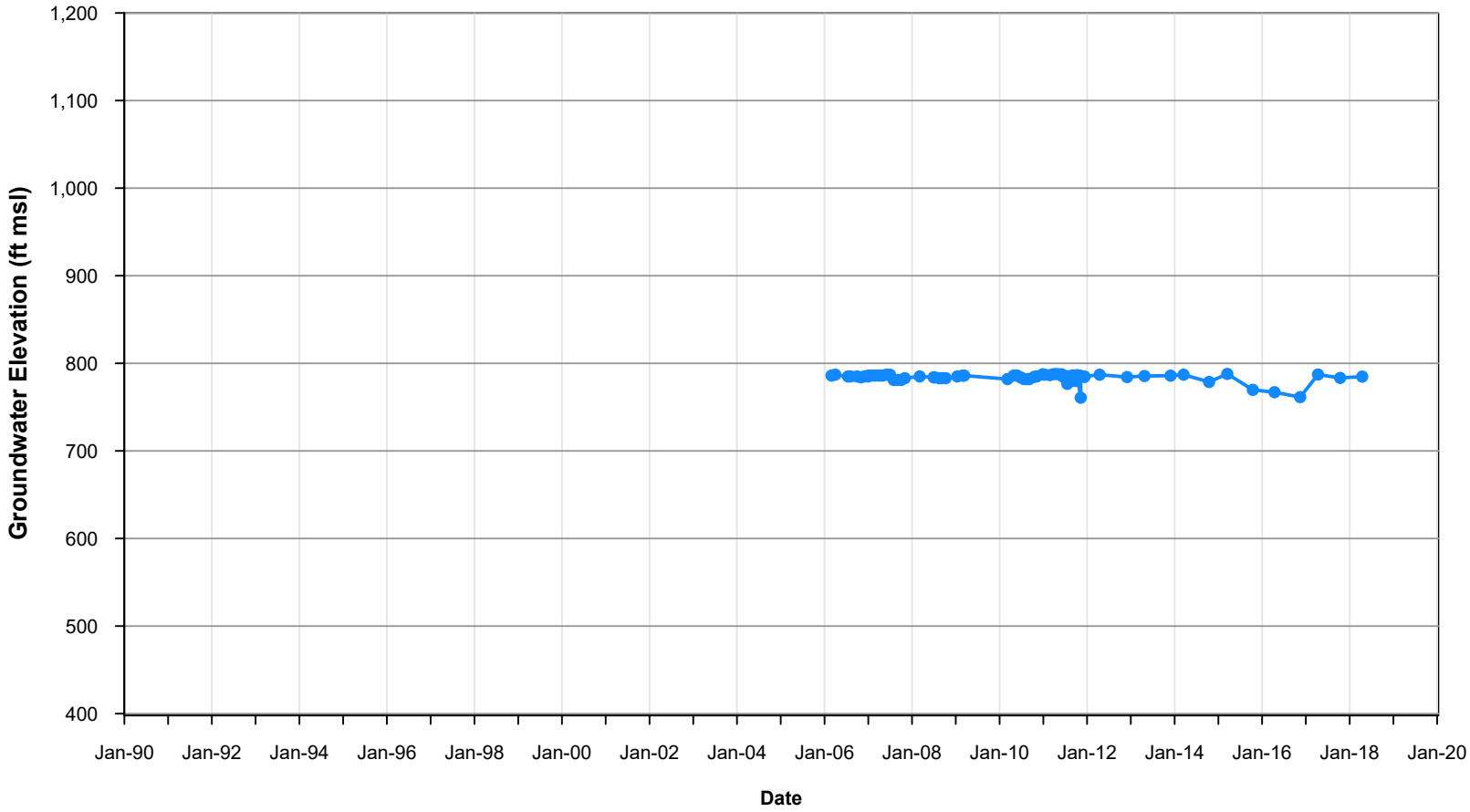
Figure 4-1
Historically Monitored Wells



Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 4-2 Flagler 2_2A Hydrographs.gpj

TODD GROUNDWATER

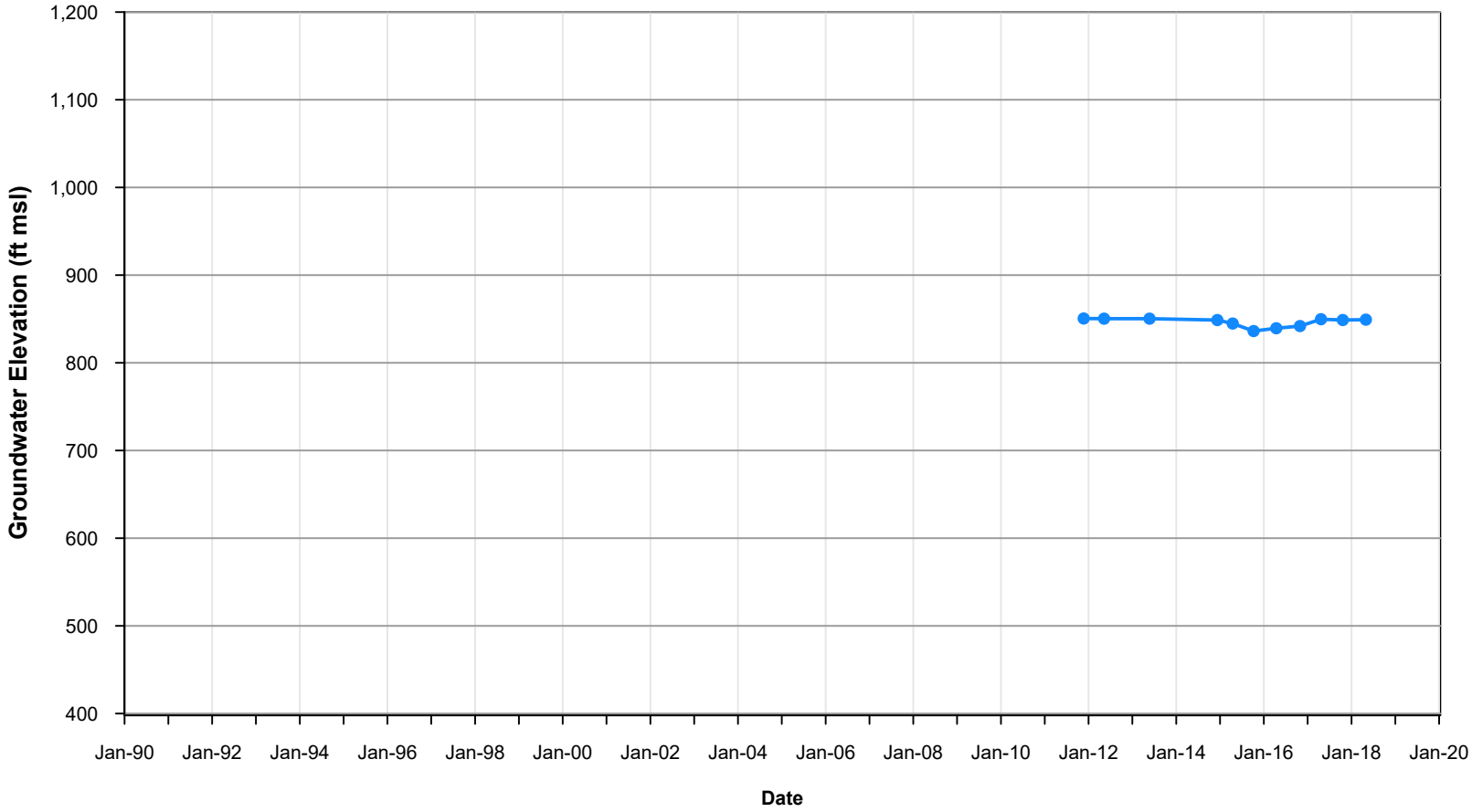
Figure 4-2
Representative Hydrographs
Flagler Wells 2 and 2A



TODD GROUNDWATER

Figure 4-3
Representative Hydrograph
Non-Potable Well 1

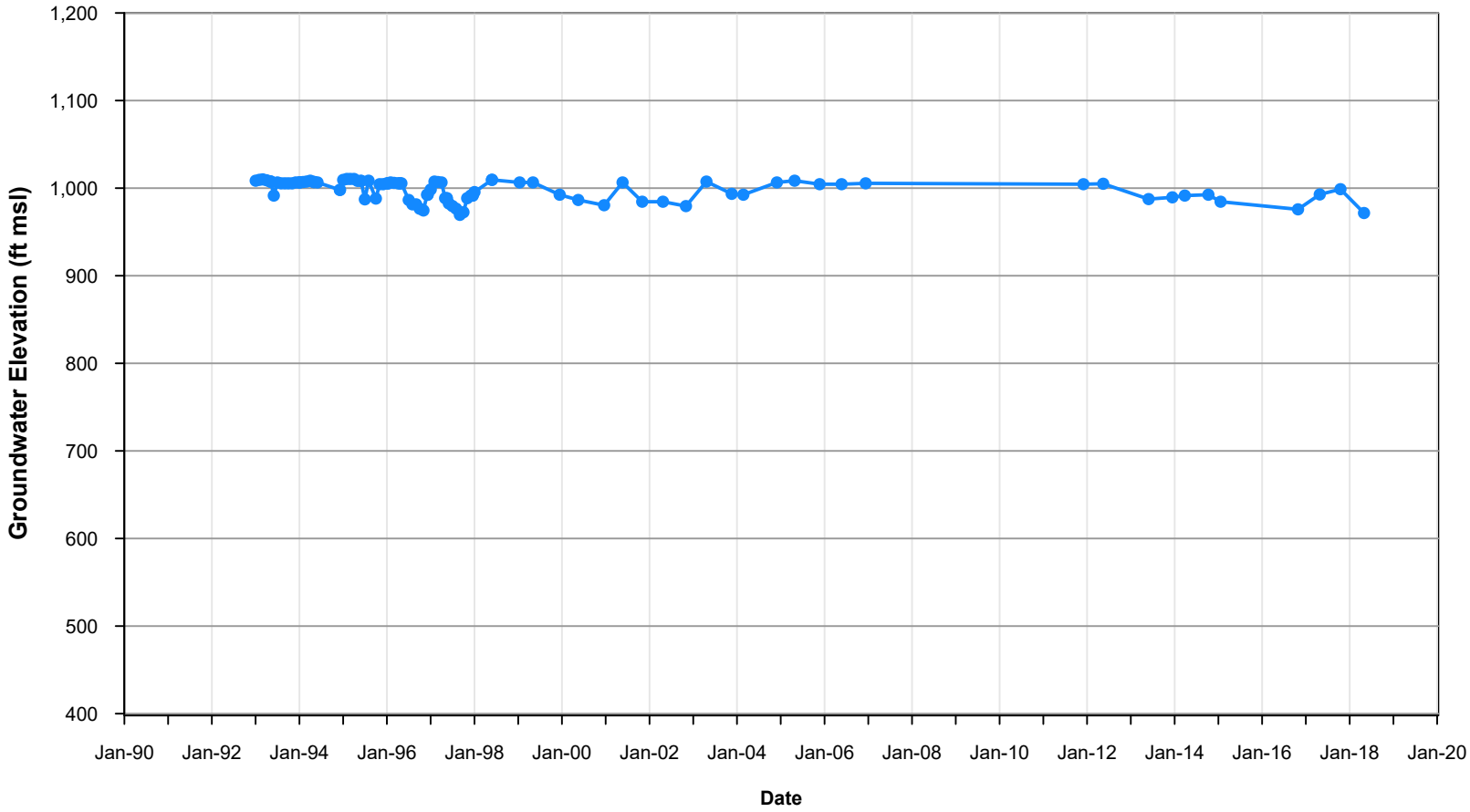
Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 4-3 Non-Potable Well 1 Hydrograph.grj



TODD GROUNDWATER

Figure 4-4
Representative Hydrograph
TVWD Well 4

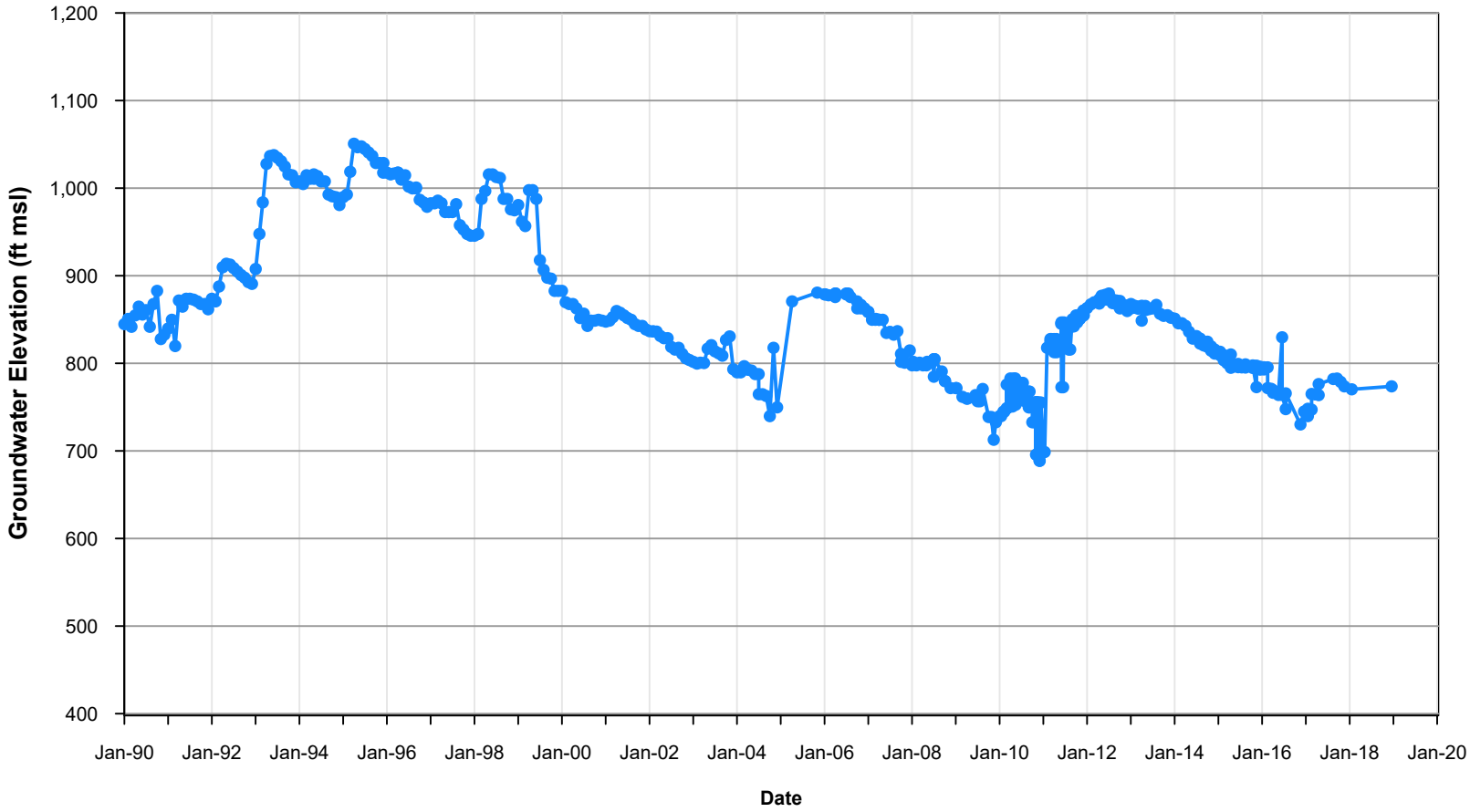
Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 4-4 TVWD Well 4 Hydrograph.gpj



TODD GROUNDWATER

Figure 4-5
Representative Hydrograph
New Sump

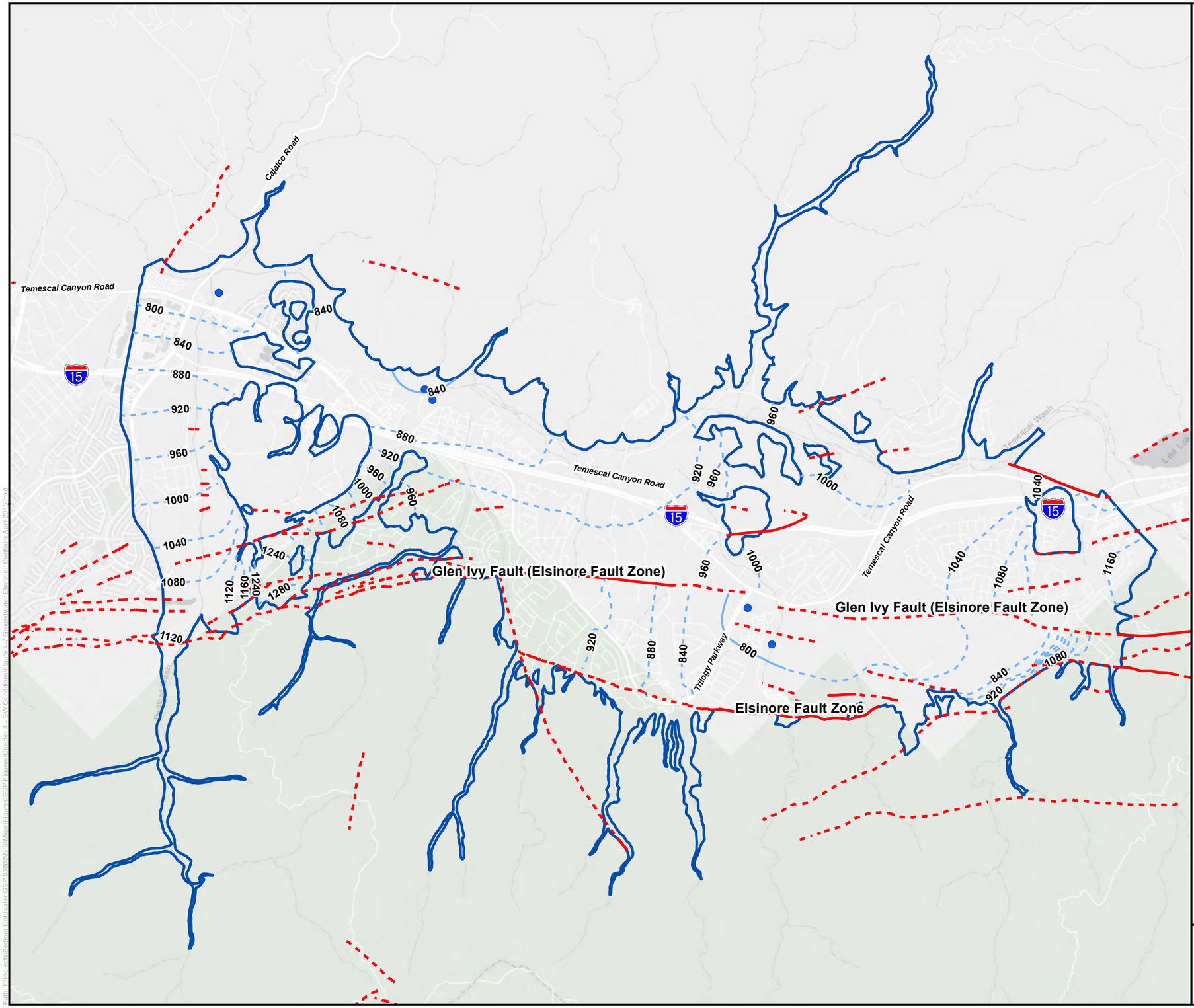
Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 4-5 New Sump Hydrograph.gpj



TODD GROUNDWATER

Figure 4-6
Representative Hydrograph
Corona Well 3

Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 4-6 Corona Well 3 Hydrograph.gpj



- Monitored Wells, Fall 2015
- 40-foot groundwater elevation contour, feet above msl, dashed where uncertain
- Fault Location, dashed where uncertain
- Bedford-Coldwater Basin

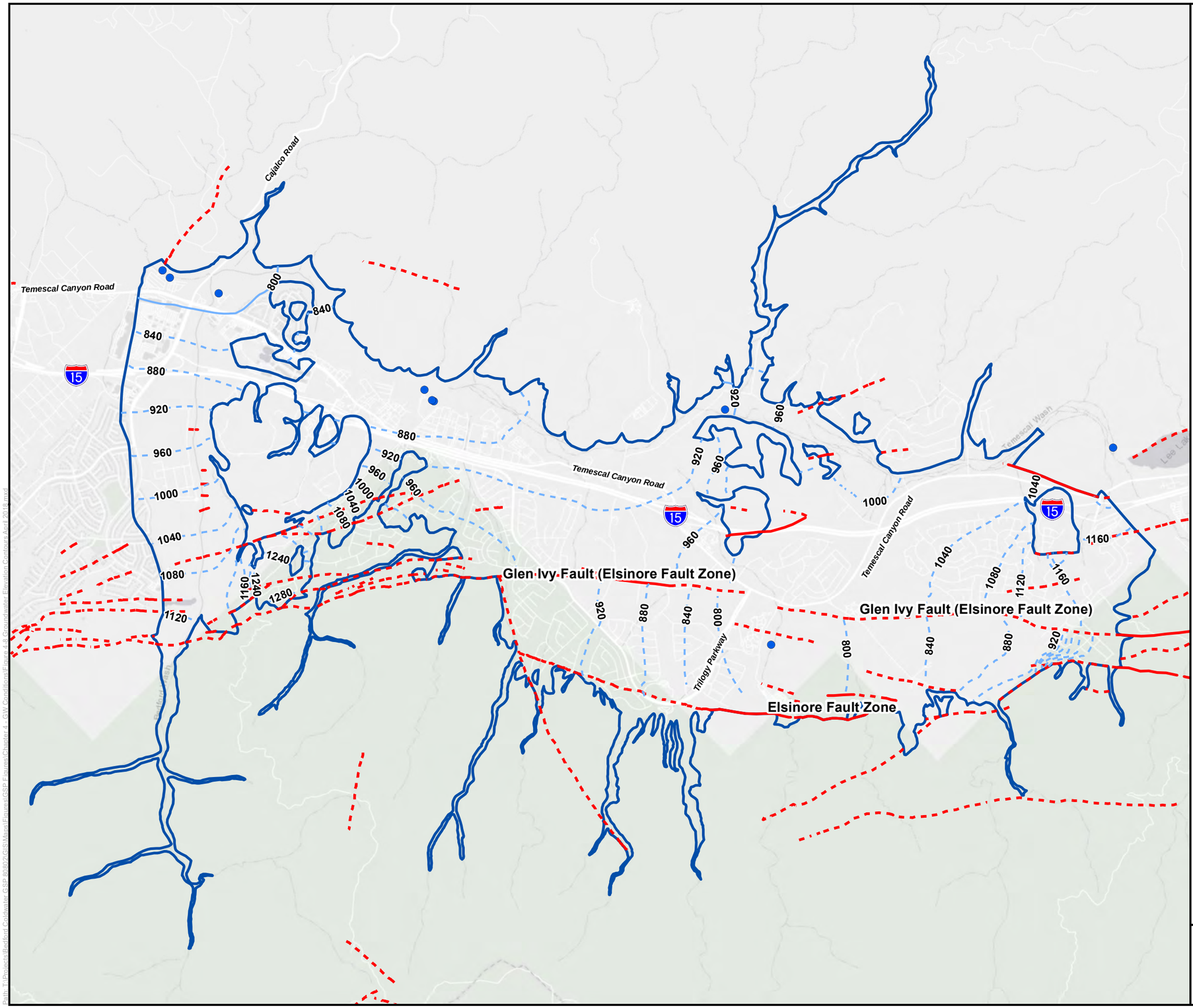
N

0 1,750 3,500

Scale in Feet

TODD GROUNDWATER

Figure 4-7
Groundwater Elevation Contours Fall 2015



Monitored Wells, Spring 2018

40-foot groundwater elevation contour, feet above msl, dashed where uncertain

Fault Location, dashed where uncertain

Bedford-Coldwater Basin

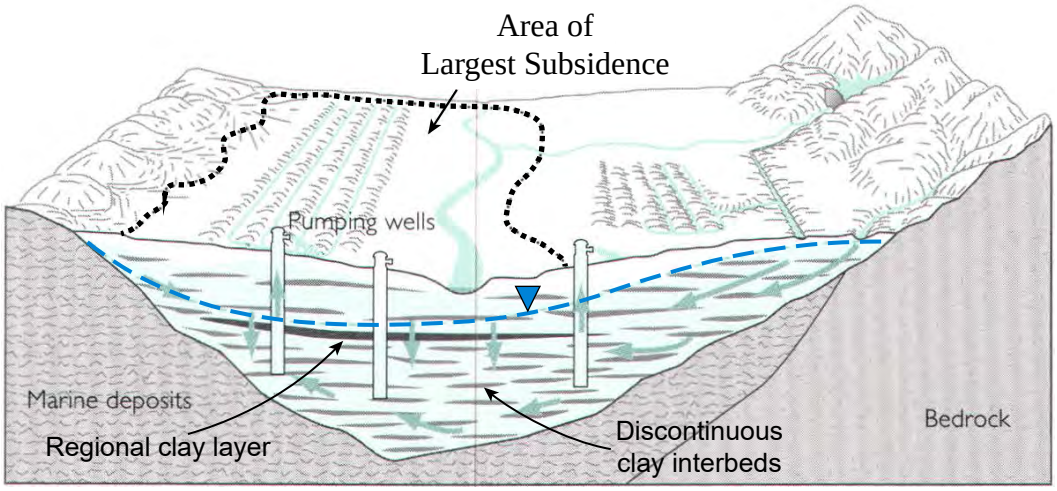
N

0 1,750 3,500

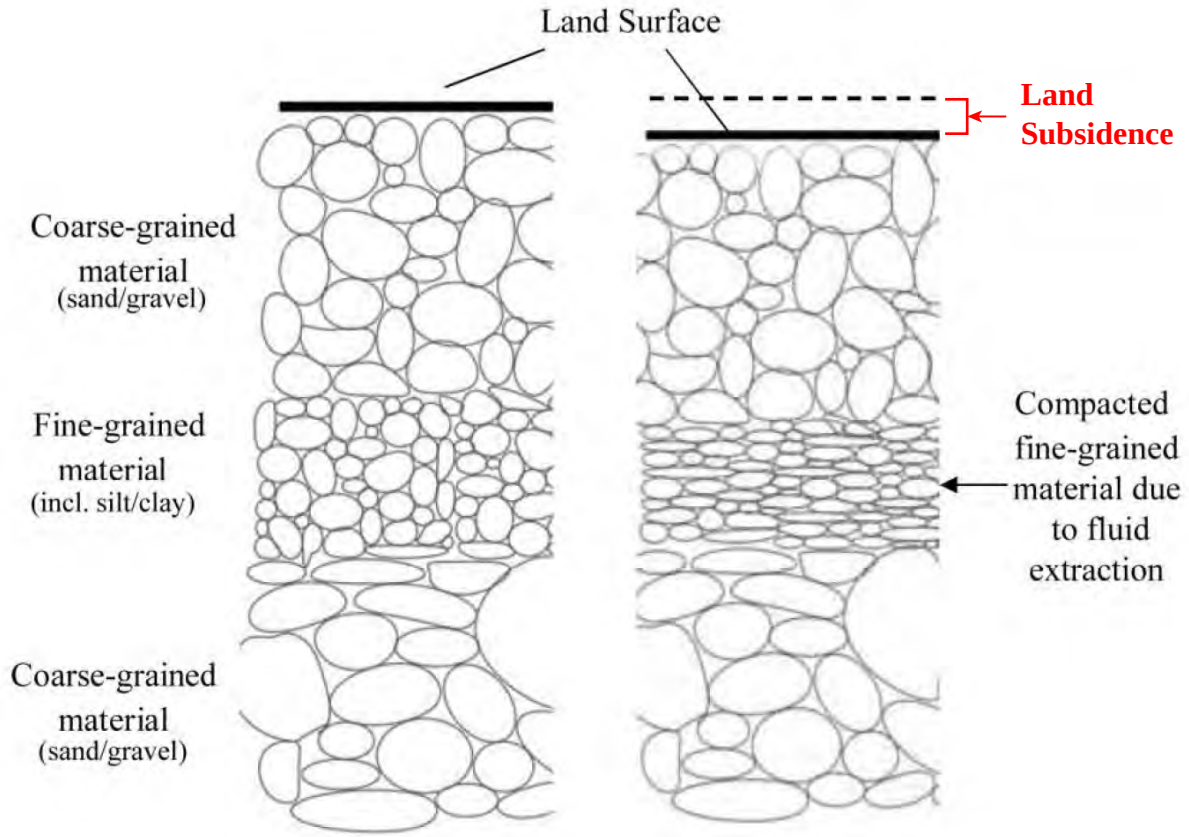
Scale in Feet

TODD GROUNDWATER

Figure 4-8
Groundwater Elevation Contours Spring 2018



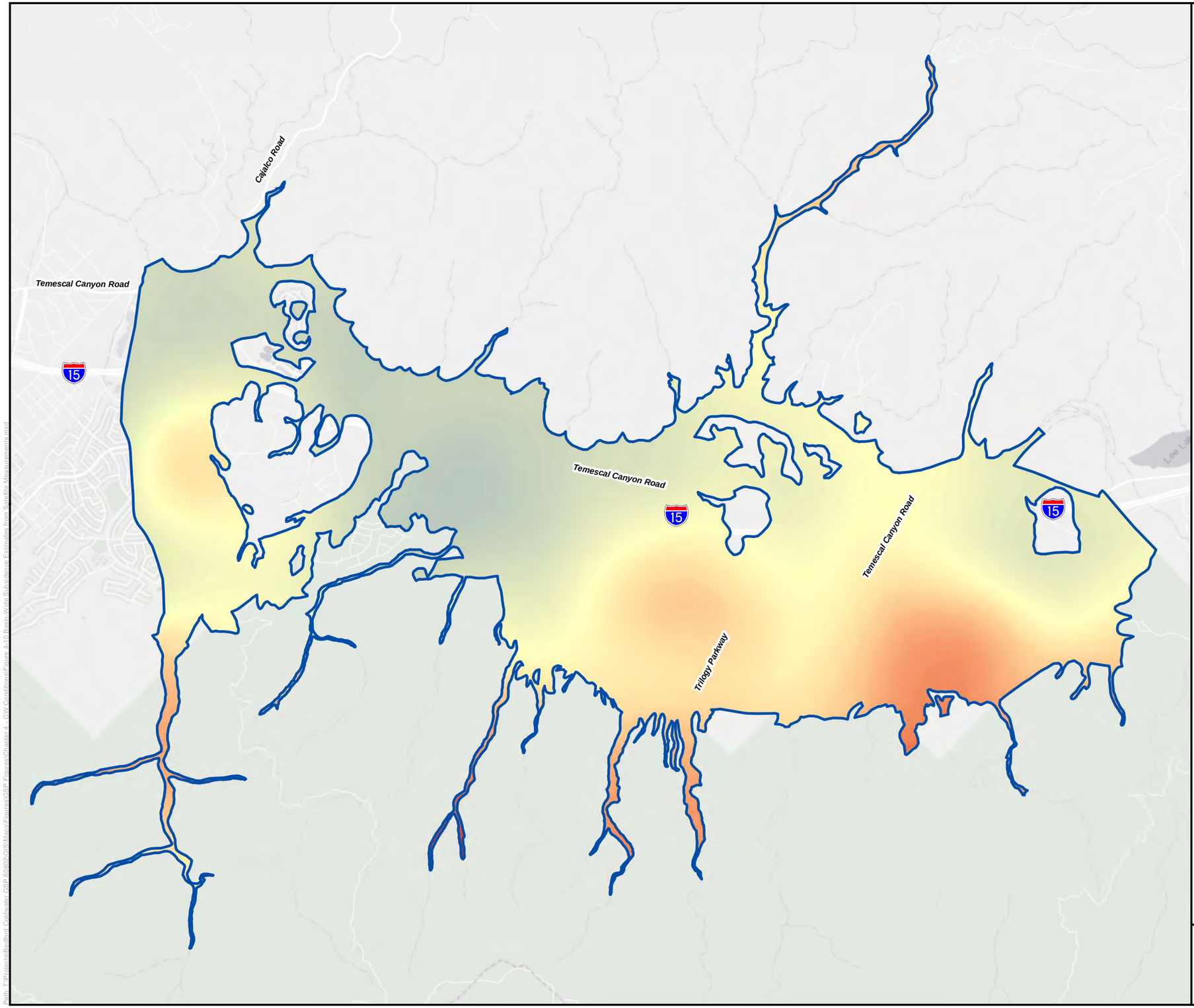
Source: Galloway et al., 1999.



After LSCE et al., 2014.

TODD GROUNDWATER

Figure 4-9
Concepts of
Land Subsidence



Bedford-Coldwater Basin

Subsidence Estimates from Satellite Measurements

High : 0.05 feet

Low : -0.05 feet

N

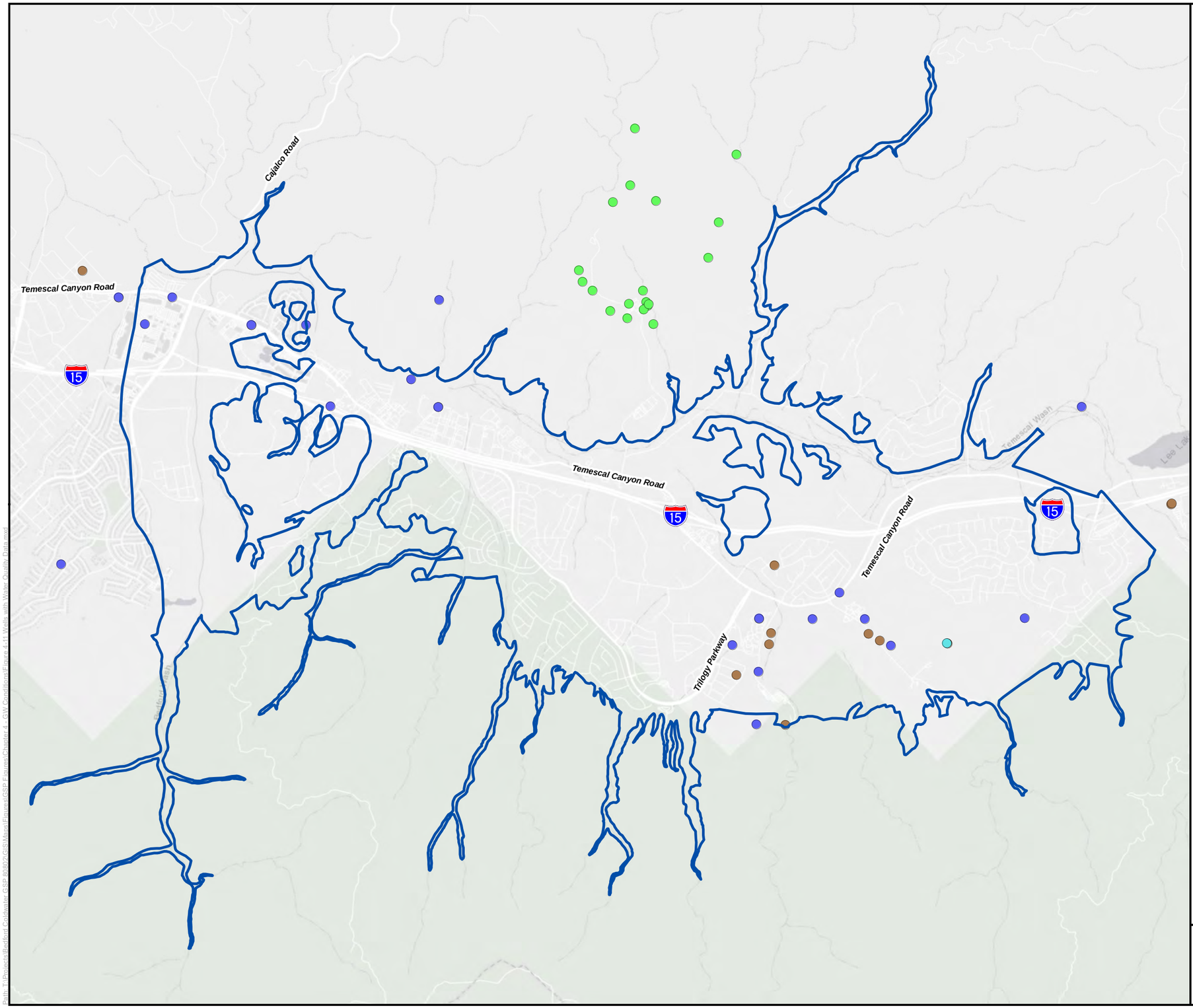
0 1,750 3,500

Scale in Feet

Data Source:
Subsidence estimates from satellite measurements provided by the TRE ALTAMIRA InSAR provided by the California Department of Water Resources.

TODD GROUNDWATER

Figure 4-10
Basin-Wide Subsidence Estimates from Satellite Measurements



- Well with Water Quality Data from State Water Resources Control Board Division of Drinking Water
- Well with Water Quality Data from California Department of Water Resources
- Well with Water Quality Data from Regional Water Quality Control Board
- Well with Water Quality Data from United States Geological Survey
- Bedford-Coldwater Basin

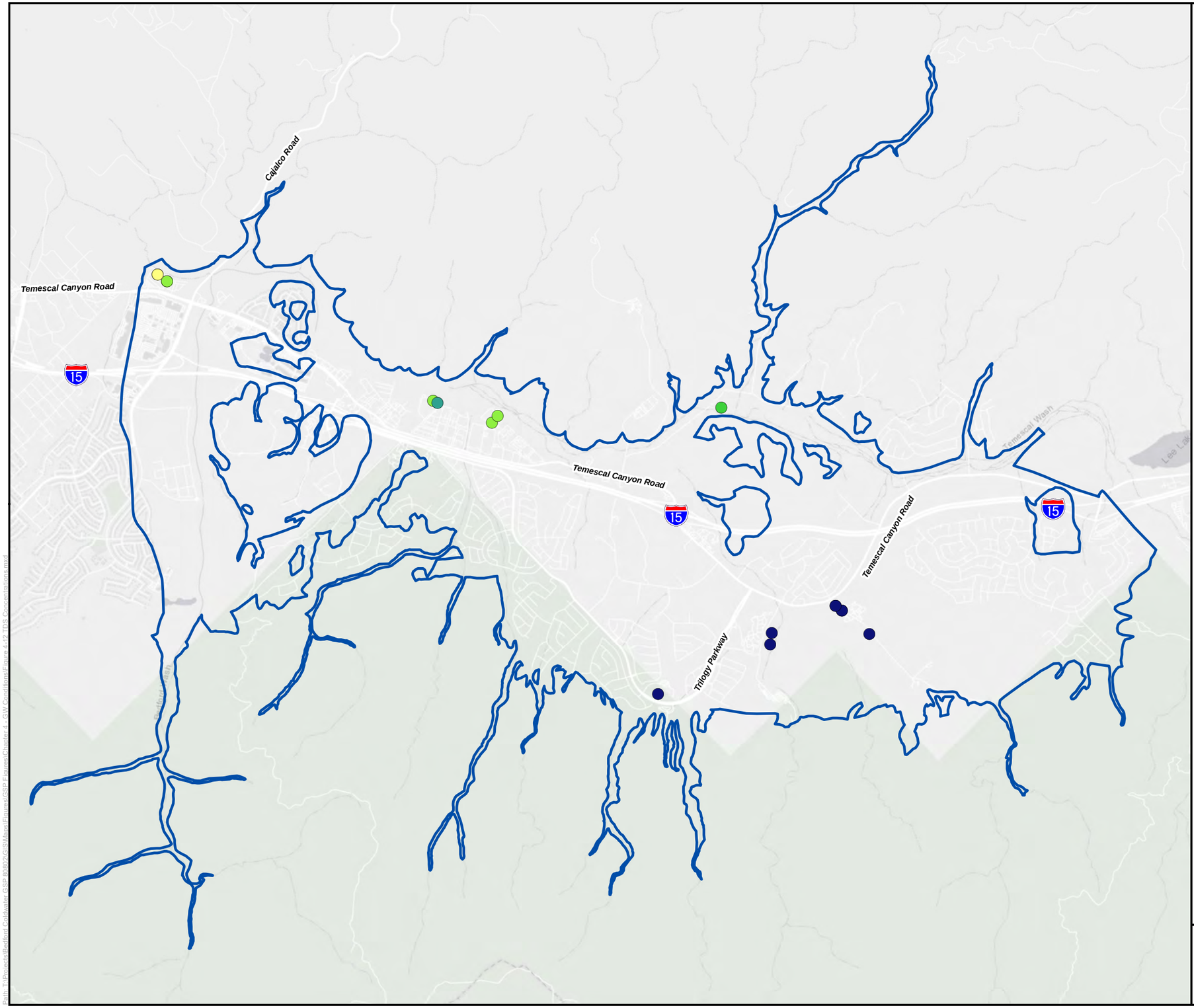
N

0 1,750 3,500

Scale in Feet

TODD GROUNDWATER

Figure 4-11
Wells with Water Quality Data



Average Recent Total Dissolved Solids (TDS) Concentration

- Less than 500 mg/L
- 500 to 600 mg/L
- 600 to 700 mg/L
- 700 to 800 mg/L
- 800 to 900 mg/L
- 900 to 1,000 mg/L
- Bedford-Coldwater Basin

N

0 1,750 3,500

Scale in Feet

TODD GROUNDWATER

Figure 4-12
Total Dissolved Solids Concentrations in Wells 2010 through 2019

Path: T:\Projects\Bedford Coldwater GSP 20002\GIS\mxd\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-12 TDS Concentrations.mxd

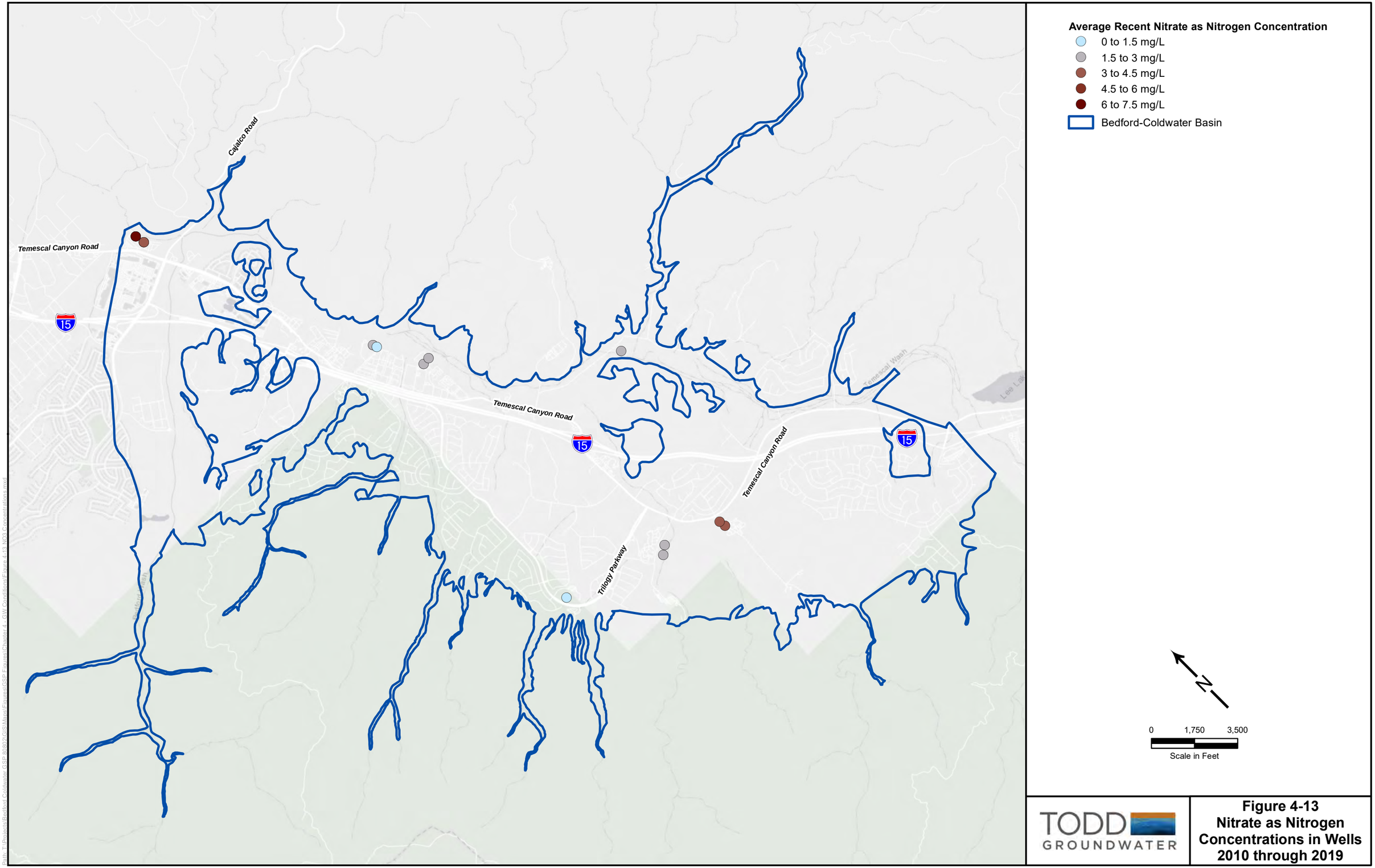
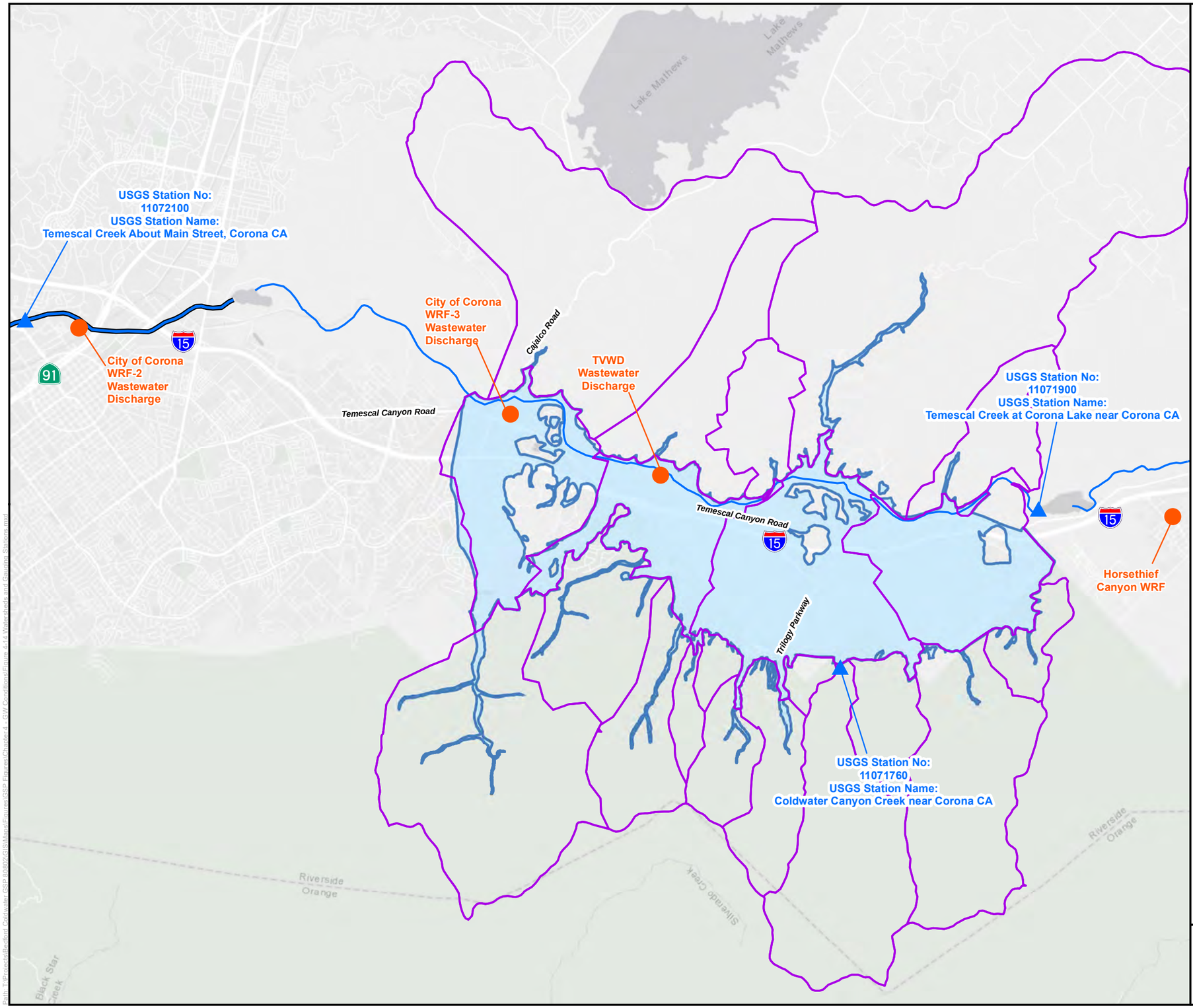


Figure 4-13
Nitrate as Nitrogen Concentrations in Wells 2010 through 2019



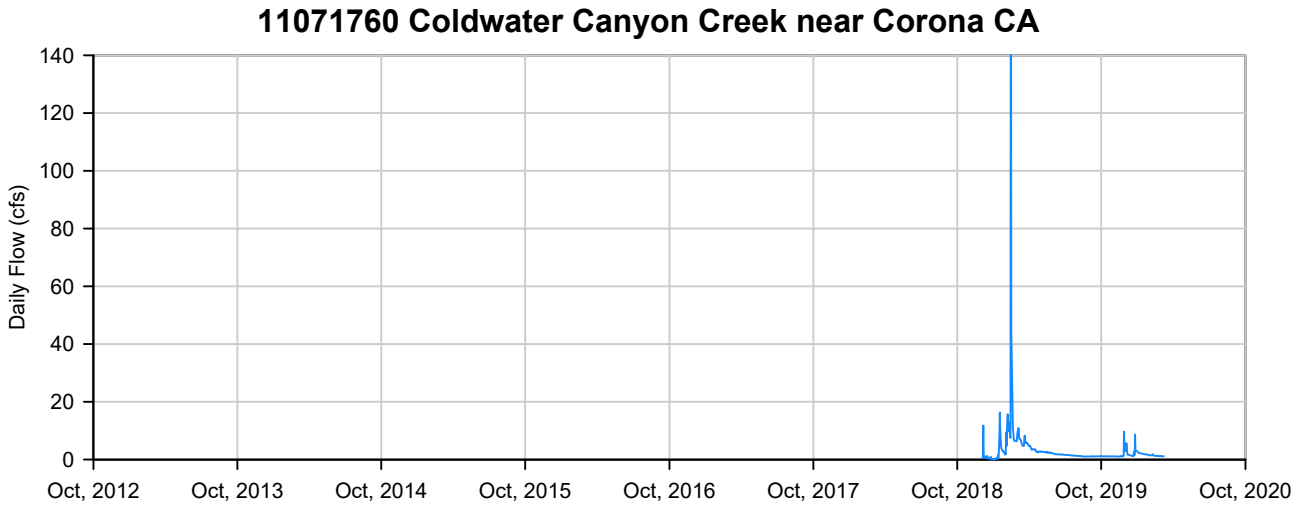
Wastewater Discharge Location
Local Watersheds
Temescal Wash Flood Channel
Temescal Wash Unlined
Bedford-Coldwater Basin
Stream Gauges

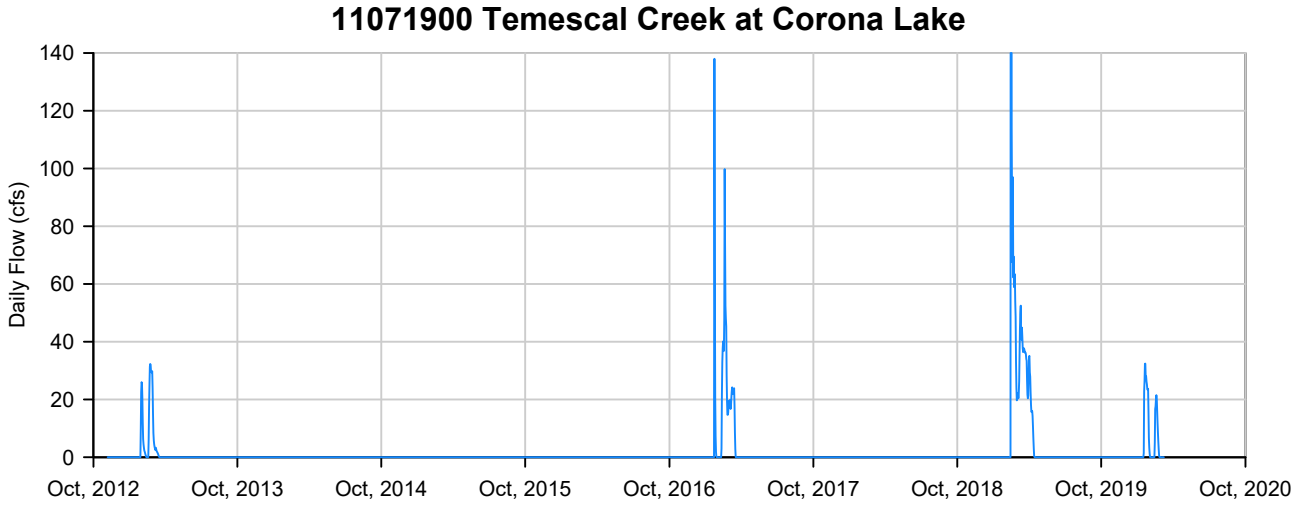
N

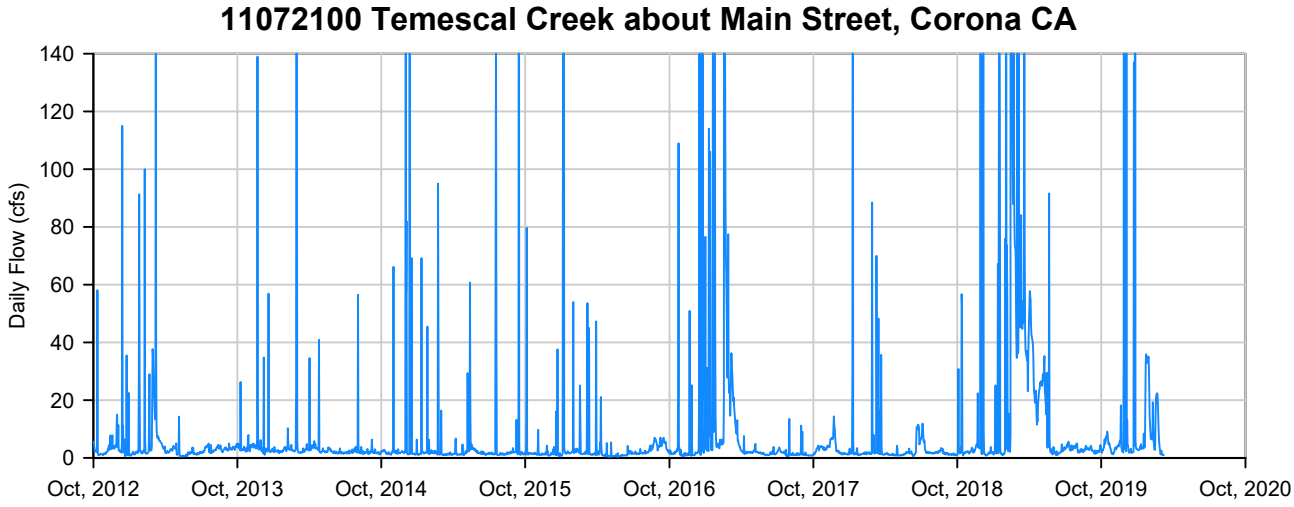
0 3,000 6,000
Scale in Feet

TODD GROUNDWATER

Figure 4-14
Local Watersheds and Gauging Stations



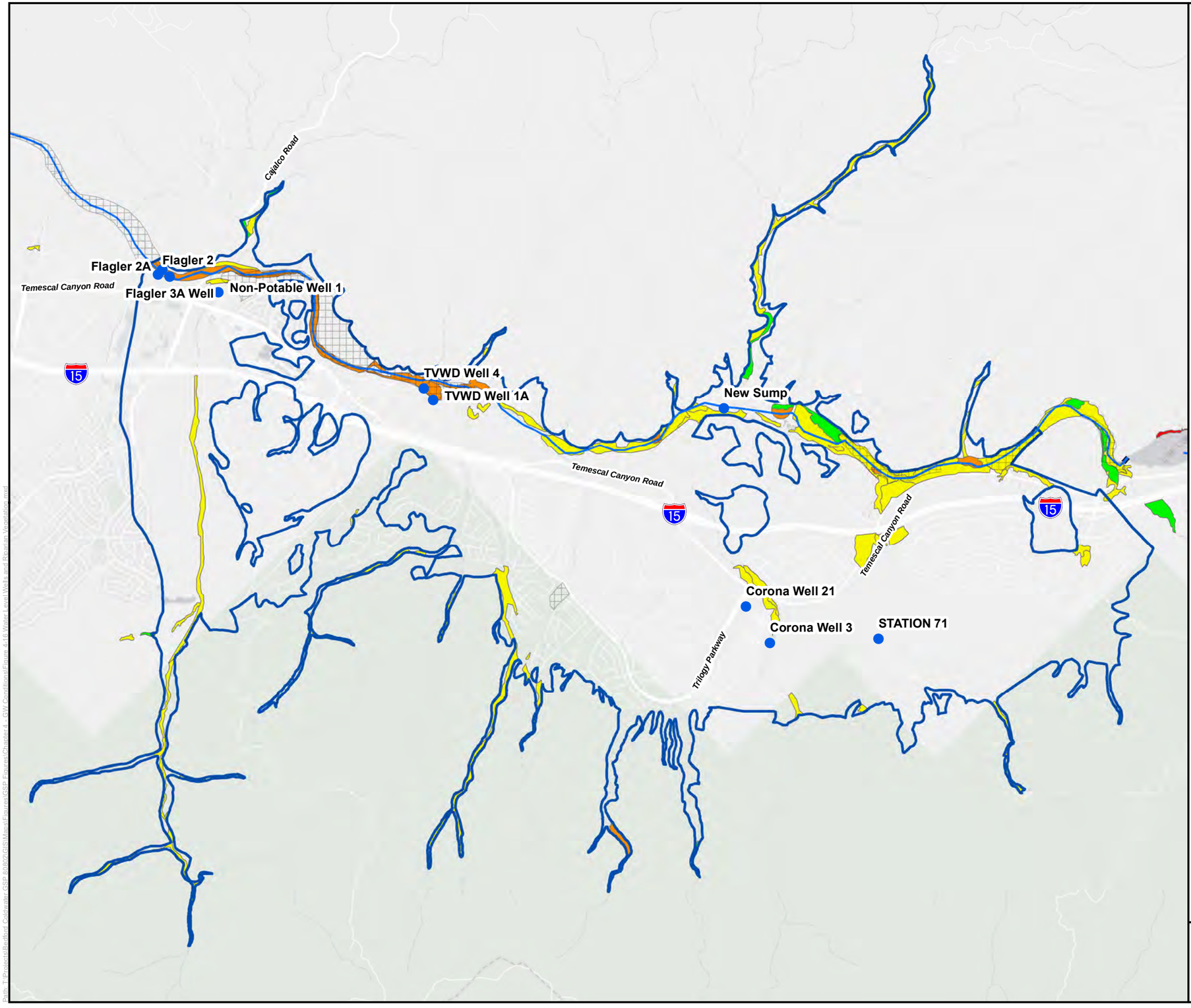




TODD GROUNDWATER

Figure 4-15
Local Streamflow
2013 through 2020

Path: T:\Projects\Bedford Coldwater GSP 80800\GRAPHICS\Figure 4-15 Local Streamflow 2013 through 2020.gpj



Recently Monitored Water Level Monitoring Wells

Dense riparian trees

Temescal Wash Unlined

Temescal Wash Flood Channel

Bedford-Coldwater Basin

Change in Normalized Difference Moisture Index (NDMI) 2012 to 2015

- 0 to 1
- -0.1 to 0
- -0.2 to -0.1
- -0.3 to -0.2
- < -0.3

N

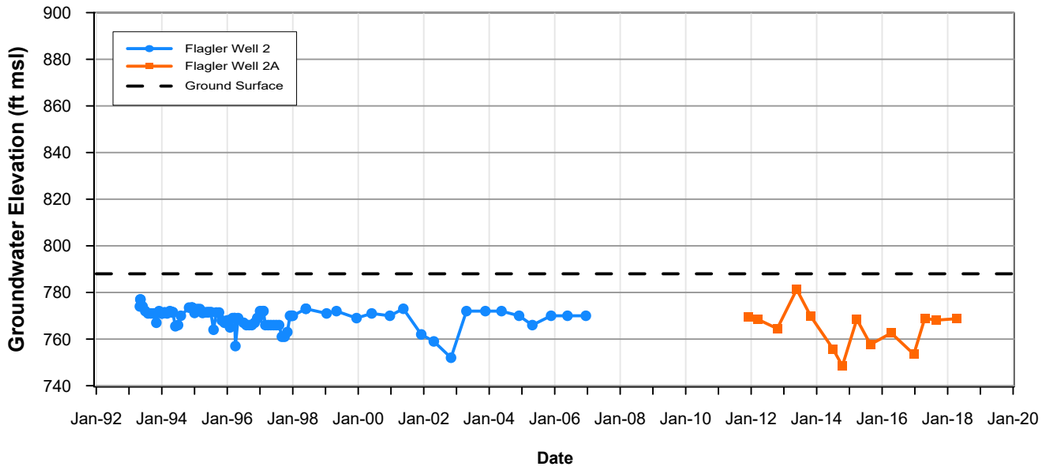
0 1,750 3,500

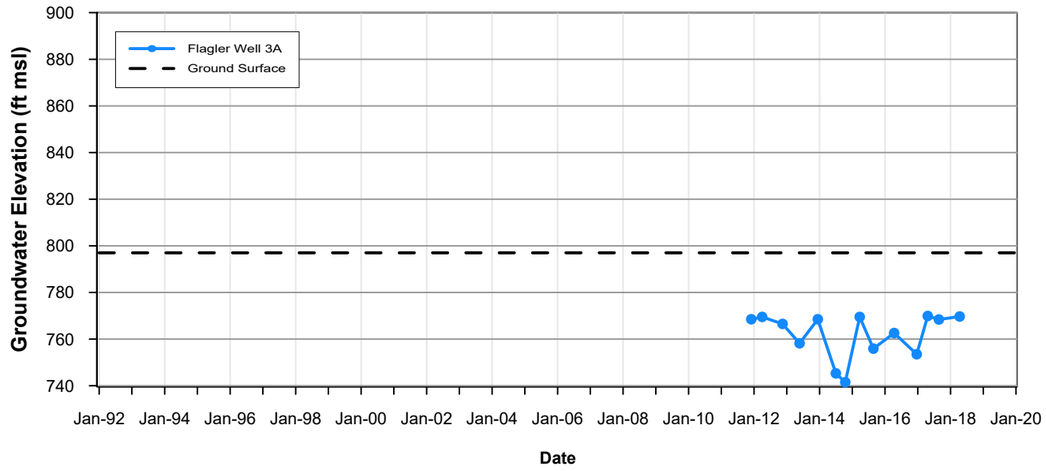
Scale in Feet

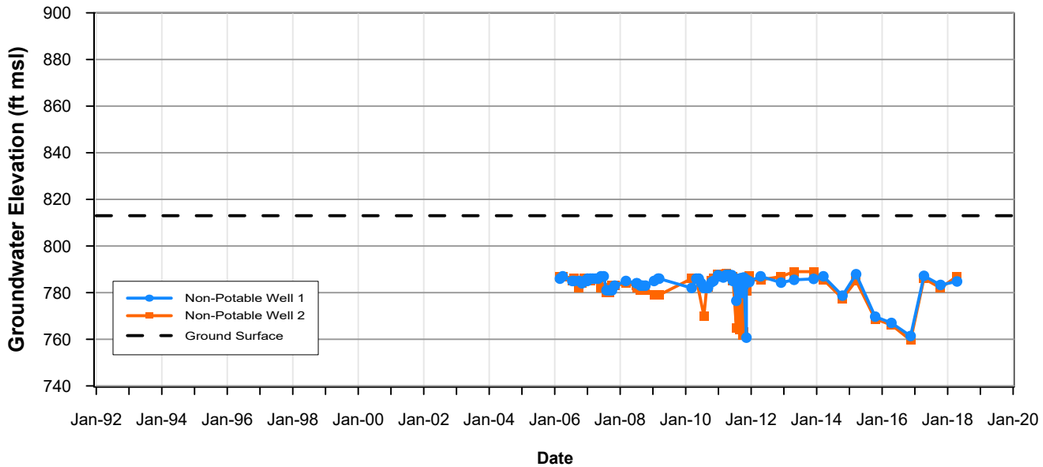
Data Source:
Nature Conservancy GDE Pulse,
https;//gde.codefornature.org/#/map

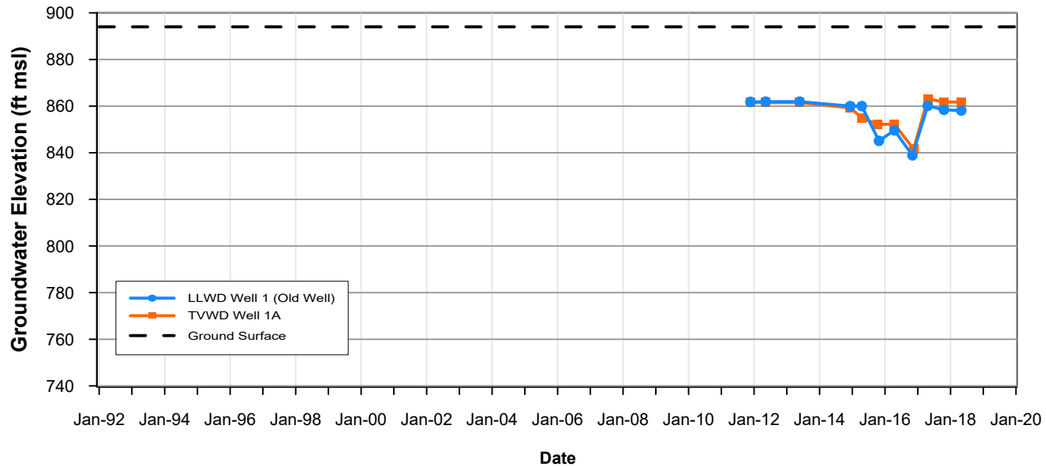
TODD GROUNDWATER

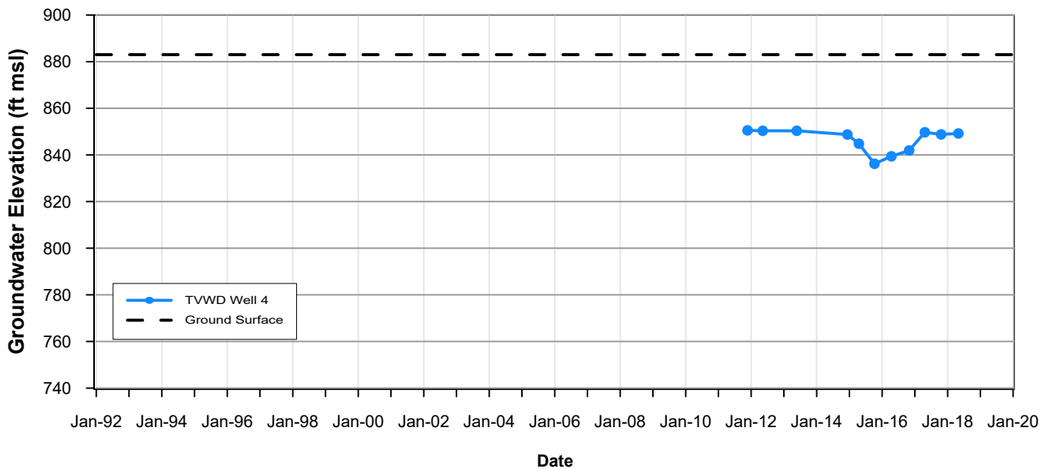
Figure 4-16
Water Level Monitoring Wells and Riparian Vegetation











TODD GROUNDWATER

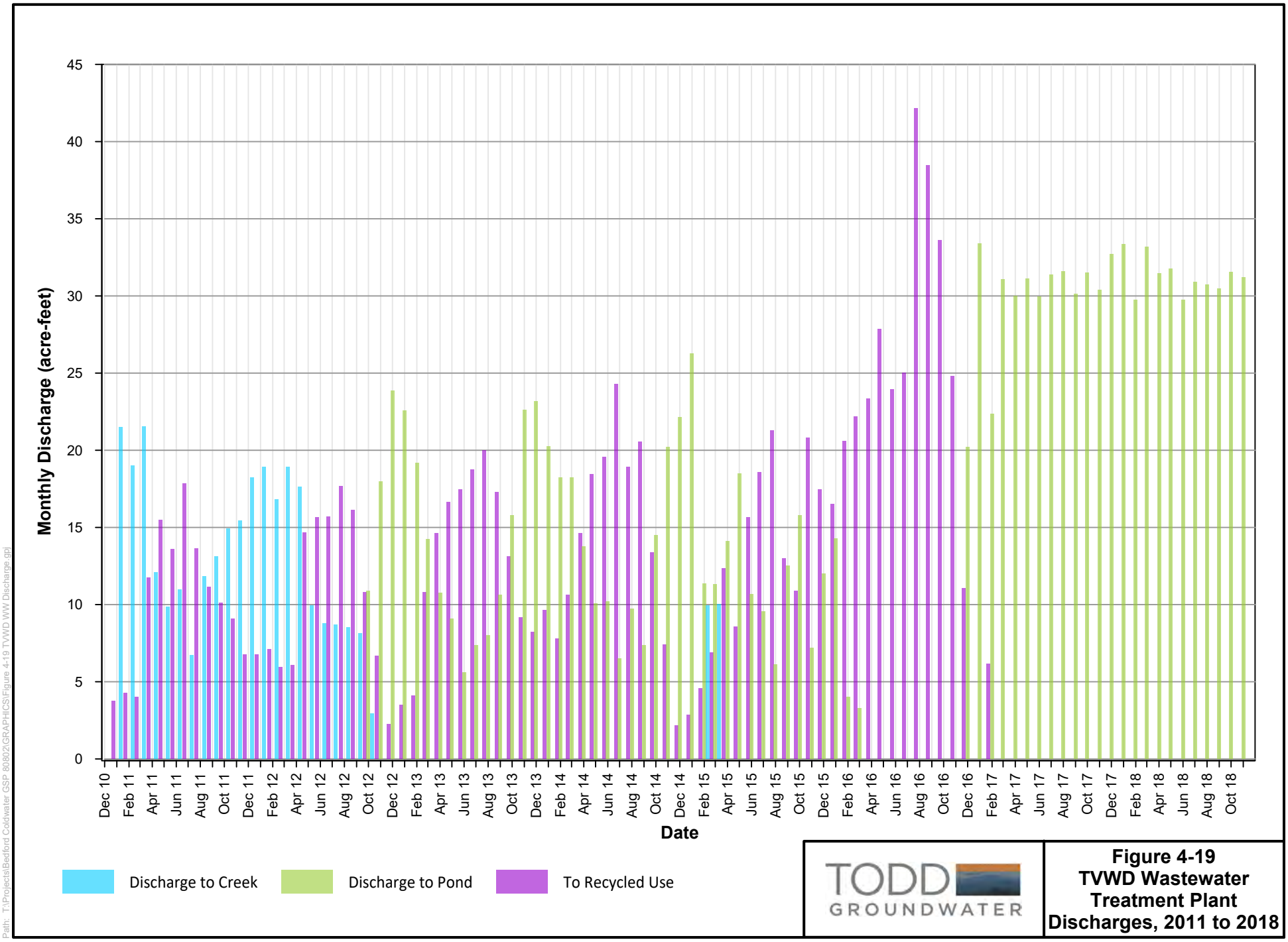
Figure 4-17
Hydrographs for Wells with Shallow Depth to Water

Path: T:\Projects\Bedford Co\Water GSP 8980\GRAPHICS\Figure 4-17 Hydrographs for Wells with Shallow Depth to Groundwater.ppt



TODD GROUNDWATER

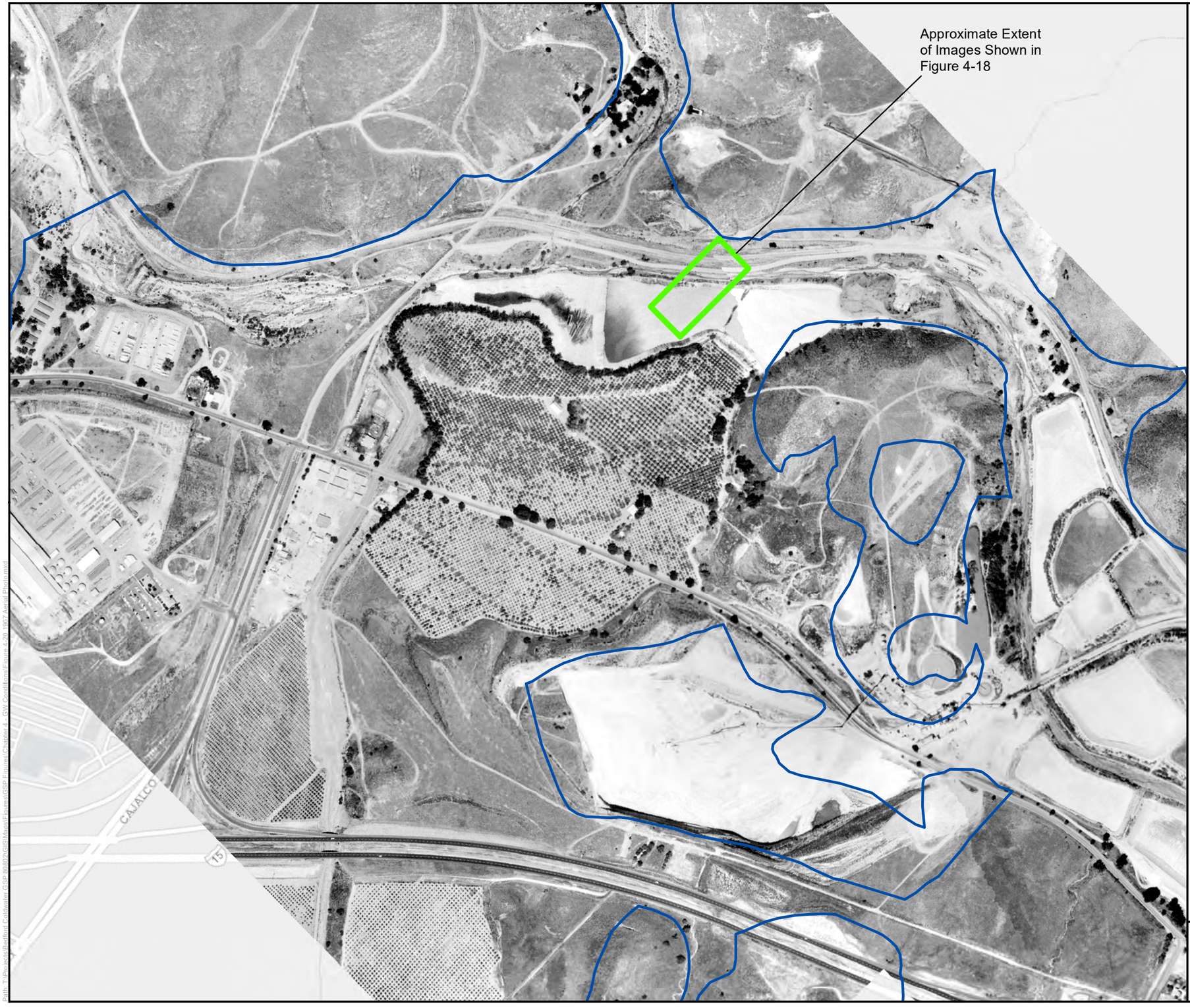
Figure 4-18
Recent Riparian Vegetation Aerial Imagery

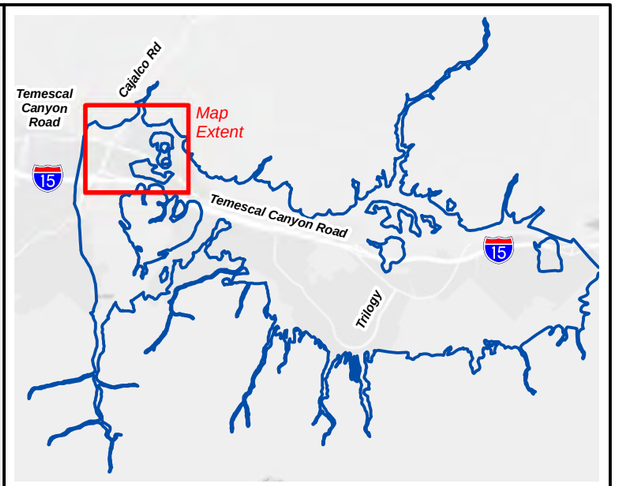


TODD GROUNDWATER

Figure 4-19
TVWD Wastewater Treatment Plant Discharges, 2011 to 2018

Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 4-19 TVWD WW Discharge.gpj





Bedford-Coldwater Basin

N

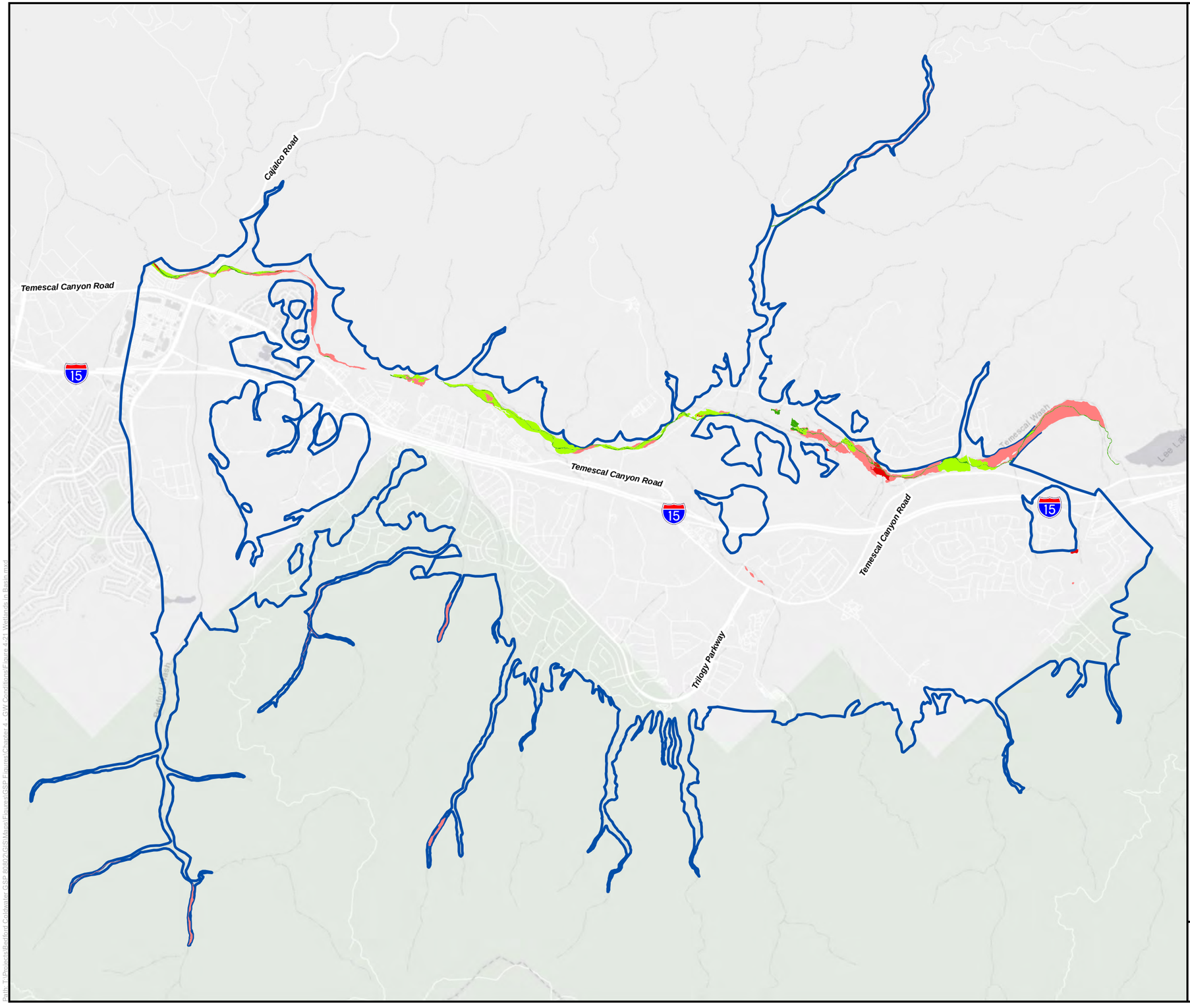
0 300 600

Scale in Feet

TODD GROUNDWATER

Figure 4-20
Aerial Photograph of Part of Temescal Wash in 1967

Path: T:\Projects\Bedford-Coldwater_GSP\MXD\GSP_Figures\Ch04_GW_Conditions\Fig4-20_1967AerialPhoto.mxd



NCCAG Wetlands in Basin

- Marsh, emergent, seasonally flooded
- Marsh, shrub-trees, seasonally flooded
- Riverine, normally flooded
- Riverine, seasonally flooded
- Bedford-Coldwater Basin

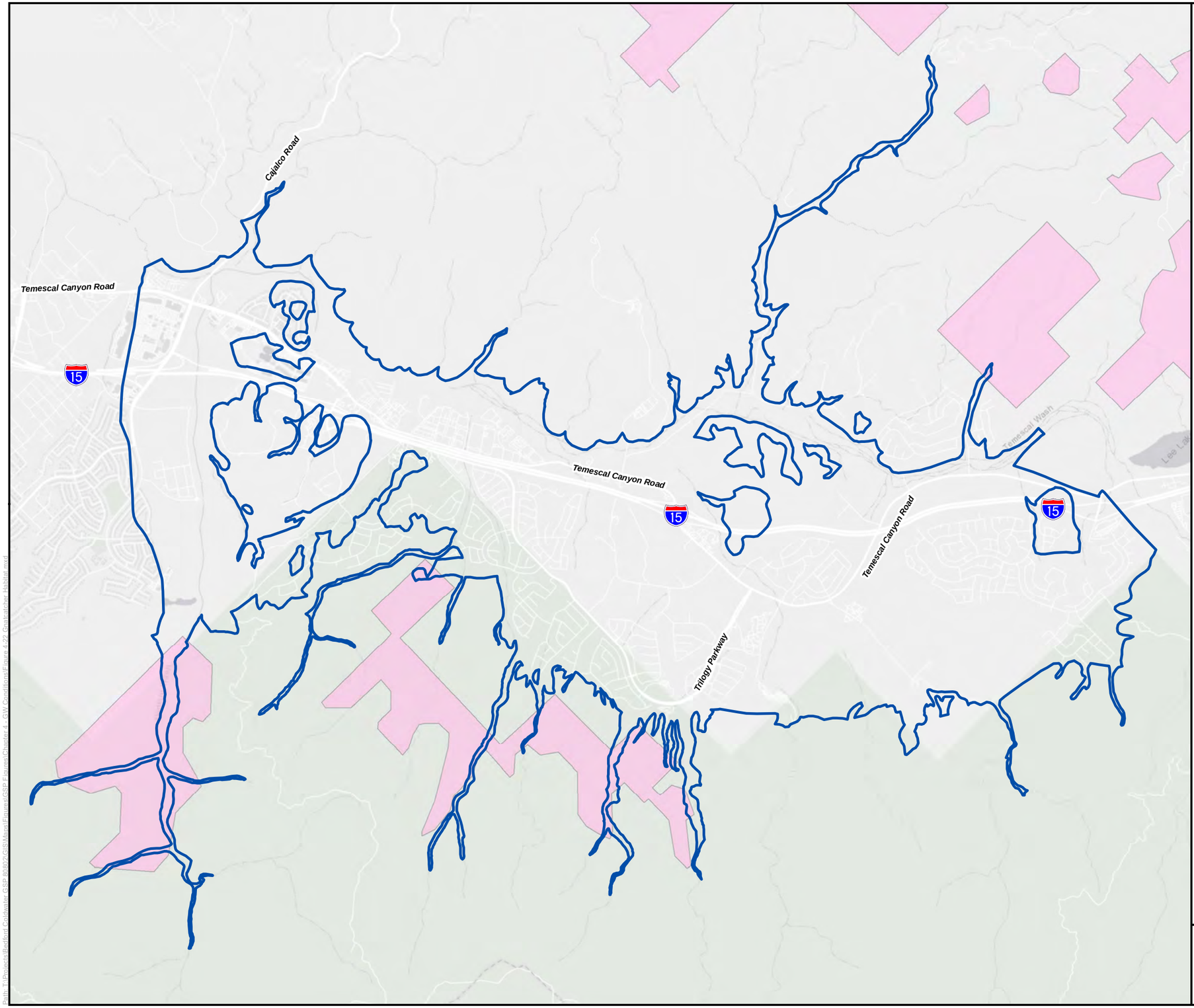
N

0 1,750 3,500

Scale in Feet

TODD GROUNDWATER

Figure 4-21
Wetlands in Basin



Bedford-Coldwater Basin

Coastal California Gnatcatcher Critical Habitat

N

0 1,750 3,500

Scale in Feet

Data Source:
US Fish and Wildlife Service habitat map tool
https;//ecos.fws.gov/ecp/report/table/critical-habitat.html

TODD GROUNDWATER

Figure 4-22
Coastal California Gnatcatcher Critical Habitat Area

Path: T:\Projects\Bedford Coldwater GSP 2022\GIS\mxd\Figures\Chapter 4 - GW Conditions\Figure 4-22 Gnatcatcher Habitat.mxd

5. WATER BUDGET

A water balance (or water budget) is a quantitative tabulation of all inflows, outflows, and storage change of a hydrologic system. The Sustainable Groundwater Management Act (SGMA) requires that water balances be prepared for the groundwater system and surface water system of a basin. If a basin contains multiple management areas, separate balances must be developed for each of them. Furthermore, water budgets must be developed for time periods representing historical, current, future no project (baseline), and future growth plus climate change (growth plus climate change) conditions.

This chapter presents the basis for selecting the water budget analysis periods, describes the boundaries and general characteristics of three management areas within the Bedford-Coldwater Subbasin (Basin), describes modeling tools used to estimate some water budget items, and presents the surface water and groundwater budgets.

5.1. WATER BUDGET METHODOLOGY

Annual balances were developed for water years 1990 through 2018, the period simulated by the numerical groundwater model. This interval was selected because it is a long hydrologic period for which important water budget data were available. The model is described in **Appendix G** and provides estimates for several components of the water balance for which direct measurements are not available: flows between groundwater and surface water bodies, flows to and from adjacent basins, evapotranspiration of riparian vegetation, and storage change. The numerical model allows a dynamic and comprehensive quantification of the water balance wherein all estimated water balance elements are reconciled and are calibrated to groundwater level changes over time. Accordingly, the numerical model is the best tool to quantify those water balance components. It will be updated regularly through the Groundwater Sustainability Plan (GSP) implementation process, providing a better understanding of the surface water-groundwater system and a tool to evaluate future conditions and management actions.

5.2. DRY AND WET PERIODS

Dry and wet periods in historical hydrology can be identified on the basis of individual years or sequences of dry and wet years. GSP Regulations require that each year during the water budget analysis period be assigned a water year type, which is a classification based on the amount of annual precipitation. **Figure 5-1** shows annual precipitation at Elsinore (National Oceanic and Atmospheric Administration (NOAA) Station GHCND:USC00042805) for water years 1899 through 2020. Water year types are also indicated and are assigned to five categories corresponding to quintiles of annual precipitation. The categories used here (dry, below normal, normal, above normal and wet) accurately describe the quintiles. These categories differ from the nomenclature commonly used in the Central Valley (critical, dry, below normal, above normal and wet) and elsewhere but do not accurately describe local categories and are based on the Sacramento River Index, which has little relevance to

conditions in the Basin. The quintile divisions for precipitation during 1899 to 2020 at the Lake Elsinore station are shown in **Table 5-1**.

Table 5-1. Water Year Type Classification (Lake Elsinore station)

Water Year Type		Range as Percent of Mean	Precipitation Range (inches)
Wet	W	>139	> 16.5
Above Normal	AN	101 to 139	12.0 to 16.5
Normal	N	75 to 101	8.9 to 12.0
Below Normal	BN	56 to 75	6.6 to 8.9
Dry	D	<56	< 6.6

Average precipitation for 1899 to 2020 was 11.88 inches per year

Individual wet and dry years are not particularly useful for groundwater management in basins where groundwater storage greatly exceeds annual pumping and recharge, which is the case in the Basin. In those basins, multi-year droughts and sequences of wet years are more relevant, because they relate to the amount of operable groundwater storage needed to support sustainable groundwater management. Multi-year wet and dry periods can be identified from a plot of cumulative departure of annual precipitation, which is also shown on **Figure 5-1**. Wet periods appear as upward-trending segments of the cumulative departure curve, and droughts appear as declining segments. By far the largest climatic deviations in this record were the sustained wet conditions from 1937 to 1944 and dry conditions from 1946 to 1965. These events pre-dated the most recent 30 years, which is the period that the California Department of Water Resources (DWR) states should be used for determining year types (DWR 2016c). They also pre-date the period simulated by the groundwater model. However, large wet and dry events like those could recur in the future, and it is prudent to consider climate uncertainty in planning for groundwater sustainability.

5.3. WATER BALANCE ANALYSIS PERIODS

GSP regulations require evaluation of the water balances over historical, current, and future periods. The historical period must include at least 10 years, and the future period must include exactly 50 years. The duration of the current period is not specified, but to be consistent with SGMA concepts it needs to include several years around 2015, which was the implementation date of SGMA. Historical and current analysis periods for the Basin were selected from within the 1990 through 2018 modeling period. Ideally, each period is characterized by average precipitation and relatively constant land and water use. Urbanization in the Basin has been gradual throughout the 1990 to 2018 period. The historical period is represented by water years 1993 through 2007, and the current period by water

years 2010 to 2013. Those periods had 101 percent and 102 percent of the 1899 to 2020 average annual rainfall, respectively.

The future period is intended to represent conditions expected to occur over the next 50 years. The model simulation period is only 29 years (1990 to 2018). To obtain a 50-year period, simulations of future conditions used the 1993 through 2017 sequence of rainfall and natural stream flow repeated twice. Average annual precipitation during 1993 to 2017 was 94 percent of the long-term average. For the baseline scenario, no adjustments were made to the hydrologic sequence. Adjustments made to simulate future climate change are described in following sections.

5.4. MANAGEMENT AREAS

As defined in the GSP regulations, a Management Area (MA) is an area within a basin for which the GSP may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors. The Basin has been divided into two MAs. They are described below and in more detail in **Appendix I**, and their boundaries are shown in **Figure 5-2**.

5.4.1. Bedford Management Area

The Bedford MA occupies roughly the eastern two-thirds of the Basin. It is separated from the Coldwater MA by the Glen Ivy Fault, which is a partial barrier to groundwater flow. The Bedford MA connects to the Elsinore Subbasin in the south and the Temescal Basin at the north end of the Basin. Some subsurface inflow from the Elsinore Subbasin to the south, and subsurface outflow to the Temescal Basin is also possible. Temescal Wash flows along the length of the Bedford MA. It also exits the north end of the Basin but traverses a bedrock reach before entering the Temescal Basin.

5.4.2. Coldwater Management Area

The Coldwater MA is the part of the Basin west of the Glen Ivy Fault. Because of downward movement on that side of the fault, Basin thickness is much greater than in the Bedford MA. A large open-pit aggregate mine is located in the southern part of this MA. Several streams enter the Coldwater MA from watersheds on the eastern slopes of the Santa Ana Mountains.

5.5. METHODS OF ANALYSIS

Complete, itemized surface water and groundwater balances were estimated by combining raw data (rainfall, stream flow, municipal pumping, and wastewater percolation from septic tanks and wastewater treatment plant discharge) with values simulated using models[3].

[3] Water balance values are shown to nearest acre-foot to retain small items, but entries are probably accurate to only two significant digits.

Collectively, the models simulate the entire hydrologic system, but each model or model module focuses on part of the system, as described below. In general, the models were used to estimate flows in the surface water and groundwater balances that are difficult to measure directly or that relate to time-dependent groundwater levels. These include surface and subsurface inflows from tributary areas, percolation from stream reaches within the Basin, groundwater discharge to streams, potential subsurface flow from the neighboring subbasin and between MAs, the locations and discharges of pumping wells, consumptive use of groundwater by riparian vegetation, and changes in groundwater storage. Descriptions of the inflows and outflows to the surface water and groundwater models are included below in Sections 5.6 and 5.7.

5.5.1. Rainfall-Runoff-Recharge Model

This Fortran-based model developed over a number of years by Todd Groundwater staff simulates hydrologic processes that occur over the entire land surface, including precipitation, interception[4], infiltration, runoff, evapotranspiration, irrigation, effects of impervious surfaces, pipe leaks in urban areas, deep percolation below the root zone, and shallow groundwater flow to streams and deep recharge. The model simulates these processes on a daily time step for 242 "recharge zones" delineated to reflect differences in physical characteristics as well as basin and jurisdictional boundaries. Simulation of watershed areas outside the Basin is included to provide estimates of stream flow and subsurface flow entering the Basin. Daily simulation results were subtotaled to monthly values for input to the groundwater model. Additional details regarding the rainfall-runoff-recharge model can be found in **Appendix G** and the model code is available on request.

5.5.2. Groundwater Model

The groundwater flow model uses the MODFLOW 2005 code developed by the United States Geological Survey (USGS) that is a public domain open-source software as required by GSP regulation §352.4(f)(3). The model produces linked simulation of surface water and groundwater, as described below. Additional documentation of the model and calibration is provided in **Appendix G**.

5.5.2.1. Surface Water Module

Stream flow in MODFLOW is simulated using the Streamflow Routing Package (SFR) where a network of stream segments represents the small streams entering the Basin from Temescal Wash and tributary watersheds.

Surface water inflows to Temescal Wash were obtained from a similar groundwater flow model of the Elsinore Subbasin. Small stream inflows were estimated using the rainfall-runoff-recharge model. Each stream segment is divided into reaches, one per model grid cell traversed by the segment. Flow is routed down each segment from reach to reach. Along each

[4] Interception refers to precipitation that does not reach the soil, but instead falls on (and is intercepted by) plant leaves, branches, and plant litter, and is subject to evaporation loss.

reach mass balance is conserved in the stream, including inflow from the upstream reach and tributaries, inflow from local runoff, head-dependent flow across the stream bed to or from groundwater, evapotranspiration losses and outflow to the next downstream reach. Flow across the stream bed is a function of the wetted channel length and width, the bed permeability and the difference in elevation between the stream surface and groundwater at the reach cell. Wetted width and depth of the stream are functions of stream flow.

5.5.2.2. Groundwater Module

The MODFLOW groundwater model is constructed to cover the entire Basin. The model grid size is oriented at 40 degrees west of north (N40W) so that it is oriented consistent with the key hydrologic features including streams and faults. The model grid size uses a uniform 100 feet (ft) horizontal grid spacing to provide sufficient resolution to resolve hydraulic gradients, well drawdown cones, and groundwater-surface water interactions in the Basin.

The Basin extends up a number of narrow tributary stream canyons. These narrow canyons can be problematic to simulate using MODFLOW because they can cause difficult numerical stability issues. To limit these effects, the model grid extends up these canyons until the canyon is less than 3 grid cells wide, or to the extent where the alluvial sediments are regularly saturated. Areas upstream of these locations have been simulated using boundary conditions to estimate inflows based on groundwater conditions and surface water model results.

The numerical model has been constructed to reflect the hydrogeological conceptual model developed for the GSP. The vertical extent of the Basin is based on the mapped depth to consolidated rock. The elevation of surface features and streambed elevations have been derived from geographic information system (GIS) files developed from the local topography and stream information.

Citrus orchards irrigated with groundwater were common in the Basin in the early 1990s, but except for one small grove in the Coldwater MA those have all been replaced by urban development. The citrus orchards present in the early 1990s were almost all replaced by urban development by 2018. Agricultural irrigation pumping of these orchards was estimated by the rainfall-runoff-recharge model, with pumping assigned to a hypothetical irrigation well at the center of each irrigated recharge zone. This pumping was phased out over time as urban development occurred. Urban irrigation is supplied by the municipal water system, which uses imported water and local wells. Municipal well extractions are known and are entered directly into the model. All major pumpers in the Basin report their annual production to WMWD, which was the source of data for several non-municipal pumping wells. Pumping at private domestic wells is not reported and is not included in the model. The number of those wells is thought to be small, and their total production is almost certainly negligible in the context of the overall Basin water budget.

5.5.3. Simulation of Future Conditions

GSP regulations §354.18(c)(3) require simulation of three future scenarios to determine their effects on water balances, yield, and sustainability indicators. For this scenario, the growth and climate change scenarios were combined, resulting in the following two scenarios:

> **Baseline.** This represents a continuation of existing land and water use patterns, imported water availability, and climate.
>
> **Growth Plus Climate Change.** This scenario implements anticipated changes in land use and associated water use, such as urban expansion, and anticipated effects of future climate change on local hydrology (rainfall recharge and stream percolation) and on the availability of imported water supplies.

Both the future simulations assume a constant level of development and related water demand in the Basin. Development in the growth plus climate change simulation is not phased in over time. This is the best way to demonstrate whether 2068 land use is sustainable because it allows for assessment of the effects of variations in climactic conditions (wet and dry cycles) on groundwater conditions, avoids subjective decisions about the concurrent timing of droughts and development, and provides time for the full effect of future conditions on groundwater to become apparent.

5.5.3.1. Baseline Scenario

The baseline simulation is a 50-year period, as required by SGMA regulations, with water budget components developed using the criteria and assumptions described below. Initial water levels are simulated water levels for September 2018 from the historical calibration simulation. That year represents relatively recent, non-drought conditions. These simulated water levels are internally consistent throughout the model flow domain and reasonably matched measured water levels at wells with available data (see **Appendix G** for discussion of model calibration).

Surface water and other inflows came from multiple sources. Monthly inflows in Temescal Wash were obtained from the baseline and growth plus climate change simulations produced by the Elsinore Subbasin groundwater model (Carollo and Todd 2021), which is concurrently being used to develop the GSP for that Subbasin. Small stream and bedrock inflows simulated for 1993 to 2017 of the calibration model period were repeated twice to obtain 50 years of data.

In the baseline scenario, land use remains the same as the current conditions. In the model, land use is represented by 2014 land use mapped by remote sensing methods and obtained from DWR, adjusted for subsequent urbanization identified in Google Earth imagery.

Municipal, commercial, and industrial (M&I) and private pumping were assumed to remain at existing levels. Initial estimates were obtained by calculating average pumping for each calendar month during 2010 through 2018 and applying those averages in every year of the

future simulation. This approach omits additions to and withdrawals from Coldwater MA storage accounts by the three municipal agencies with wells in that MA. Municipal use of imported water was also assumed to remain at existing levels. From the standpoint of the groundwater budget, total municipal water use was used only to estimate pipe leaks. Use of imported water by the Temescal Valley Water District (TVWD) was obtained from that agency's 2015 Urban Water Management Plan (RMC and Woodard & Curran 2017), and imported water use in the parts of the City of Corona (Corona) and Elsinore Valley Municipal Water District (EVMWD) service areas within the Basin were assumed to be the same on a per-acre basis for developed areas.

The Baseline scenario also assumes wastewater percolation and recycling continue as they have in recent years. Discharges from the TVWD Water Reclamation Facility (WRF) to Temescal Wash were discontinued in 2013. All of the plant outflow is recycled for irrigation during spring, summer, and fall (assumed April through November), and most or all of it is percolated in ponds at the WRF when irrigation demand is low (December through March).

5.5.3.2. Growth Plus Climate Change Scenario

The growth plus climate change scenario incorporated anticipated effects of climate change, urban development, and associated changes in water and wastewater management. In this scenario, rainfall and reference evapotranspiration (ET_0) were adjusted to 2070 conditions using monthly multipliers developed by DWR based on climate modeling studies. The multipliers were applied to historical monthly data for the 1993 to 2017 hydrologic period used in the model. DWR prepared a unique set of multipliers for each foursquare kilometer (km^2) cell of a grid covering the entire state. Nine climate grid cells overlie the Basin and its tributary watershed areas. For each recharge analysis polygon in the rainfall-runoff-recharge model, multipliers from the nearest climate grid cell were used. The climate in 2070 is expected to be drier and warmer than at present.

Figure 5-3 compares average monthly precipitation and ET_0 before and after applying the climate change multipliers. Simulations of irrigated turf in the rainfall-runoff-recharge model indicated that the combined effect of the warmer and drier climate will be to increase annual irrigation demand by about 10 percent.

In the growth plus climate change scenario, bedrock inflow and surface inflow from tributary streams along the perimeter of the Basin were re-simulated using the rainfall-runoff-recharge model to reflect the effects of urban development in some of the tributary watersheds and of climate change. Urbanization also increased surface runoff within the Basin, which was routed to small streams and Temescal Wash.

Projected land use in 2068, shown in **Figure 5-4,** was developed on the basis of population projections, land use designations in the Temescal Canyon Area Plan (Riverside County 2018), assumed urban infill, and topography. A comparison of land use acreage by land use category and management area for 1990, 2018, and 2068 is shown in **Table 5-2**. Conversion of grassland to residential land use was the dominant change in both management areas and also occurred in tributary watershed areas.

Total municipal water use in 2068 was estimated to be double the amount in 2018. This estimate is an approximate average of several factors. The Temescal Canyon Area Plan (Riverside County 2018) assigns developed land uses to almost the entire Basin area, and the area of undeveloped lands is presently about equal to the area of developed lands. Thus, the amount of developed land could plausibly double. However, the Area Plan also included estimates of future population that would extrapolate to a 2068 population only 58 percent greater than the current population. Finally, TVWD's 2015 Urban Water Management Plan (RMC and Woodard & Curran 2017) included projections of future water use out to 2040. Extrapolating those trends to 2068 indicates water use 1.55 times greater than in 2015.

For the growth plus climate change scenario, average annual groundwater pumping in the Coldwater MA was assumed to equal average historical pumping during 2010 through 2017, with an increase proportional to the estimated amount of irrigation return flow from future increased use of imported water. In the Bedford MA, average annual groundwater pumping was assumed to be equal to 2020 production volumes. Municipal pumping in Coldwater was distributed among wells in proportion to their averages during 2010 to 2017 and in Bedford it was distributed as recorded in 2020. All remaining municipal water use was assumed to be obtained from imported water.

Water pipe leak rates in the EVMWD and City of Corona service areas were assumed to decrease to 5 percent of delivered water from the rates reported in the 2015 Urban Water Management Plans (7.0 percent and 6.6 percent, respectively). The leak rate in the TVWD service area was assumed to continue at the low rate reported in 2015 (2 percent).

Wastewater generation was assumed to double by 2068, in proportion to the increase in total urban water use. Wastewater disposal was assumed to change, however. In recent years more of the outflow from the TVWD WRF has been percolated in ponds than has been recycled for irrigation. This proportion was assumed to reverse, such that all outflow would be recycled for irrigation during April through November and all would be percolated in ponds during November through March. The small discharge from Corona WRF-3 to Temescal Wash at the northern end of the Basin was assumed to be eliminated, consistent with the City of Corona's plans to decommission that WRF.

In the growth plus climate change scenario, mining operations were assumed to have ended and the mine areas to have been converted to stormwater control facilities with groundwater recharge capacity during high runoff periods.

Table 5-2. Bedford-Coldwater Basin Land Use in 1990, 2018 and 2068 (acres)

Land Use	Bedford MA			Coldwater MA			Tributary Watersheds		
	1990	2018	2068	1990	2018	2068	1990	2018	2068
Citrus	1,261	0	0	719	32	32	0	0	0
Grassland	2,403	1,603	413	187	103	33	16,703	16,429	16,174
Shrubs/Trees	368	144	64	173	138	82	13,777	13,693	13,693
Dense riparian	256	159	159	8	27	27	0	0	0
Sparse riparian	303	303	303	0	0	0	0	0	0
Open water	0	0	0	0	0	0	0	0	0
Low-density residential	199	529	485	66	88	88	0	0	0
Residential	179	1,379	2,725	76	405	606	0	94	327
Turf	7	263	326	0	170	226	0	85	107
Commercial	0	30	671	24	33	50	0	0	0
Industrial	232	469	469	0	0	0	0	0	0
Quarry	434	252	252	441	588	588	365	555	555
Vacant	785	1,232	561	38	148	0	0	0	0

5.6. SURFACE WATER BALANCE

This section describes and quantifies the water balance of creeks and rivers that cross the Basin. All significant inflows to and outflows from these surface water bodies are included in the water balance. The surface water balance shares two flows in common with the groundwater balance: 1) percolation from surface water to groundwater and 2) seepage of groundwater into surface water. Each of these is an outflow from one system and an inflow to the other.

Annual surface water balances during 1990 to 2018 were compiled from monthly data for each MA, and average annual water balances were calculated for each of the three analysis periods (1993 to 2007 and 2010 to 2013 for the historical simulation, and 2019 to 2068 for the future simulations). Key features of the surface water balances for each management area and analysis period are described below, followed by additional information about the methods used to quantify items in the water balances.

Historical annual surface water balances for the Bedford MA during 1990 to 2018 are shown in **Figure 5-5** (upper graph). Average annual surface water budgets for the model, historical, current, and future budget analysis periods are listed in **Table 5-3** and detailed surface water budget tables are included in **Appendix J**. Inflow occurs predominantly in wet years and derives from Temescal Wash, east side tributaries and runoff, and streams entering from the Coldwater MA, in descending order of magnitude. Outflow is almost entirely surface outflow in Temescal Wash to Temescal Basin.

In the baseline simulation, discharges of reclaimed water to Temescal Wash consisted only of the small flows from Corona WRF-3; TVWD WRF discharges had already ceased in 2013. Other inflows to the Bedford MA were close to the magnitudes of those flows during the historical and current periods. In the growth plus climate change scenario, Temescal Wash inflows from the Elsinore Subbasin were slightly larger due urbanization and wastewater discharges in that area. Local tributary inflows were slightly reduced due to the warmer, drier climate. There was little change in net stream percolation and outflow to the Temescal Basin.

Annual surface water balances for the Coldwater MA are also shown in **Figure 5-5** (middle graph) and **Table 5-3**. The only inflow of significance is from tributary streams draining the eastern slopes of the Santa Ana Mountains. Those inflows decreased somewhat under the growth plus climate change scenario because of warmer, drier climatic conditions. Less inflow led to less stream percolation (33 percent lower than historical) and less outflow to the Bedford MA (14 percent lower than historical).

A substantial amount of water is imported into the Basin. It is delivered directly to users and does not flow into streams or lakes. Imports began in 1992, and annual amounts since then are shown in **Figure 5-5** (bottom graph). Imported water consists of State Water Project (SWP) water purchased from the Metropolitan Water District of Southern California (Metropolitan) and delivered to TVWD through the Temescal Valley Pipeline.

Table 5-3. Average Annual Surface Water Budgets

Inflow or Outflow	Bedford Management Area				Coldwater Management Area			
	Historical 1993 to 2007	Current 2010 to 2013	Baseline[1] 2019 to 2068	Growth Plus Climate Change[1] 2019 to 2068	Historical 1993 to 2007	Current 2010 to 2013	Baseline[1] 2019 to 2068	Growth Plus Climate Change[1] 2019 to 2068
Inflows								
Temescal Wash	13,560	10,761	10,892	12,857	0	0	0	0
Tributary inflow	8,201	8,522	7,412	6,477	6,280	6,164	5,278	4,611
Wastewater discharges	712	1,227	60	0	0	0	0	0
Groundwater flow into streams	791	1,137	990	1,380	16	2	2	1
Total Inflows	23,264	21,646	19,354	20,714	6,296	6,166	5,279	4,612
Outflows								
Stream percolation	-1,564	-2,015	-1,661	-1,714	4,160	3,216	2,780	2,779
Surface outflows	-21,700	-19,631	-17,693	-19,000	2,136	2,950	2,499	1,834
Total Outflows	-23,264	-21,646	-19,354	-20,714	6,296	6,166	5,279	4,612

[1] The 50-year future baseline simulation uses historical hydrology for 1993 to 2017 two times in succession.

5.6.1. Inflows to Surface Water

5.6.1.1. Precipitation and Evaporation

Precipitation and evapotranspiration on the land surface are accounted for in the rainfall-runoff-recharge model. Those processes are not included in the surface water balances, which address only water in stream channels, lakes, and imported water. Precipitation and evaporation on the surface of creeks and rivers are invariably miniscule percentages of total stream flow and are not included in the water budget.

5.6.1.2. Tributary Inflows

Tributary inflows to the Basin are from Temescal Wash and tributary watersheds along the east and west sides of the Basin. Temescal Wash inflows were obtained from the Elsinore Subbasin groundwater model. Surface inflows from nine Santa Ana Mountain watersheds that discharge to the Coldwater MA were estimated using the rainfall-runoff-recharge model, with daily flows subtotaled to monthly flows for input to the groundwater model. Inflows from six eastside tributary watersheds that discharge to the Bedford MA were similarly simulated.

5.6.1.3. Valley Floor Runoff

The rainfall-runoff-recharge model simulates runoff from valley floor areas, which include impervious surfaces in urban areas. Runoff from valley floor areas was added to flows in tributary streams or Temescal Wash at several locations.

5.6.1.4. Wastewater Discharges

Reclaimed water was discharged from TVWD WRF to Temescal Wash beginning around 1991 and gradually increasing to about 2 cubic feet per second (cfs) during 2008 to 2012. Discharges ceased after that as TVWD increased its capacity to percolate the water in winter and recycle it for irrigation in summer. The City of Corona's WRF-3 discharges small amounts of reclaimed water to Temescal Wash near the downstream end of the Basin, averaging about 0.2 cfs but increasing to as much as 0.6 cfs in some winters. The City plans to decommission this plant and route its inflow to WRF-1 in the Temescal Basin in Corona.

5.6.1.5. Groundwater Discharge to Streams

Groundwater discharges into streams when the adjacent water table is higher than the stream bed or the water level in the stream. This occurs sometimes along Temescal Wash in the Bedford MA. Because groundwater levels fluctuate over time, estimates of these discharges were obtained from the groundwater model.

5.6.2. Outflows of Surface Water

5.6.2.1. Net Evaporation

Evaporation from streams is almost always a negligible fraction of total flow and is not explicitly itemized in the water budgets or simulated in the model.

5.6.2.2. Surface Water Percolation to Groundwater

In wet years, percolation from streams along the reaches between the Basin boundary and Temescal Wash is a significant outflow of surface water. Along Temescal Wash in the Bedford MA, the Wash gains flow from groundwater in some reaches and loses it to groundwater in others, depending on the relationship between the stream surface and adjacent groundwater table. These exchanges vary in time as well as location, but over the long run they are of generally similar magnitudes. Because of this dynamic interaction between surface water and groundwater, estimates of flows across the bed of Temescal Wash were obtained from the groundwater model.

5.6.2.3. Surface Outflow from Management Areas and the Basin

Surface outflow from the Coldwater MA to the Bedford MA was calculated by subtracting net percolation losses along the tributary streams from their inflows at the Basin boundary. The net losses were simulated by the groundwater model. Surface outflow in Temescal Wash to the Temescal Basin was calculated as the residual in the surface water balance for the Bedford MA.

5.7. GROUNDWATER BALANCE

Annual groundwater inflows and outflows for each management area for the 1990 to 2018 model simulation period are shown as stacked bars in **Figure 5-6**. Inflows are stacked in the positive (upward) direction and outflows are stacked in the negative (downward) direction. A similar stacked-bar chart for the baseline simulation is shown in **Figure 5-7** and for the growth plus climate change simulation in **Figure 5-8**. Average annual groundwater budgets for each MA and budget analysis period are listed in **Table 5-4** and detailed groundwater budget tables are included in **Appendix J**. Highlights of the water budgets are described below, followed by additional information on methods used to quantify each budget item.

In the Bedford MA, the major inflow is percolation from streams especially during wet years. In recent years (2012 to 2018), reclaimed water percolation has become another major inflow. The major outflows include M&I pumping and groundwater discharge to streams. Historically, agricultural pumping also has contributed to outflow from the basin but decreased to a negligible amount by 2007.

Percolation from streams—principally Temescal Wash—was similar across all analysis periods. This was because Temescal Wash inflows increased under the growth plus climate change scenario, offsetting decreased inflow from local tributary streams. Meanwhile, total pumping increased by 71 percent from the historical to the growth plus climate change scenario, which resulted in a slight increase in induced percolation from the Wash. The small increase in bedrock inflow under the growth plus climate change scenario was because urbanization of parts of the tributary watersheds produced enough additional recharge to more than offset the effects of climate change. Subsurface inflow progressively decreased and subsurface outflow increased from the historical period to the growth plus climate change scenario. This was caused by declining water levels in the Coldwater MA, which

reversed the direction of flow across the boundary between the MAs around the end of the historical period. Recharge from pipe leaks roughly doubled due to urbanization but remained a small fraction of total inflows (five percent) because of TVWD's low reported pipe leak rate.

Overall in the Bedford MA, both future scenarios show increases in reclaimed water percolation.

Outflows in both scenarios also increased. The net result is a slightly decreased change in storage over the historical period, but the basin is still expected to have a positive change in storage (more inflow than outflow) under future conditions, even under growth and climate change projections.

In the Coldwater MA, percolation from streams occurs as infrequent, episodic events. As shown in **Figure 5-6**, percolation can range from 15,000 acre-feet (AF) in wet years to no stream percolation in dry years. M&I pumping has dominated basin outflows although it has decreased from its peak in the late 1990s. Similar to the Bedford MA, agricultural pumping was an outflow historically but decreased to negligible by 2001.

The differences between the historical, current, and future scenarios stem mostly from the years selected for inclusion in the averaging. Bedrock inflow decreased slightly in the growth plus climate change scenario because of the warmer, drier climatic conditions. The increase in dispersed recharge on both irrigated and non-irrigated lands under the growth plus climate change resulted from urbanization. A fraction of runoff from impervious surfaces is assumed to flow to adjacent pervious soils, creating localized concentrated recharge. This was included in the recharge for non-irrigated lands. As in the Coldwater MA, pipe leaks increased due to urbanization but remained only four percent of total inflows.

Overall in the Coldwater MA, in both future scenarios inflows significantly increase from dispersed rechange over non-irrigated land. Outflows are expected to decline as M&I pumping is projected to be limited in the future based on agreements between the GSA agencies. The combined increased inflow and decreased outflow results in significantly increased storage in future conditions, which reverses the historical water level declines in the Coldwater MA.

Table 5-4. Average Annual Groundwater Budgets

Water Balance Items	Bedford Management Area					Coldwater Management Area				
	Historical 1993 to 2007	Current 2010 to 2013	Historical 1993 to 2017	Baseline[1] 2019 to 2068	Growth Plus Climate Change[1] 2019 to 2068	Historical 1993 to 2007	Current 2010 to 2013	Historical 1993 to 2017	Baseline[1] 2019 to 2068	Growth Plus Climate Change[1] 2019 to 2068
Groundwater Inflow										
Subsurface inflow	480	103	353	102	93	10	90	41	34	48
Percolation from streams	1,564	2,015	1,516	1,661	1,714	4,160	3,216	3,327	2,780	2,779
Bedrock inflow	867	816	819	776	828	583	526	536	467	435
Dispersed recharge: non-irrigated land	776	1,040	740	929	1,031	327	487	330	1,164	1,575
Dispersed recharge: irrigated land	792	578	674	559	940	468	336	396	289	396
Pipe leaks	126	156	143	33	92	30	39	35	17	32
Reclaimed water percolation	391	587	638	1,868	2,161	0	0	0	0	0
Quarry recharge	85	21	92	162	471	0	0	0	0	0
Total Inflow	**5,080**	**5,315**	**4,974**	**6,090**	**7,331**	**5,579**	**4,694**	**4,665**	**4,751**	**5,264**
Groundwater Outflow										
Subsurface outflow	-179	-370	-205	-498	-423	-92	0	-55	-15	-7
Wells - M&I and domestic	-1,235	-577	-1,110	-1,315	-1,895	-5,802	-2,969	-4,787	-3,002	-3,072
Wells - agricultural	-728	-65	-460	0	0	-929	-186	-623	-40	-88
Groundwater discharge to streams	-791	-1,137	-786	-990	-1,380	-16	-2	-10	-2	-1
Riparian evapotranspiration	-482	-732	-512	-760	-1,015	-285	-234	-281	-154	-168
Quarry Operations / Losses	-1,447	-1,845	-1,663	-2,422	-2,466	-606	-595	-653	0	0
Total Outflow	**-4,863**	**-4,726**	**-4,737**	**-5,986**	**-7,179**	**-7,730**	**-3,986**	**-6,410**	**-3,212**	**-3,337**
Net Change in Storage										
Inflows minus outflows	217	589	237	104	152	-2,152	708	-1,744	1,539	1,927

[1]: The 50-year future simulation uses historical hydrology for 1993 to 2017 two times in succession.

5.7.1. Inflows to Groundwater

Inflows to the groundwater flow system in both MAs are dominated by rainfall recharge and stream percolation, which vary widely from year to year depending on hydrologic conditions. Variations in bedrock inflow from tributary watersheds is steadier because flow through fractured bedrock in those watersheds attenuates the recharge pulses that occur in wet years. Urban sources of recharge including irrigation return flow and pipe leaks are less variable from year to year but gradually increased during the simulation period in parallel with urban growth.

5.7.1.1. Dispersed Recharge from Rainfall and Irrigation

Dispersed recharge from rainfall and applied irrigation water is estimated by the rainfall-runoff-recharge model. The model simulates soil moisture storage in the root zone, with inflows from rainfall infiltration and irrigation, and outflows to evapotranspiration and deep percolation. Simulation is on a daily basis. In recharge zones with irrigated crops—which includes urban landscaping and agricultural irrigation (citrus)—irrigation is assumed to be applied when soil moisture falls below a certain threshold. When soil moisture exceeds the root zone storage capacity, the excess becomes deep percolation. Rainfall and irrigation water comingle in the root zone and in deep percolation. For the purposes of displaying an itemized water balance, the amount of deep percolation derived from irrigation is estimated as a percentage of the simulated irrigation quantity, and the remainder of the dispersed recharge is attributed to rainfall. Deep percolation of applied irrigation water (irrigation return flow) is generally similar from year to year, whereas rainfall percolation varies significantly on an annual basis. Because urban landscape irrigation increased while agricultural irrigation decreased during the simulation period, total recharge on irrigated lands decreased only slightly. Water pipe leaks were estimated as the percentage of unaccounted for water listed in the 2015 Urban Water Management Plan (eight percent of delivered water, RMC and Woodard & Curran), distributed uniformly over areas of urban land use. Sewer pipes convey only water used indoors, and their leak rate was assumed to be half of the leak rate for water pipes. The one-dimensional dispersed recharge rates are multiplied by the surface area of each recharge zone to obtain volumetric flow rates, and those are subtotaled by management area.

Figure 5-9 shows a map of average annual dispersed recharge during 1993 to 2007. Although this period does not reflect the most current land use, it is a relatively long averaging period that includes a wide range of year types. Most dispersed recharge occurs during relatively wet years. Average annual recharge rates ranged from less than 0.4 to slightly over 13 inches per year (in/yr). Within the Basin, land use had the largest effect on recharge, with residential land uses having relatively high rates because of landscape irrigation, pipe leaks and percolation of a fraction of the runoff from impervious areas. In tributary watershed areas, partitioning of deep percolation beneath the root zone into stream base flow versus groundwater recharge had a strong influence on simulated recharge. In watersheds on the east side of the Basin, a higher percentage of deep percolation was assigned to base flow than in watersheds on the west side of the Basin in order to better match observed stream flows.

5.7.1.2. Percolation from Streams

Inflows to the stream network in the surface water module of the groundwater model include a combination of gauged flows, and simulated runoff from tributary watersheds and valley floor areas obtained from the rainfall-runoff-recharge model.

The surface water module of the groundwater model simulates percolation reach by reach along each stream that crosses the basin, including Temescal Wash and small streams emanating from 15 watersheds around the periphery of the Basin. Percolation is affected by groundwater levels where the water table is equal to or higher than the elevation of the stream bed. This is sometimes the case along Temescal Wash, but the small tributary streams are mostly high above the water table elevation except up in the canyons where they first enter the Basin.

5.7.1.3. Reclaimed Water Percolation

Reclaimed wastewater is percolated in ponds at the TVWD WRF and the City of Corona's WRF-3. However, most of the reclaimed water is recycled for irrigation. Annual or monthly data describing the partitioning of reclaimed water into irrigation, pond percolation and discharge to Temescal Wash were obtained from TVWD and the City of Corona.

5.7.1.4. Subsurface Groundwater Inflow

Subsurface inflow from an adjacent MA or a neighboring basin is simulated by the groundwater model based on water level gradients and subsurface permeability along the boundary segments. In the Coldwater MA, the only such boundary is the Glen Ivy Fault, and flow across that boundary is almost entirely outward to the Bedford MA. In addition to the Glen Ivy Fault, the Bedford MA receives a small among of subsurface inflow from the Elsinore Subbasin and generates a small amount of outflow to the Temescal Basin. Small amounts of subsurface inflow to both MAs also occurs where they abut upland tributary watersheds. Recharge in those watersheds flows toward the Basin through fractures in bedrock. This process is simulated by the rainfall-runoff-recharge model.

5.7.1.5. Quarry Recharge

Quarry recharge represents inflows of surface water into existing quarries where it is allowed to recharge into the groundwater. In the Coldwater MA, streamflow from Mayhew Creek and some other smaller streams is directed into existing quarry areas where the water is contained and allowed to percolate. Coldwater Creek has been redirected around an existing quarry. Although Coldwater Creek is not currently directed into a quarry, there have been historic instances where flood flows have gone into the quarries, especially prior to 2005. A portion of the estimated streamflow from the rainfall-runoff-recharge model for each stream is recharged to groundwater at the quarry location.

Similarly, in the Bedford MA, streamflow from Brown and McBride Creeks flows into the Mobile Sand quarry located just north of the TVWD WRF. In addition, streamflow from Temescal Wash can flow into the quarry location especially during high and flood flows. The quarry pit at this location is below the water table and is consistently flooded. To estimate

the recharge, the MODFLOW model applies a boundary condition based on the observed water level in the pit to estimate the volume of quarry recharge.

5.7.2. Outflows from Groundwater

Major outflows from the Basin are groundwater pumping (municipal, industrial, agricultural, and domestic), groundwater discharge into streams, and evapotranspiration by riparian vegetation.

5.7.2.1. Pumping by Wells

Pumping from M&I wells has been measured and recorded for many years by TVWD and Western. Those data are used in the groundwater model. Total pumping for both MAs was about 11,000 (acre feet per year) AFY in the 1990s and decreased to around 3,000 AFY by 2018. This trend was caused by the replacement of groundwater-supplied citrus orchards to urban land uses supplied almost entirely by imported water. In the Bedford MA, TVWD pumps groundwater to supplement recycled water used for irrigation. In the Coldwater MA, groundwater is pumped and exported for municipal use in the Elsinore Subbasin and Temescal Basin by EVMWD and the City of Corona. Pumping is expected to remain around current volumes in the Coldwater MA, consistent with the existing agreement between Corona and EVMWD. However, pumping in the Bedford MA is expected to increase to accommodate future TVWD non-potable water demands.

5.7.2.2. Subsurface Outflow

Subsurface outflows to other MAs or external basins were calculated with the groundwater model by the same methods used to simulate subsurface inflows. The two outflow boundaries are from the Coldwater MA to the Bedford MA and from the Bedford MA to the Temescal Basin. Both of those flows are minor components of the water budget (one to four percent of total outflows).

5.7.2.3. Groundwater Discharge to Streams

Discharges from the Basin to surface water bodies are simulated by the groundwater model based on streambed wetted area, permeability, and on the amount by which the simulated groundwater elevation in a model stream cell is higher than the simulated surface water elevation. This probably occurs at times along Temescal Wash, although dry-season Google Earth aerial photographs rarely show open water in the channel. The groundwater model simulated groundwater discharge to Temescal Wash that averaged 16 percent of total outflow from the Bedford MA during 1993 to 2007.

5.7.2.4. Riparian Evapotranspiration

Evapotranspiration of groundwater by phreatophytic riparian vegetation is influenced by available soil moisture and by depth to the water table. Like other types of vegetation, phreatophytes use soil moisture supplied by rainfall when it is available. Any remaining evapotranspiration demand is met by drawing water from the water table. Phreatophyte use of groundwater is assumed to decrease from the maximum rate when the water table is at

the land surface to zero when the water table is 20 feet or more below the ground surface. These calculations are applied at all model cells, but non-zero amounts only occur where the depth to water is commonly less than 20 feet. Aerial photographs indicate a correlation between those areas and the presence of dense, lush riparian vegetation.

Riparian evapotranspiration (ET) was a relatively minor component of groundwater outflow in both MAs—averaging four percent of total outflows from the Coldwater MA and 10 percent of total outflows from the Bedford MA.

5.7.2.5. Quarry Operations and Losses

Quarry outflows represents outflows associated with active or passive quarry operations to account for observed water conditions within the deeper quarry pits. In the Coldwater MA, excavations continued within the large quarry pits following periods of high groundwater levels for the period from 1990 to 2010. During model calibration, it was necessary to assume that additional pumping or other groundwater removal occurred during these operational periods to maintain the observed groundwater levels. Since 2010, it is our understanding that no additional pumping to maintain quarry water levels at the elevations necessary for deepening pits has occurred, which is supported by the historical model calibration.

In the Bedford MA, the rim of the Mobile Sand quarry located just north of the TVWD WRF is low enough to allow surface flow between the pit and Temescal Wash when water levels in the pit or Wash are high. To estimate these flows, the groundwater model applies a boundary condition based on the observed water levels in the pit and Wash to estimate the volume of into or out of the pit. This is a head-dependent boundary condition that is able to calculate either quarry recharge or outflow based on groundwater conditions.

5.8. CHANGE IN GROUNDWATER STORAGE

Figure 5-10 shows the cumulative change in storage from the model for the two Management Areas during 1990 through 2068. The baseline and growth plus climate change scenario results for 2019 to 2068 are displayed as continuations of the historical storage changes from 1990 to 2018.

As shown, groundwater storage in the Bedford MA increased slightly during 1990 to 2018, presumably as a result of the decrease in total groundwater pumping. Consistent with total simulated inflows and outflows, the storage trend during 2019 to 2068 was level to slightly increasing for both future scenarios. Storage was slightly higher during droughts under the growth plus climate change scenario relative to the future baseline scenario. This is because urban recharge continues during droughts. High recharge in wet years tended to reset storage for both scenarios to a similar elevation that is partly limited by interaction with Temescal Wash.

Simulated historical storage in the Coldwater MA declined by a cumulative total of 60,000 AF from 1990 to 2004. EVMWD and Corona entered into an agreement to limit pumping in the MA to safe or sustainable yield in 2008 (Corona and EVMWD 2008). As a result, there was

little additional cumulative decline from 2005 to 2018. As a result of decreased pumping, storage under both future scenarios increased steadily from 2019 to 2068. Inflows exceeded outflows in the water budget because of increased urban recharge and continued limitation of pumping. The rate of storage increase was slightly higher under the growth plus climate change scenario relative to the baseline scenario, which can be attributed to increased urban return flow recharge.

5.9. ESTIMATE OF SUSTAINABLE YIELD

The sustainable yield is defined as the volume of pumping that the Basin can sustain without causing undesirable effects. It is not a fixed or inherent natural characteristic of a groundwater basin. Rather, it is influenced by land use activities, importation of water, wastewater and stormwater management methods, potential recharge with recycled water, and the locations of wells with respect to interconnected streams. The estimates of sustainable yield presented in this section reflect the current status of those variables under the historical and future scenarios and evaluates whether there would be a long-term increase or decrease in basin storage if those conditions continued over a 50-year future period.

A long analysis period is needed to evaluate yield because of the episodic nature of natural recharge. Whereas pumping, irrigation return flow, and pipe leaks are fairly constant from year to year, recharge from precipitation and streams varies widely. Because of evolving land use during 1990 to 2018, no subset of years is ideal for estimating sustainable yield. For the purposes of this GSP historical sustainable yield was calculated based on 1993 to 2017, which is representative of long-term average conditions in terms of precipitation and stream flow. Sustainable yield was estimated for each management area for the historical simulation (using 1993 to 2017) and the two future simulations (both using all 50 years of the simulation). A simple estimate of sustainable yield can be obtained by adding average annual pumping to average annual change in storage, as shown in **Table 5-5**.

Table 5-5. Estimated Sustainable Yield

Management Area	Sustainable Yield (acre-feet per year)		
	Historical 1993 to 2017[1]	**Baseline 2019 to 2068[2]**	**Growth Plus Climate Change 2019 to 2068[2]**
Bedford	1,808	1,419	2,047
Coldwater	4,319	4,581	5,088
Total	6,127	6,000	7,134

[1] For the historical sustainable yield estimate, average annual water budgets during 1993 to 2017 were used.
[2] The 50-year future simulation uses historical hydrology for 1993 to 2017 two times in succession.

The baseline simulation generally produces a better estimate of sustainable yield for planning purposes because it incorporates existing land and water use patterns and a long averaging period that more completely captures climatic and conjunctive use cycles. The sustainable yield under baseline conditions was estimated by the same method used for the historical budget analysis period: simulated average annual storage change over the 50-year simulation was added to average annual pumping for each MA.

This method of estimating sustainable yield ignores head-dependent responses to pumping in the water budget. In other words, storage change is not the only variable that responds to an increase in pumping. In reality, the response is spread out among storage change, subsurface inflow, subsurface outflow, percolation from streams and groundwater seepage into streams. If those head-dependent boundaries are major parts of the flow system, then an increase in pumping will result in an increase in the estimate of sustainable yield. This boundary interaction effect was not revealed in the Coldwater MA because head-dependent boundary flows there are relatively minor. However, the simulations in the Bedford MA show some variability in sustainable yield as a result of variable pumping in the simulations. The sustainable yield estimates for the Bedford MA understate sustainable yield because of the high degree of interconnection between groundwater and surface water in Temescal Wash. Additional pumping increases net percolation from the Wash at times when the Wash is flowing. This increase in recharge approximately balances increased pumping, thereby preventing a long-term decrease in storage. This situation results in higher estimates of sustainable yield, as shown in the Bedford MA growth plus climate change sustainable yield in Table 5-5.

The estimates of sustainable yield presented here for the two management areas differ from previous estimates that had different objectives. A previous study of groundwater development potential for the Bedford MA quantified many aspects of the water budget but did not explicitly state an estimated sustainable yield (WEI 2015b). It was asserted that a yield estimate based on historical data would not be representative of future conditions and that future pumping and recharge could strongly affect net percolation from Temescal Wash and therefore also the calculated sustainable yield. The study also did not discuss recharge and pumping related to mining activities, which current modeling shows are important components of the water budget. However, the study recommended that total pumping of no more than 2,000 AFY be implemented in conjunction with water-level monitoring to track the associated long-term changes in storage.

For the Coldwater MA, an estimated yield of 3,300 AFY was the basis of a 2008 agreement between City of Corona and EVMWD regarding sharing of yield (Corona and EVMWD 2008). This is roughly consistent with pumping and storage change in the current period water budget (**Table 5-4**), but it is smaller than the yield estimates calculated here for the baseline and growth plus climate change scenarios.

The sustainable yield estimates presented here are the result of a comprehensive review of the historical and future water budget components throughout the Basin. The higher future yield values are the result of increased urban recharge as development progresses in the Basin, as required for SGMA.

Sustainable yields calculated from the future scenarios are based on projections far into the future. Slight imbalances in estimated water budgets can result in large cumulative changes in storage, and hence in the calculated yields. By the same token, the long planning horizon provides ample time to adjust water management (recharge and pumping) to maintain basin operation within the sustainable yield if long-term rising or falling trends in cumulative storage in fact occur. In the context of this GSP, sustainable yield estimated from the water budget is contingent on the absence of undesirable results related to water levels, storage, subsidence, water quality, or depletion of interconnected surface water. Quantitative sustainability criteria are presented in Section 6 that define thresholds at which groundwater conditions become undesirable for each of those sustainability indicators. For example, if pumping at the above estimates of sustainable yield caused subsidence or significant impacts on riparian or aquatic habitats, the yield may need to be reduced to avoid those impacts. Accordingly, this sustainable yield value is a broad indicator. It indicates no overdraft based on the water budget, but it must be interpreted through evaluation of undesirable results.

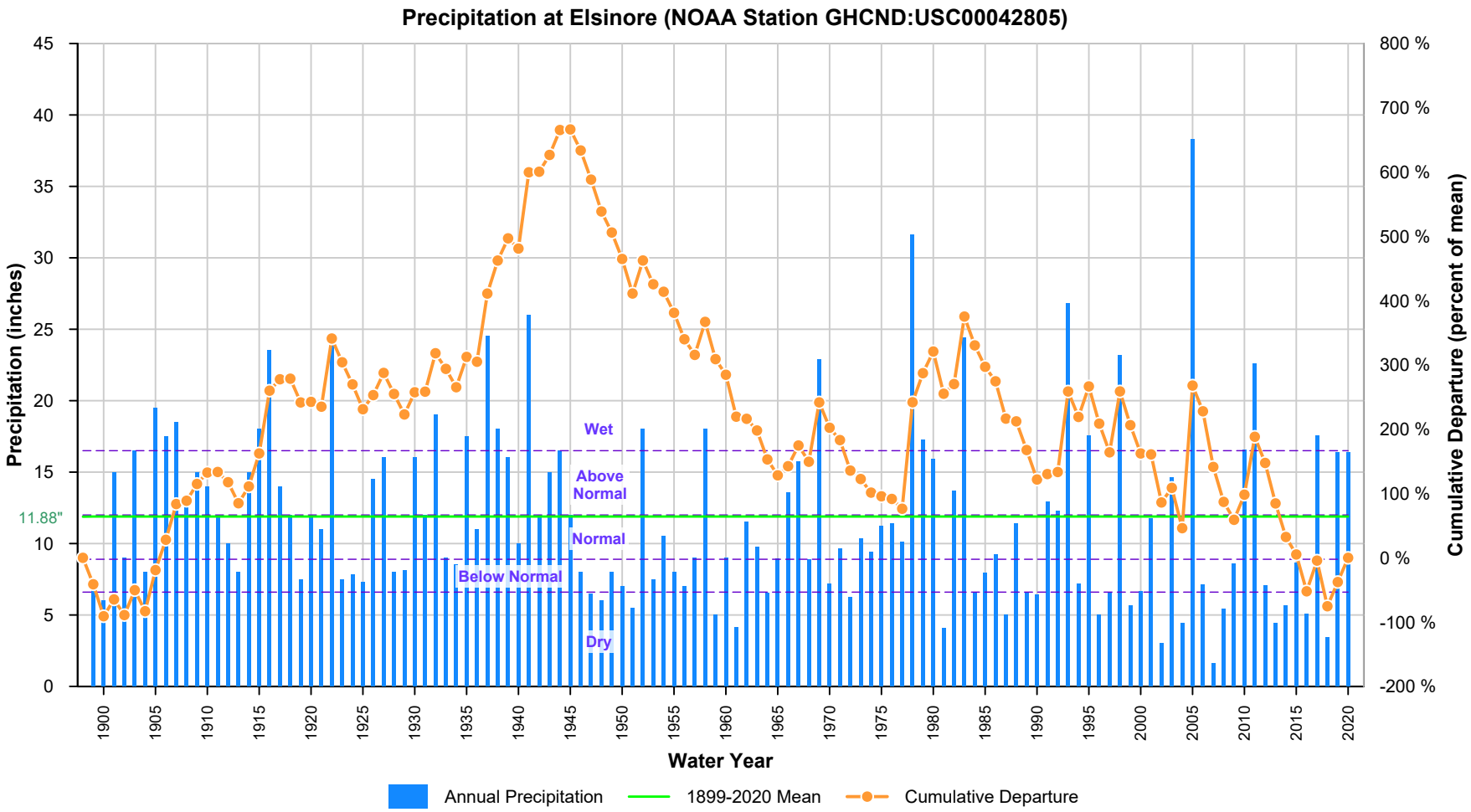
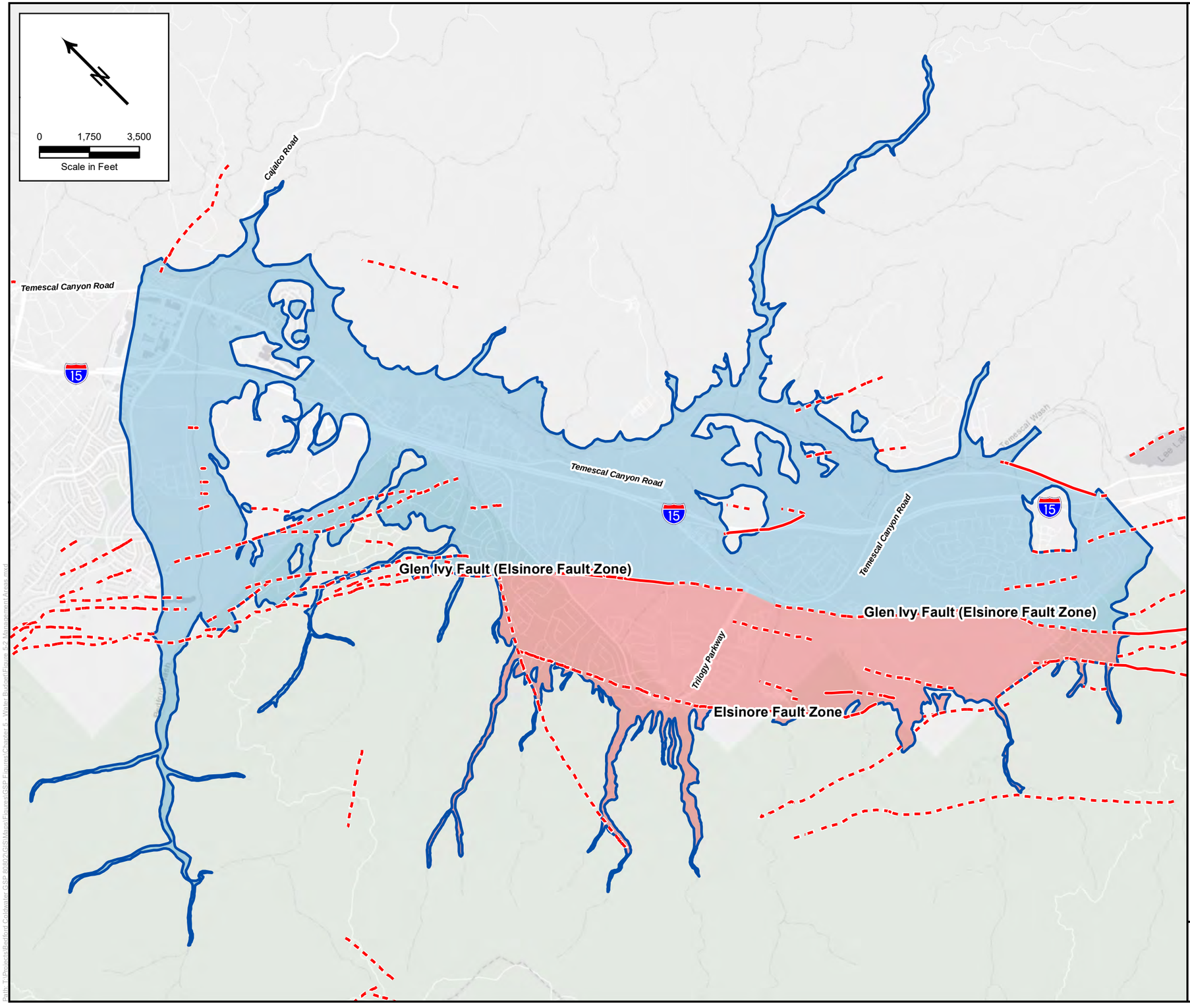


Figure 5-1
Cumulative Departure of Annual Precipitation

Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 5-1 Cumulative Departure of Precipitation.gpj



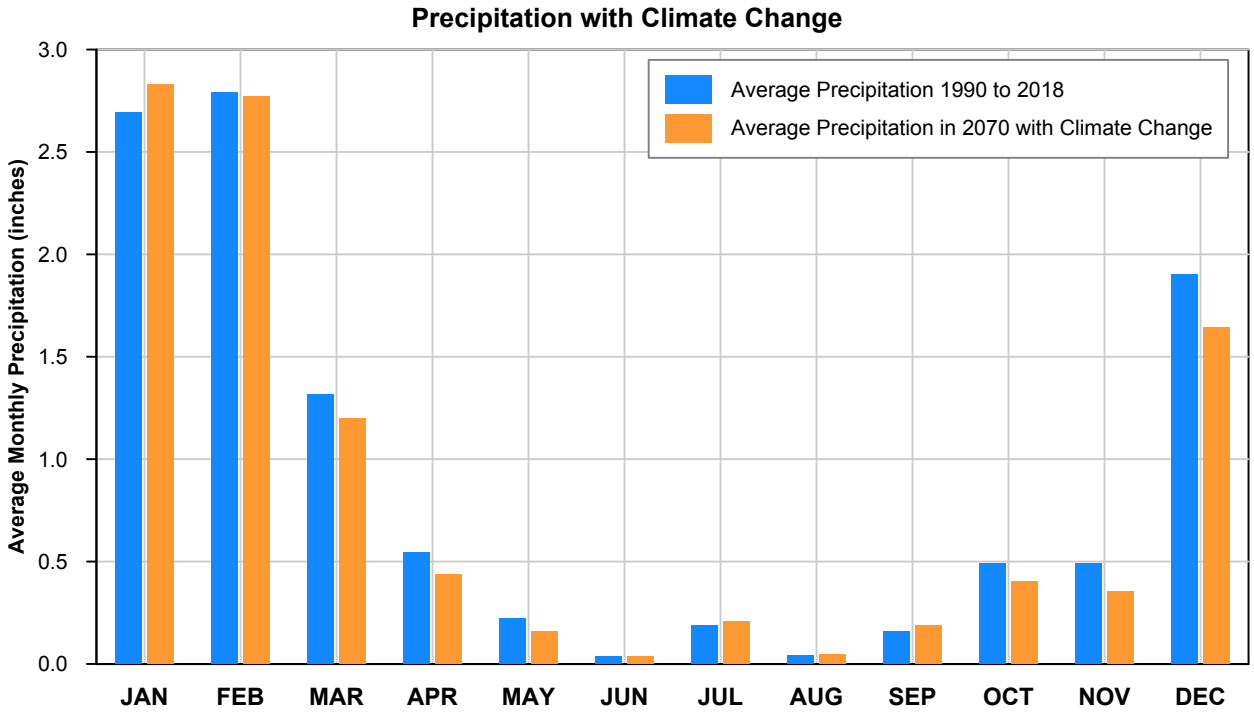
Bedford-Coldwater Basin
Bedford Management Area
Coldwater Management Area
Fault Location, dashed where uncertain

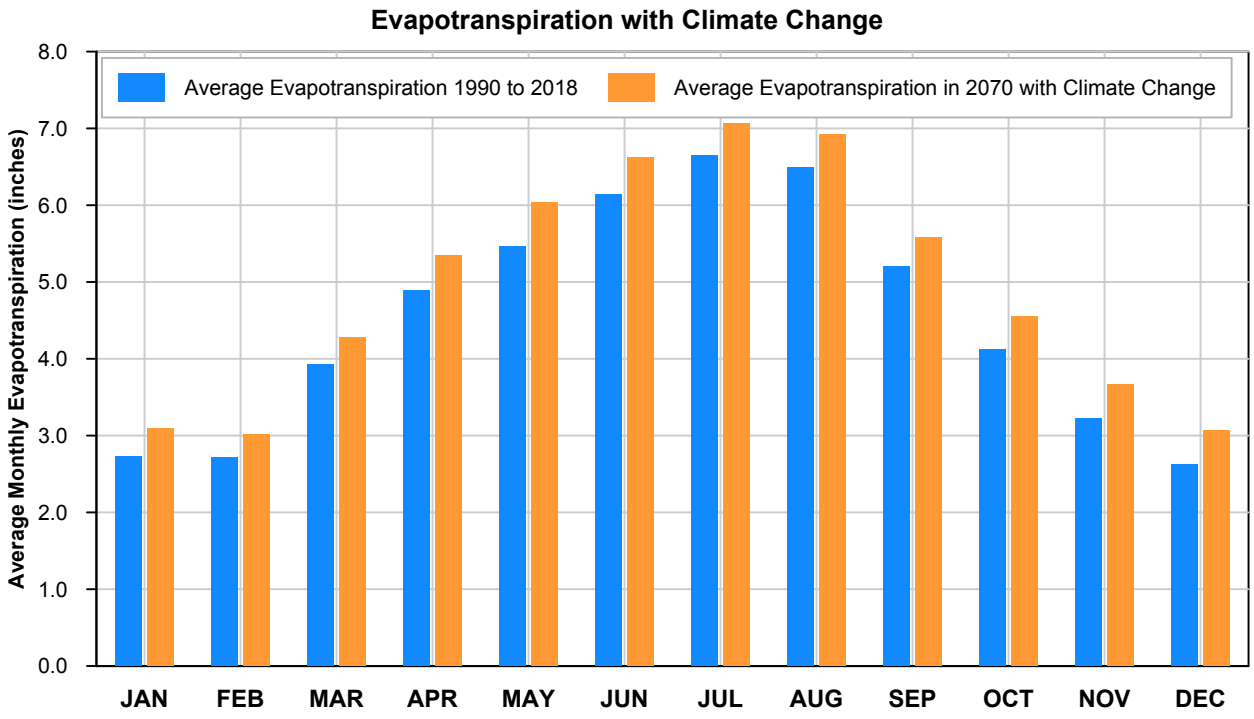
N

0 1,750 3,500
Scale in Feet

TODD GROUNDWATER

Figure 5-2
Management Areas

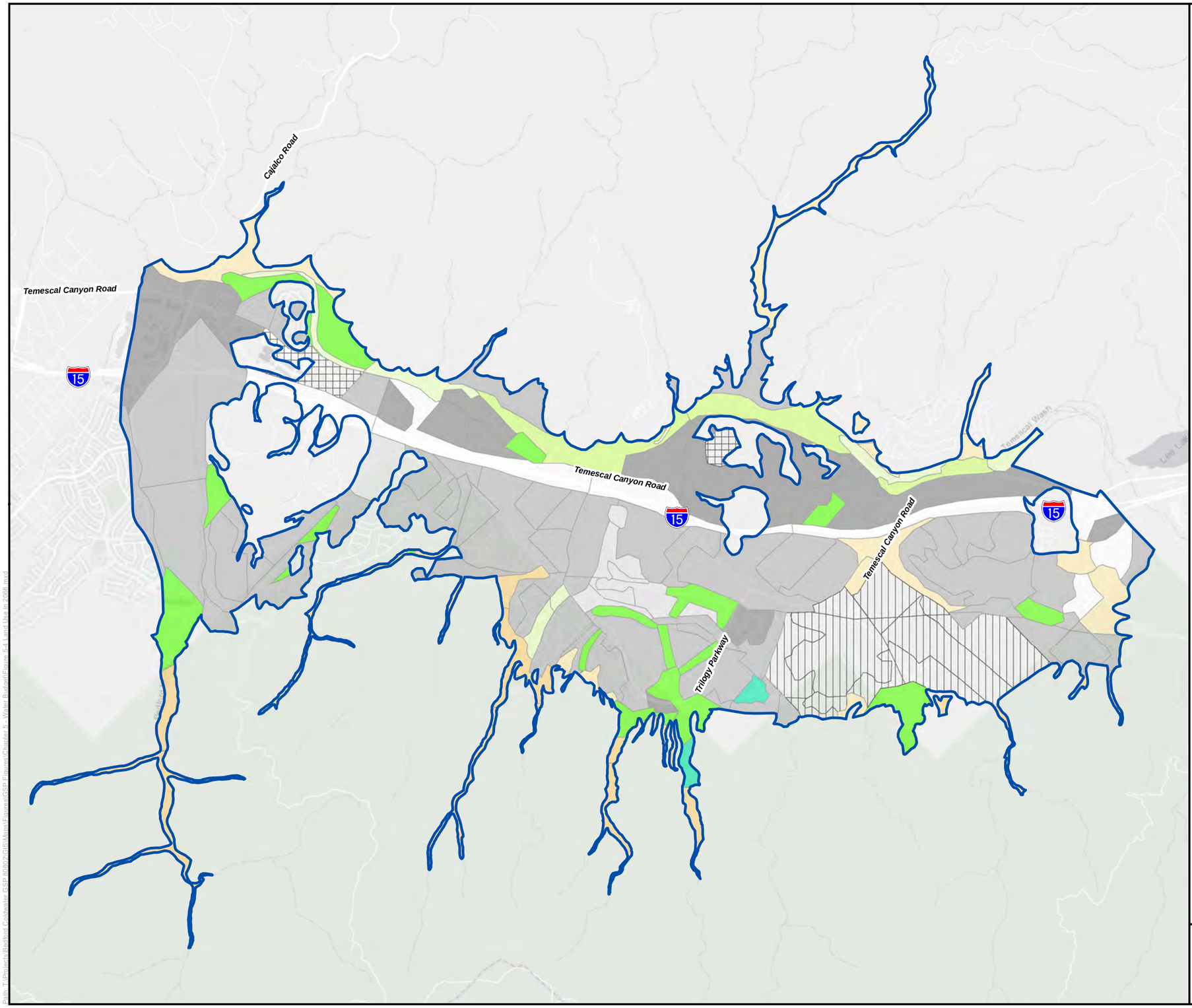




Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 5-3 Effect of Climate Change on Precipitation and Evapotranspiration.gpj

TODD GROUNDWATER

Figure 5-3
Effect of Climate Change on Precipitation and Evapotranspiration



Land Use in 2068

- Citrus
- Dense Riparian
- Sparse Riparian
- Grassland
- Shrubs / Trees
- Commercial
- Industrial
- Quarries
- Stormwater Control and Recharge (former quarries)
- Turf
- Residential
- Low Density Residential
- Vacant
- Bedford-Coldwater Basin

N

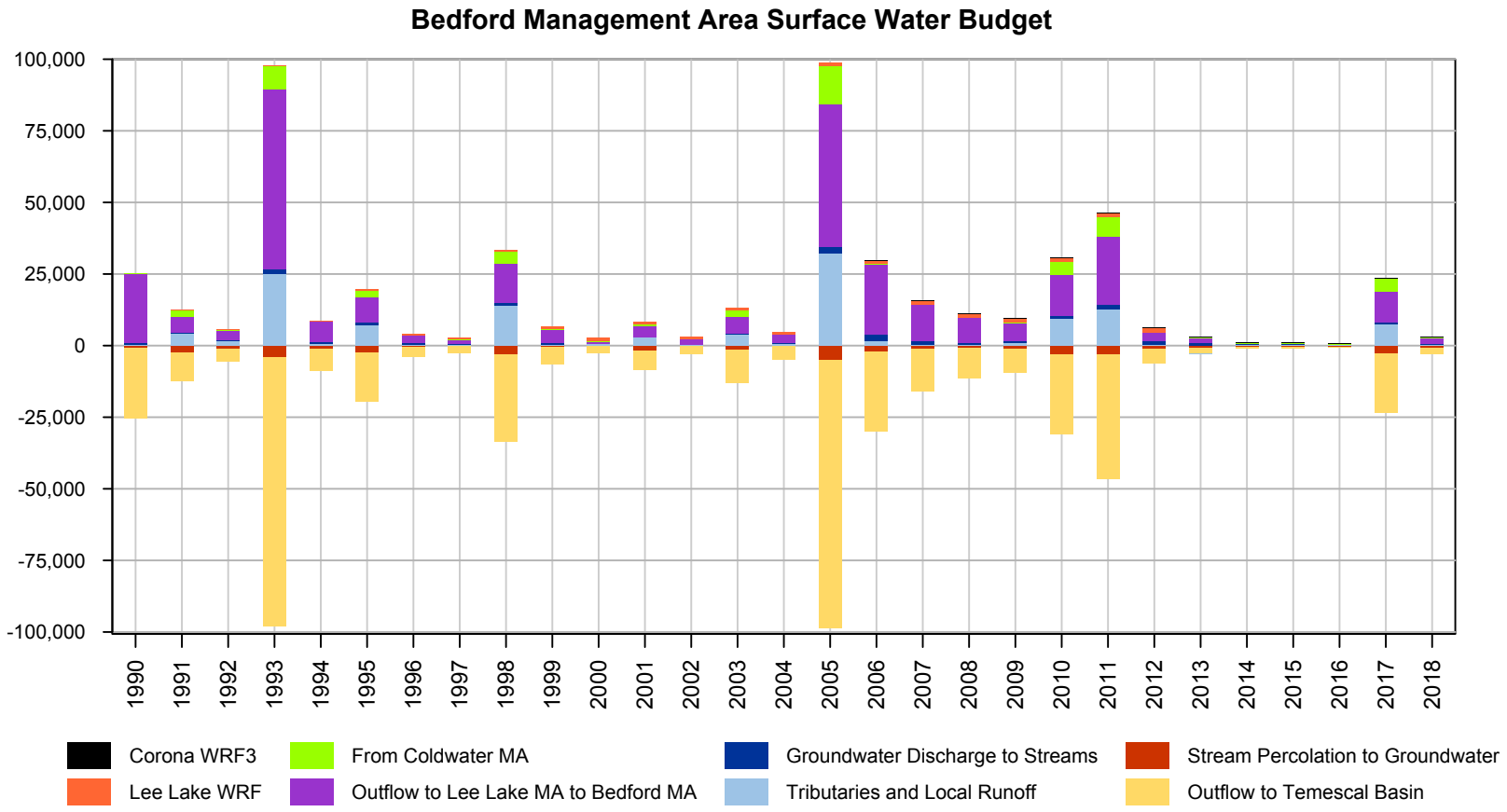
0 1,750 3,500

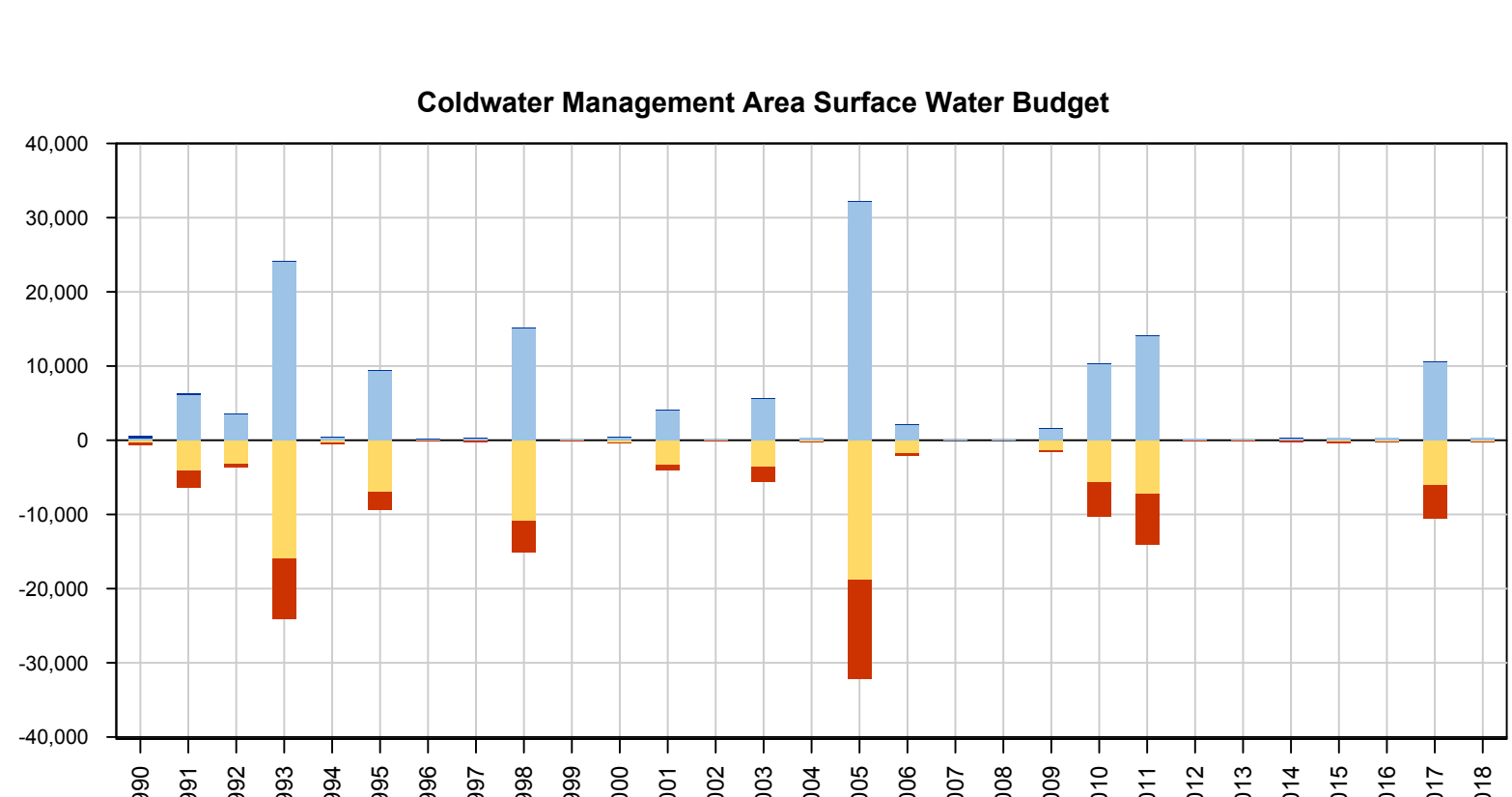
Scale in Feet

TODD GROUNDWATER

Figure 5-4
Land Use in 2068

Path: T:\Projects\Bedford Canyon_GSP\mxds\GSP Figures\Chapter 5 - Water Budget\Figure_5-4_Land Use in 2068.mxd

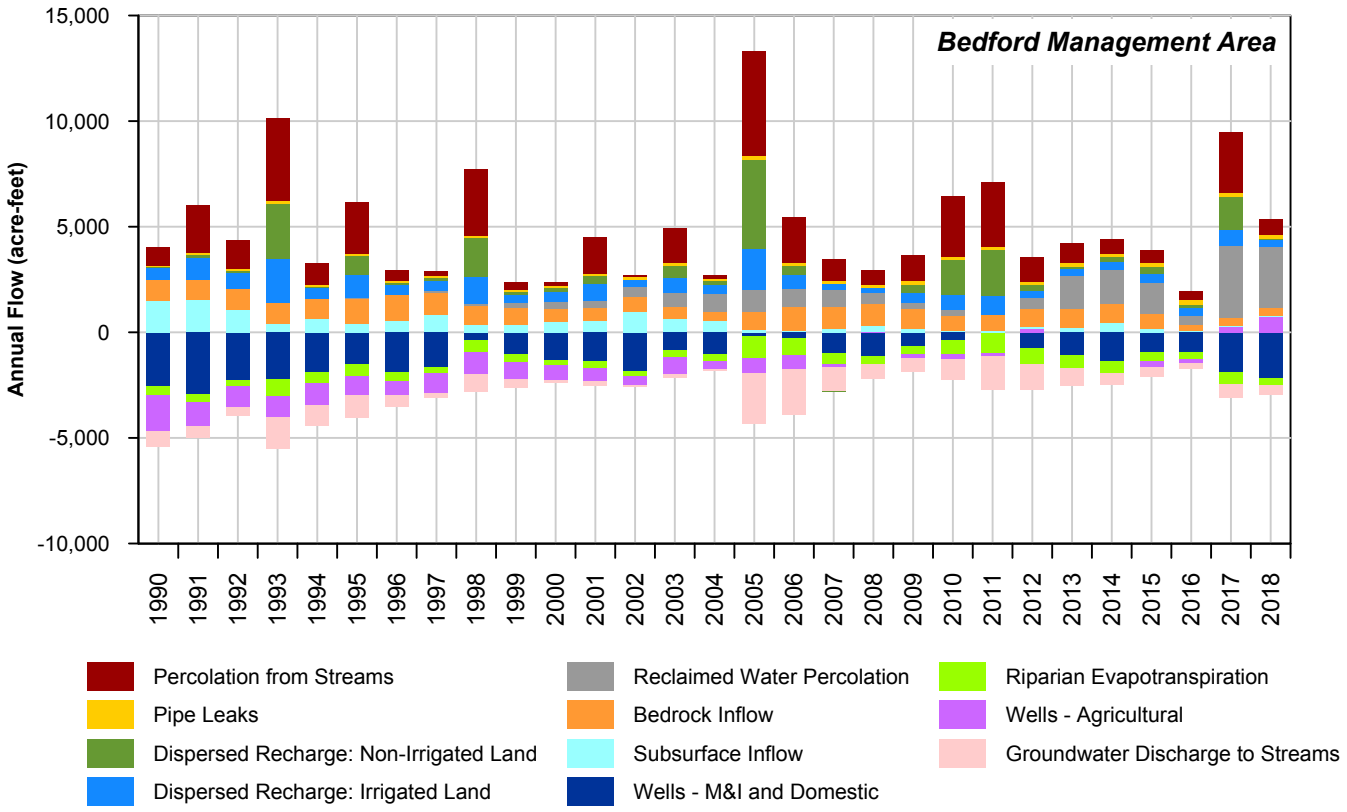


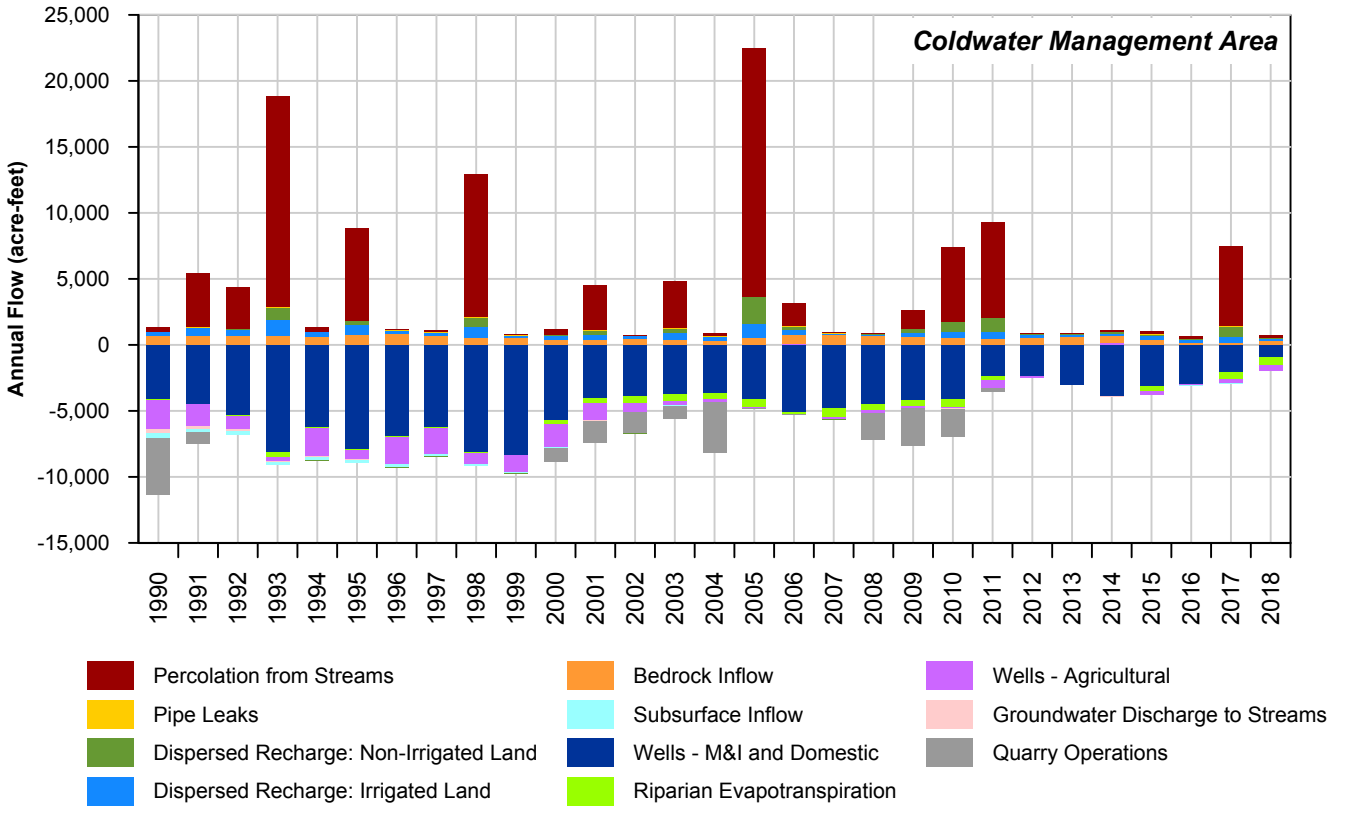


Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 5-5 Annual Surface Water Budgets 1990-2018.gpj

TODD GROUNDWATER

Figure 5-5
Surface Water Budgets
1990 through 2018

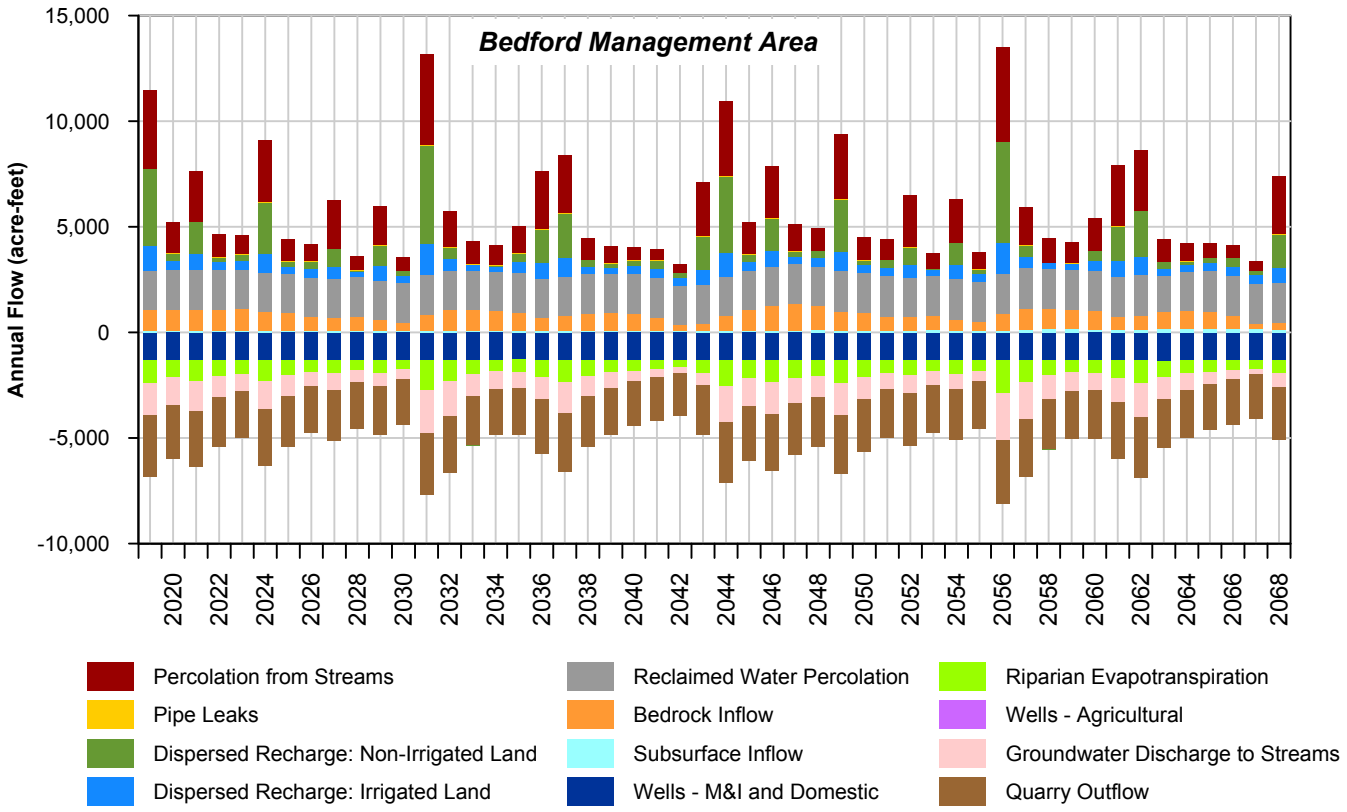


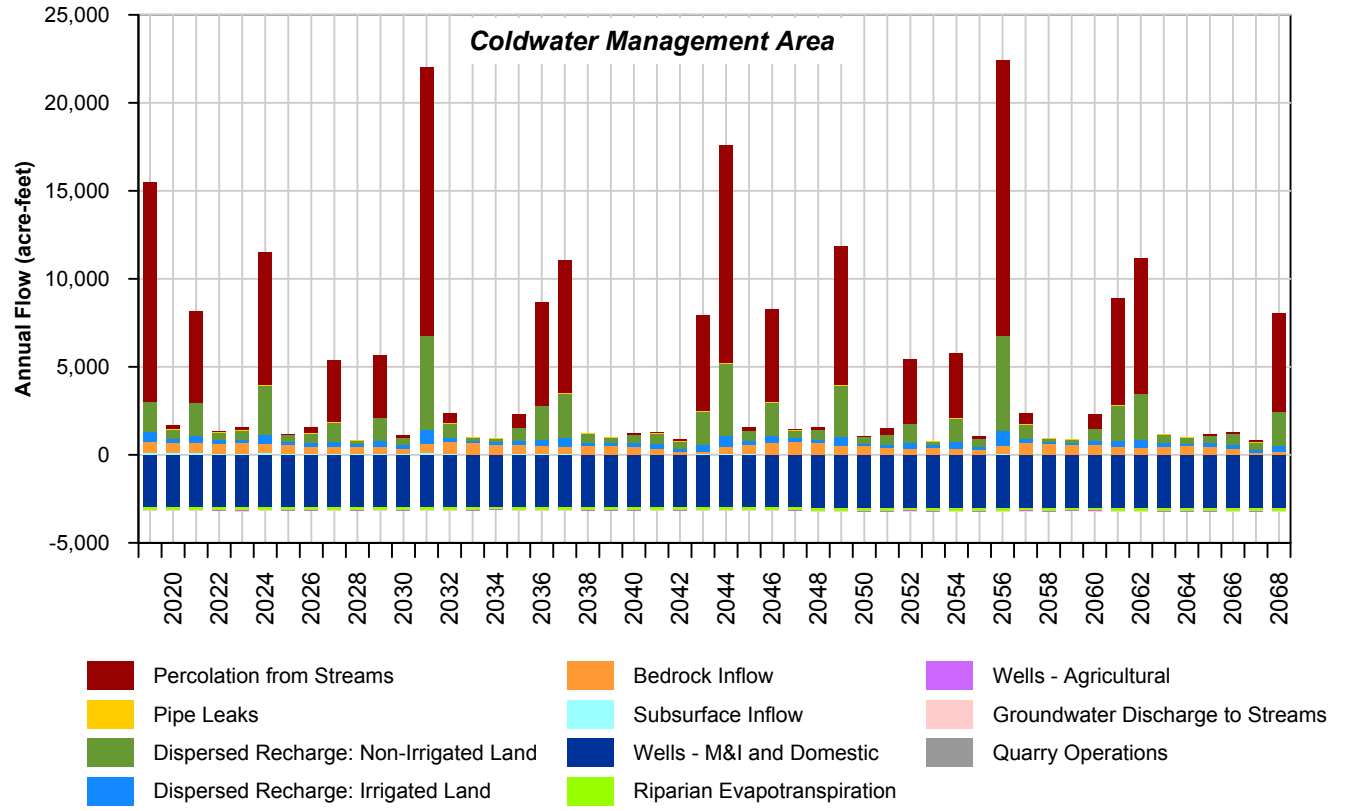


TODD GROUNDWATER

Figure 5-6
Annual Groundwater Budgets, 1990 to 2018

Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 5-6 Annual Groundwater Budgets 1990-2018.gpj

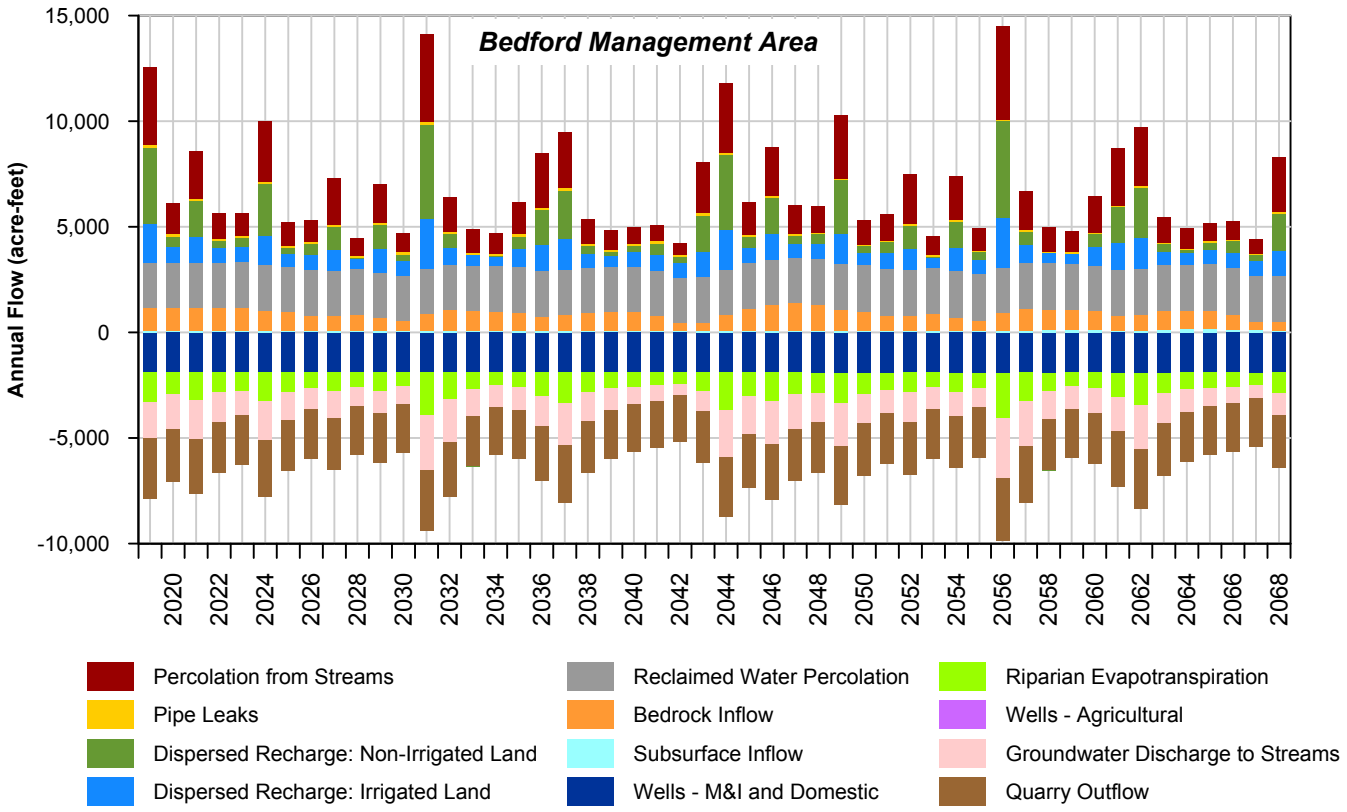


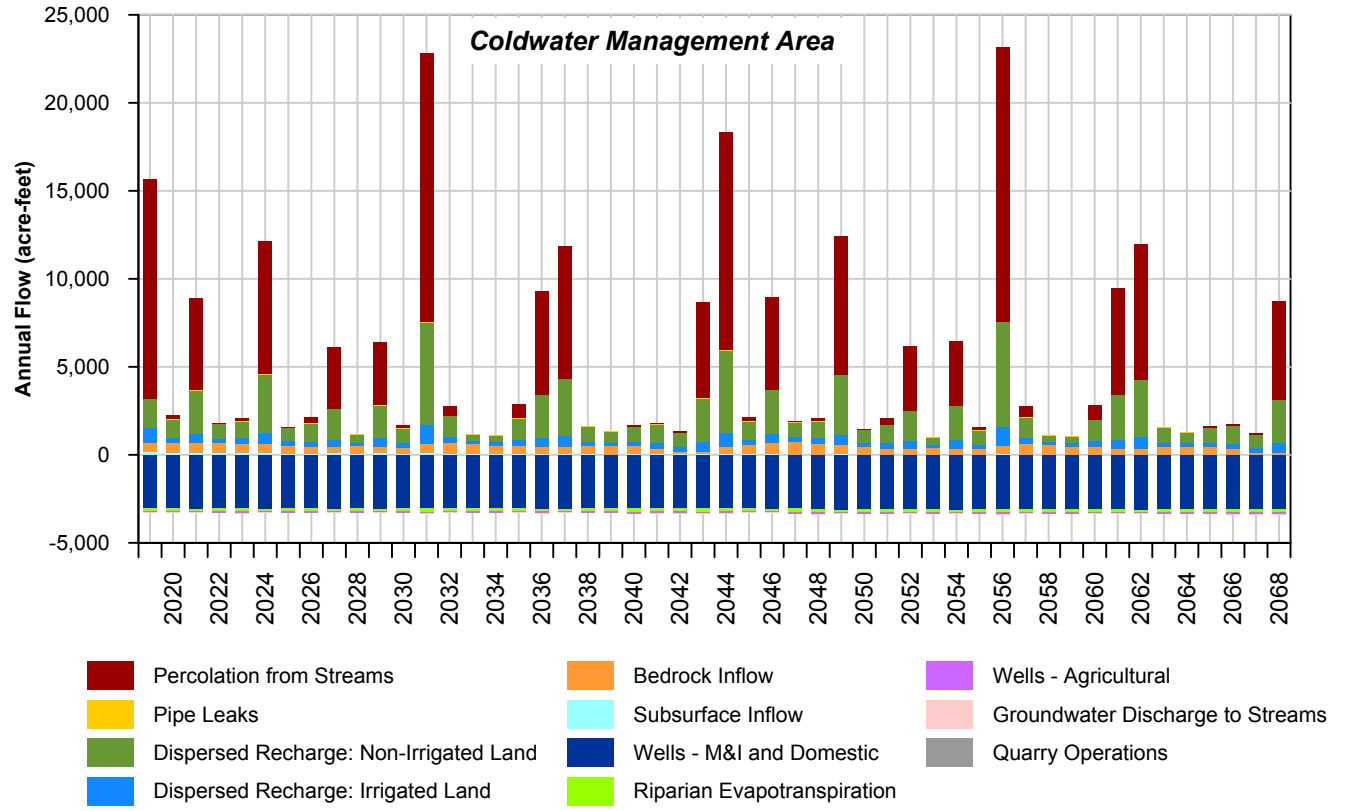


Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 5-7 Annual Groundwater Budgets - Future Baseline.gpj

TODD GROUNDWATER

Figure 5-7
Annual Groundwater Budgets, Baseline





Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 5-8 Annual Groundwater Budgets - Growth Plus Climate Change.gpj

TODD GROUNDWATER

Figure 5-8
Annual Groundwater Budgets, Growth Plus Climate Change

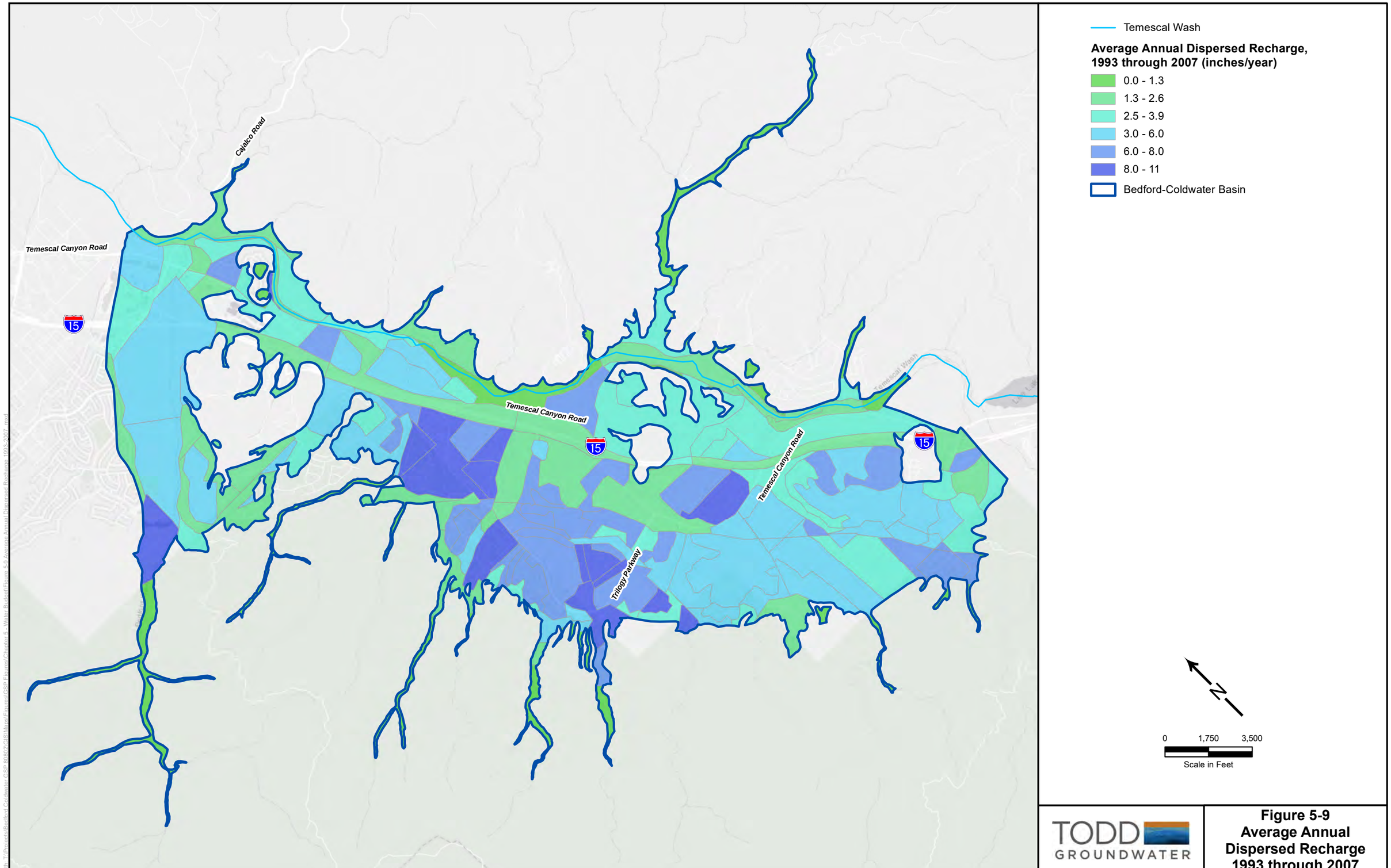
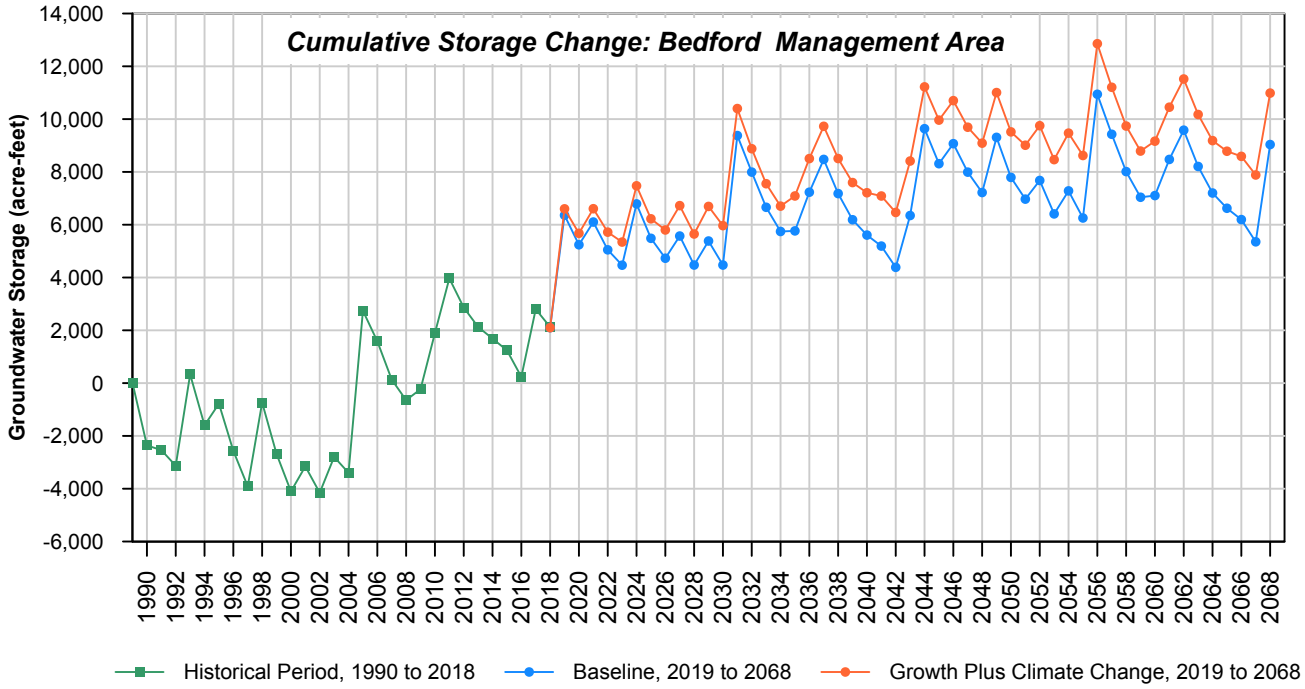
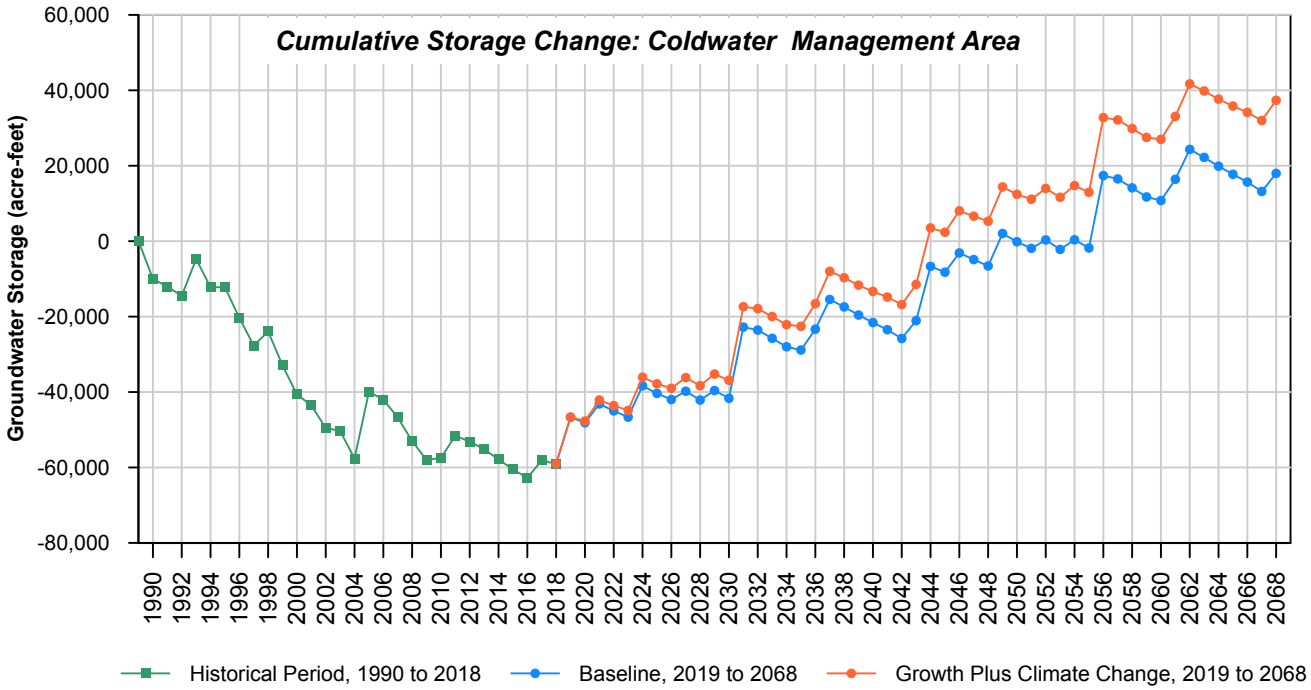


Figure 5-9
Average Annual Dispersed Recharge 1993 through 2007





TODD GROUNDWATER

Figure 5-10
Cumulative Storage Changes 1990 to 2068

Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 5-10 Cumulative Storage Changes 1990-2068.grp

6. SUSTAINABLE MANAGEMENT CRITERIA

The Sustainable Groundwater Management Act (SGMA) defines sustainable management as the use and management of groundwater in a manner that can be maintained without causing *undesirable results*, which are defined as significant and unreasonable effects caused by groundwater conditions occurring throughout the Bedford-Coldwater Subbasin (Basin), which include:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply.
- Significant and unreasonable reduction of groundwater storage.
- Significant and unreasonable seawater intrusion.
- Significant and unreasonable land subsidence that substantially interferes with surface land uses.
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

For these sustainability indicators[5], a Groundwater Sustainability Plan (GSP) must develop quantitative sustainability criteria that allow the Groundwater Sustainability Agency (GSA) to define, measure, and track sustainable management. These criteria include the following:

- Undesirable Result – significant and unreasonable conditions for any of the six sustainability indicators.
- Minimum Threshold (MT[6]) – numeric value used to define undesirable results for each sustainability indicator.
- Measurable Objective (MO) – specific, quantifiable goal to track the performance of sustainable management.

Together, these sustainability criteria provide a framework to define sustainable management and delineate between favorable and unfavorable groundwater conditions. This framework also supports quantitative tracking that identifies problems promptly, allows assessment of management actions, and demonstrates progress in achieving the goal of sustainability.

[5] If one or more undesirable results can be demonstrated as not present and not likely to occur, a GSA is not required to establish the respective sustainability criteria per GSP Regulations §354.26(d); in the inland Bedford-Coldwater Basin (Basin) seawater intrusion is not present and not likely to occur.

[6] The abbreviations for Minimum Threshold (MT) and Measurable Objective (MO) are provided because these terms are used often; however, the full unabbreviated term is used when helpful for clarity or when included in a quotation.

6.1. SUSTAINABILITY GOAL

The sustainability goal can be described as the mission statement of the GSA for managing the Basin; it embodies the purpose of sustainably managing groundwater resources and reflects the local community's values—economic, social, and environmental. The sustainability goal for the Basin, stated below, was developed through discussion at several GSA meetings.

6.1.1. Description of Sustainability Goal

The goal of the GSA in preparing this GSP is to sustain groundwater resources for the current and future beneficial uses of the Bedford-Coldwater Basin in a manner that is adaptive and responsive to the following objectives:

- Provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses;
- Provide reliable storage for water supply resilience during droughts and shortages;
- Protect groundwater quality;
- Support beneficial uses of interconnected surface waters; and
- Support integrated and cooperative water resource management.

This goal is consistent with SGMA and is based on information from the Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget sections that:

- Identify beneficial uses of Basin groundwater and document the roles of local water and land use agencies;
- Describe the local hydrogeologic setting, groundwater quality conditions, groundwater levels and storage, and inflows and outflows of the Basin; and
- Document the ongoing water resource monitoring and conjunctive management of groundwater, local surface water, recycled water and especially imported water sources that help protect groundwater quality and maintain water supply.

6.1.2. Approach to Sustainability Indicators

The approach to assessing the sustainability indicators and setting the sustainability criteria has been based on:

- Review of available information from the Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget sections of the GSP.
- Discussions with Bedford-Coldwater stakeholders and local agency representatives, GSA manager meetings, and workshops.

This approach has developed throughout the process and generally began with definition of what an undesirable result is; this initially has been exploratory and qualitative and based on plain-language understanding of what *undesirable* means. Potential minimum thresholds

have been explored in terms of when, where, how long, why, under what circumstances, and what beneficial use is adversely affected. This step identified seawater intrusion as not present and not likely to occur.

Beyond a qualitative identification of what is undesirable, the approach to defining sustainability indicators varies among the undesirable results. Several of the undesirable results are directly or indirectly related to groundwater levels, including conditions related to groundwater storage, subsidence, and interconnected surface water. The definition began in terms of groundwater levels in individual wells but has recognized that storage depletion, subsidence, and impacts on connected surface water occur as water levels decline. As a result, the sustainability criteria for those indicators are interrelated across space and time, and are coordinated, consistent, and reasonable based on the available data.

The consideration of the causes and circumstances of undesirable results is an important one in Bedford-Coldwater as multiple agencies rely on this small Basin. Water is produced and used in the Basin by Temescal Valley Water District (TVWD) and produced for use in the Basin and in the neighboring Temescal and Elsinore Basins by the City of Corona (Corona) and Elsinore Valley Municipal Water District (EVMWD), respectively. Cooperative groundwater management between these three major agencies is essential to ensure sustainability.

The intent is to quantify and qualify sustainability criteria such that they guide good management without setting off false alarms or triggering costly, ineffective, or harmful management actions.

6.1.3. Summary of Sustainable Management Criteria

This section documents the six sustainability criteria as relevant to Bedford-Coldwater Basin and as guided by the Sustainability Goal. As documented in this section, the Basin has been and is being managed sustainably relative to all criteria (except seawater intrusion, which does not apply because the Basin is over 20 miles from the ocean). Accordingly, sustainability does not need to be achieved, but it does need to be maintained through the planning and implementation horizon. This will involve continuation and improvement of existing management actions. It also will include improvement and expansion of management actions and monitoring. These improvements are addressed for each sustainability criterion specific subsections.

While the Bedford-Coldwater Basin has been managed sustainably, the following sustainability criteria are defined in this section because potential exists for future undesirable results.

- The Minimum Threshold for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well by operational considerations to maintain water levels at or above current pump intakes or screen bottoms (whichever is higher) in municipal water supply wells. Undesirable results are indicated when two consecutive exceedances occur in each of two consecutive

years, in two-thirds or more of the currently monitored wells in each Management Area.

- The Minimum Threshold for reduction of groundwater storage for all Management Areas is fulfilled by the minimum threshold for groundwater levels as proxy.
- The Minimum Threshold for land subsidence is defined as a cumulative decline equal to or greater than one foot of decline since 2015, which represents current conditions and the SGMA start date. This is equivalent to a rate of decline equal to or greater than 0.2 feet in any five-year period. The extent of cumulative subsidence across the Basin will be monitored and evaluated using Interferometric Synthetic Aperture Radar (InSAR) data available through the SGMA Data Viewer during the 5-year GSP updates. Subsidence as a result of groundwater elevation decline is closely linked to groundwater levels and it is unlikely that significant inelastic subsidence would occur if groundwater levels remain above their minimum thresholds.
- The Minimum Thresholds for degradation of water quality address nitrate and total dissolved solids (TDS) for the entire Basin.
    - The Nitrate Minimum Threshold (in both Management Areas) is defined as 5-year average concentrations of all monitored wells not exceeding the 10 milligrams per liter (mg/L) drinking water maximum contaminant level (MCL) for Nitrate as Nitrogen.
    - The TDS Minimum Threshold (in both Management Areas) is defined as the 5-year average concentrations not exceeding the 1,000 mg/L secondary MCL for TDS.
- The Minimum Threshold for depletion of interconnected surface water is the amount of depletion associated with the lowest water levels recorded during the 2010 to 2015 drought. Specifically, undesirable results would occur if more than half of monitored wells near Temescal Wash had static water levels lower than 35 feet below the adjacent riparian vegetation ground surface elevation for a period of more than one year.

6.2. CHRONIC LOWERING OF GROUNDWATER LEVELS

Chronic lowering of groundwater levels can indicate significant and unreasonable depletion of supply, causing undesirable results to domestic, agricultural, or municipal groundwater users if continued over the planning and implementation horizon. As a clarification, drought-related groundwater level declines are not considered chronic if groundwater recharge and discharge are managed such that groundwater levels recover fully during non-drought periods.

Declining groundwater levels directly relate to other potential undesirable effects (for example regarding groundwater storage, land subsidence and interconnected surface water); these are described in subsequent criterion specific sections.

Groundwater elevation trends in the Basin are represented by hydrographs documented in Groundwater Conditions Section 4.1. Over time, groundwater elevations have varied in response to precipitation, groundwater pumping, and groundwater use trends; however, the

Basin does not display widespread chronic groundwater level declines and is not characterized by overdraft.

6.2.1. Description of Undesirable Results

As groundwater levels decline in a well, a sequence of increasingly severe undesirable results will occur. These include an increase in pumping costs and a decrease in pump output. With further declines, the pump may break suction, which means that the water level in the well has dropped to the level of the pump intake. This can be remedied by lowering the pump inside the well, which can cost thousands of dollars. Chronically declining water levels will eventually drop below the top of the well screen. This exposes the screen to air, which can produce two adverse effects. Water entering the well at the top of the screen will cascade down the inside of the well, and entraining air may result in cavitation damage to the pump. The other potential adverse effect of exposure to air is accelerated corrosion of the well screen. Over time, corrosion creates a risk of well screen collapse, which often renders the well unusable. If water levels decline by more than about half of the total thickness of the aquifer (or total length of well screen), water might not be able to flow into the well at the desired rate regardless of the capacity or depth setting of the pump. This might occur where the thickness of basin fill materials is relatively thin. While describing a progression of potential adverse effects, at some point the well no longer fulfills its water supply purpose and is deemed to have "gone dry." For the purposes of this discussion, a well going dry means that the entire screen length (to the bottom of the deepest screen) is unsaturated.

For purposes of setting a Minimum Threshold, undesirable results are defined as a well going dry. This appears to be a low standard and not protective of private wells but there are very few private wells in the Basin. The rationale is summarized as follows with more explanation in the following sections:

- There are very few active private wells in the Basin, as residential users are connected to municipal water supplies. The BCGSA is aware of a small number of private wells used for non-potable supply in the Basin. A systematic well inventory identifying all active private wells will be conducted to locate active wells and identify their uses, as described in Section 8.7. This project was designed to locate and characterize the construction and use of existing private wells so that they can be included in sustainable management of the Basin.
- Known private wells are for non-potable uses and are of similar depths and construction to the monitored municipal supply wells. No private wells have been reported to have water shortages in the California Department of Water Resources (DWR) led *Household Water Supply Shortage Reporting System* (DWR 2021).
- Responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner; there is a reasonable expectation that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts.

6.2.2. Potential Causes of Undesirable Results

For Bedford-Coldwater Basin, the primary potential cause of declining groundwater levels and associated undesirable results would be increased groundwater production and/or reduced inflows (recharge). Given that the Bedford-Coldwater Basin is not characterized by basin-wide chronic groundwater level declines, then the undesirable results of a well losing yield, having damage, or "going dry" represent a more complex interplay of causes and shared responsibility.

Some of the potential causes are within the Bedford-Coldwater Groundwater Sustainability Agency (BCGSA) responsibility; most notably, a GSA is responsible for groundwater basin management without causing undesirable results such as chronic groundwater level declines. SGMA also requires that a GSA address significant and unreasonable effects caused by groundwater conditions *throughout the basin.* This indicates that a GSA is not solely responsible for local or well-specific problems and furthermore that responsibility is shared with a well owner. A reasonable expectation exists that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts, and with some anticipation that neighbors also might construct wells (consistent with land use and well permitting policies).

6.2.3. Definition of Undesirable Results

As context, the Bedford-Coldwater Sustainability Goal has the objective to provide a long-term, reliable, and efficient groundwater supply for municipal, industrial, and other uses.

In that light, the definition of undesirable results would be the chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. This is defined by groundwater conditions occurring throughout the Basin, with a focus on operation of wells. This definition also recognizes that chronic lowering of groundwater levels could affect groundwater flow to or from the hydraulically connected Temescal and Elsinore Basins, and thereby potentially affect their ability to maintain sustainability.

As documented in Groundwater Conditions Section 4.1, analysis of hydrographs reveals that Bedford-Coldwater is not characterized by basin-wide chronic groundwater level declines. While affected at times by drought, groundwater levels in broad areas of the Basin have been maintained at relatively stable levels. Moreover, the Bedford-Coldwater area has not been marked by reports of significant impacts to shallow supply wells as a result of water level declines. In the absence of reported well problems associated with declining groundwater levels, it can be concluded that undesirable results for the chronic lowering of water levels are not occurring in the Bedford-Coldwater and that the Basin is managed sustainably relative to groundwater levels.

6.2.4. Potential Effects on Beneficial Uses and Users

Groundwater is a source of supply in the Basin and supplies water for municipal, industrial, and other beneficial uses. Groundwater has been and is being used for the range of beneficial uses, even during drought, and with reasonable operation and maintenance by well owners.

6.2.5. Sustainable Management Criteria for Groundwater Levels

The general approach to defining sustainability criteria (minimum thresholds and measurable objectives) for groundwater levels has involved selection of representative monitoring wells, review of groundwater level data, and review of supply well location/construction information to gage potential undesirable effects on wells. Specifically, this has included evaluating historical water levels and well operations in monitored wells. This approach is founded on the idea that undesirable results are the reduction of available supply in these monitored wells.

6.2.5.1. Selection of MT by Well

The approach includes selection of existing wells currently monitored in the Basin. Sustainability criteria would be defined for each of these wells, and each would be monitored for groundwater levels with respect to MTs and MOs. These wells are primarily production wells, which is not optimal for monitoring because pumping lowers water levels resulting in monitoring that is sometimes not representative of aquifer conditions. On the other hand, they are generally representative of production wells throughout the Basin.

Groundwater level data and hydrographs of each monitored well have been reviewed along with well construction and pumping equipment details in each monitored well. These data were used to review wells that the BCGSA currently monitors to confirm that they are suitable for use as Key Wells for defining MTs and MOs. This process showed that all the wells that the BCGSA agencies currently monitor are appropriate for use as Key Wells and monitoring of these wells will continue in the future. **Table 6-1** shows information on the Key Wells in the Basin. The table also shows well construction and pump intake information along with maximum historical depth to water and well-specific MT. The locations of the Key Wells are shown on **Figure 6-1**.

Table 6-1. Minimum Thresholds for Groundwater Levels

Local Well Name	Agency	Management Area	Monitoring Frequency	Total Well Depth (feet)	Screen Interval Depths (feet)	Pump Intake Depth (feet)	Historical Maximum Depth to Water (feet)	Date of Maximum Depth to Water	Threshold Description	Threshold Depth to Water (feet)
Corona Well 20	Corona	Coldwater	Static - Monthly	660	200 to 580	460	375.10	1/17/2017	Pump intake	460
Corona Well 21	Corona	Coldwater	Static - Monthly	660	200 to 580	460	398.00	12/1/2001	Pump intake	460
Corona Well 3	Corona	Coldwater	Static - Monthly	543	100 to 530	479	392.00	12/16/2016	Pump intake	479
Corona Non-Potable Well 1	Corona	Bedford	Continuous (SCADA)	Unkown	Unkown	Unkown	55.60	11/13/2016	Nearby pump intake	80
Corona Non-Potable Well 2	Corona	Bedford	Continuous (SCADA)	Unkown	Unkown	Unkown	55.40	11/13/2016	Nearby pump intake	80
EVMWD Flagler 2A Well	EVMWD	Bedford	Continuous (SCADA)	105	51 to 92	80	48.00	10/18/2019	Pump intake	80
EVMWD Flagler 3A Well	EVMWD	Bedford	Continuous (SCADA)	100	51 to 90	80	57.00	10/18/2019	Pump intake	80
Corona & EVMWD Trilogy	EVMWD	Coldwater	Quarterly	579	250 to 360 and 390 to 450	No pump	359.30	10/12/2016	Ten feet above bottom of screen	440
EVMWD Station 71	EVMWD	Bedford	Quarterly	600	239 to 588	507	499.92	7/21/2017	Pump intake	507
EVMWD Mayhew Well 2	EVMWD	Coldwater	Quarterly	740	300 to 730	507	440.99	11/28/2017	Pump intake	507
TVWD Well 1 (Old well)	TVWD	Bedford	Continuous (SCADA)	100	40 to 80	No pump	42.50	11/1/2016	Ten feet above bottom of screen	70
TVWD Well 1A	TVWD	Bedford	Continuous (SCADA)	100	40 to 80	85	53.40	11/15/2016	Ten feet above bottom of screen	70
TVWD Well 4	TVWD	Bedford	Continuous (SCADA)	100	40 to 80	85	46.80	10/7/2015	Ten feet above bottom of screen	70
TVWD TP-1	TVWD	Bedford	Continuous (SCADA)	103	39 to 99	85	Unknown	Unknown	Pump intake	85
TVWD TP-2	TVWD	Bedford	Continuous (SCADA)	90	30 to 85	85	Unknown	Unknown	Ten feet above bottom of screen	75
TVWD Foster	TVWD	Bedford	Continuous (SCADA)	93	38 to 88	84	Unknown	Unknown	Ten feet above bottom of screen	78
TVWD New Sump	TVWD	Bedford	Continuous (SCADA)	74	Unkown	66	101.67	8/1/1994	Pump intake	66

6.2.6. Minimum Thresholds

According to GSP Regulations Section 354.28(c)(1), the minimum threshold for chronic lowering of groundwater levels must be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. MTs for chronic lowering of groundwater levels are to be supported by information on the rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the Basin. However, as documented in the Groundwater Conditions Section 4.1.3, groundwater levels are not chronically declining in Bedford-Coldwater. While groundwater levels decline in dry and critically-dry years, they have recovered in normal, above normal, and wet years. Groundwater levels in some wells were at historical lows after the recent drought ending in 2016 but are recovering.

Currently, none of the wells have groundwater levels below their respective MTs and no undesirable results are known to have occurred in the past. Nonetheless, MTs have been developed because the potential exists for chronic lowering of groundwater levels in the future.

Using available recent and reliable information on the construction of existing supply wells, the MT levels shown in **Table 6-1** are protective of most supply wells. Based on historical lows, the MTs account for historical groundwater level variations, and consideration has been given to supporting Basin management flexibility, for example to avoid setting off false alarms or triggering costly, ineffective, or harmful management actions.

The MTs shown in **Table 6-1** were developed making use of available data. However, uncertainties exist as summarized below:

- The geographic distribution of wells in the groundwater level monitoring program is uneven.
- Information on vertical groundwater gradients is lacking and groundwater levels in shallow wells may not be represented adequately by relatively deep wells.
- The specific location, status, and construction of most existing private wells is not known, or the information is not readily available (in databases).

These uncertainties have been recognized and are being addressed in this GSP as follows:

- Mapping and prioritization of geographic gaps in the monitoring program.
- Installation of two new dedicated monitoring wells sited and designed to support the groundwater level monitoring program (among other objectives) and to become Key Wells.
- Identification and mapping of existing active private production wells within the Basin, as described in Section 8 Projects and Management Actions.

The benefits of these efforts will accrue over the next few years and will support review and update of the MTs in the 5-Year GSP Update in 2027.

6.2.6.1. Minimum Thresholds and Criteria for Undesirable Results

Undesirable results are based on exceedances of MT levels and must be defined not only in terms of how they occur (as described in Section 6.2.2 Potential Causes of Undesirable Results), but also when and where. By definition, undesirable results are not just drought-related but chronic and are not just local but basin-wide.

The distinction between drought and chronic declines may not be clear when declines are occurring, particularly during drought when it is not known whether subsequent years will bring recovery. Moreover, effects of declining levels on individual well owners may be real problems, whether or not they represent basin-wide sustainability issues.

The BCGSA will perform quarterly or more frequent groundwater level monitoring. Accordingly, groundwater level monitoring and annual reporting provides an early warning system that allows response by the BCGSA and local groundwater users. From this perspective, two consecutive exceedances in each of two consecutive years is regarded as indicating when an undesirable result is occurring. The exceedances would be measured at a Key Well as part of the regular quarterly monitoring program. It should be noted that GSA responses do not have to wait for two years and may involve a staged response as in urban water shortage contingency plans.

While undesirable results relate to groundwater conditions throughout the Basin, the Basin has been organized into two management areas (MAs). As discussed in Section 5.4, this reflects the fact that the Basin is separated by a fault zone, limiting (but not eliminating) flow between the two MAs. Groundwater level MTs will be evaluated separately for each MA, because the groundwater histories are distinct, albeit linked. As a result, undesirable results could occur in one MA and not the other. Accordingly, undesirable results are indicated to be occurring when two-thirds or more of the currently monitored wells in the MA have had two consecutive exceedances in each of two consecutive years.

To summarize for the Bedford-Coldwater Basin:

> The **Minimum Threshold** for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well by operational considerations to maintain water levels at or above current pump intakes or screen bottoms (whichever is higher) in municipal water supply wells. Undesirable results are indicated when two consecutive exceedances occur in each of two consecutive years, in two-thirds or more of the currently monitored wells in each Management Area.

6.2.6.2. Relationship of Minimum Threshold to Other Sustainability Indicators

The establishment of MTs also needs to consider potential effects on other sustainability indicators. These indicators are discussed later in this section; the following are brief discussions.

- **Groundwater Storage**. The MTs for groundwater levels are protective of groundwater storage. These MTs are defined in terms of operational considerations

for wells used to support beneficial uses in the Basin. The major concern expressed in the Sustainability Goal is to have reliable storage for drought conditions. As the water level MTs support maintenance of production capacity in wells, they also support maintenance of reliable storage.

- **Seawater Intrusion.** There is no possibility of seawater intrusion in the Bedford-Coldwater Basin as it is more than 20 miles from the ocean. Accordingly, there is no seawater intrusion minimum threshold and no relationship with other minimum thresholds.
- **Subsidence.** Subsidence is linked to groundwater levels. It is unlikely that significant inelastic subsidence would occur if groundwater levels remain within the operational range of water levels, which have been used to define groundwater level MTs. Accordingly, the minimum threshold for groundwater levels is consistent with and supportive of the objective to prevent subsidence undesirable results.
- **Water Quality.** General relationships are recognized, for example that contaminants may be mobilized by changing groundwater levels or flow patterns. Maintenance of groundwater levels within historical operational ranges would minimize any effects on maintenance of water quality at or above minimum thresholds. The groundwater quality issues in Bedford-Coldwater Basin are associated primarily with salt and nutrient loading and not likely to be affected by groundwater levels or flow within operational ranges.
- **Interconnected Surface Water.** The set of monitoring wells used to evaluate interconnected surface water overlaps with the set of wells used for the groundwater levels minimum threshold. In general, the MTs for interconnected surface water are similar to or higher than those for groundwater levels; the higher MTs would be controlling.

6.2.6.3. Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Bedford-Coldwater Basin is adjacent to the Temescal Basin and the Elsinore Basin. Groundwater flow directions are from the Elsinore Basin through Bedford MA to the Temescal Basin with some drainage into the Temescal Wash. The Bedford-Coldwater groundwater level MTs would support maintenance of groundwater levels above their respective MTs in Bedford MA. This in turn will support maintenance of groundwater levels in the Temescal Basin.

6.2.6.4. Effect of Minimum Threshold on Beneficial Uses and Users

Groundwater is the major source of supply in the GSP Area and supplies wells for municipal, industrial, and other beneficial uses and users. The MTs are based generally on well operations, which recognizes that groundwater has been and is being used reasonably for the range of beneficial uses even during drought, and with reasonable operation and maintenance by well owners. The MTs quantify undesirable results as involving two-thirds of wells in a MA with two consecutive exceedances in each of two consecutive years, which provides early warning of declining groundwater levels.

While there are a small number of private wells in the Basin, there are no DACs or SDACs in the Basin and the only private domestic well in the Basin belongs to the Glenn Ivy Hot Springs.

The BCGSA believes that all other private wells in the Basin are used for non-potable supply. Project 2 (described in Section 8.7) is designed to locate and characterize the construction and use of all existing active private wells to ensure that the minimum threshold for groundwater levels is protective of all users in the Basin, recognizing the human right to water.

6.2.6.5. Relationship of Minimum Threshold to Regulatory Standards

No federal, state or local standards exist for groundwater levels.

6.2.6.6. How Management Areas Can Operate without Causing Undesirable Results

The establishment of MTs has been consistently conceived and applied across both Management Areas. MTs are based on well operations, which vary from well to well representing local conditions that do not necessarily occur at the same time across the MAs. Maintenance of water levels within the operational range in wells is not anticipated to cause undesirable results between the two MAs.

6.2.6.7. How the Minimum Threshold will be Monitored

Monitoring for the groundwater levels MT will be conducted as part of the BCGSA groundwater level monitoring program, data and analytical results will be presented in the Annual GSP Reports. The BCGSA monitoring program includes wells monitored by Corona, EVMWD, and TVWD.

6.2.7. Measurable Objectives

Measurable Objectives are defined herein as an operating range of groundwater levels, allowing reasonable fluctuations with changing hydrologic and surface water supply conditions and with conjunctive management of imported water and groundwater. The groundwater level MTs represent the bottom of the operating range and are protective of groundwater users. The top of the operating range is generally where the water table approaches the soil zone and ground surface, except where groundwater and surface water are interconnected or groundwater dependent ecosystems exist. Section 6.7 addresses these areas and potential undesirable results with Depletions of Interconnected Surface Water. With these important exceptions, the top of the operating range is below the soil zone, thereby minimizing potential agricultural drainage problems.

> The **Measurable Objective** is to maintain groundwater levels above the historical maximum depth to groundwater, and to maintain groundwater levels within the operating range as defined in this section.

Groundwater conditions with respect to chronic groundwater level declines are already sustainable. Therefore, no interim milestones are needed to achieve sustainability by 2042.

6.2.7.1. Discussion of Monitoring and Management Measures to be Implemented

Data gaps and sources uncertainties have been identified in this section, including the lack of reliable and accessible information on active private well pumping and construction.

Management actions to maintain groundwater levels have been ongoing and effective for decades. These actions (consistent with the Sustainability Goal objective to support integrated and cooperative water resource management) have included acquiring imported water for direct use, providing recycled water for irrigation, and other conjunctive use operations. The BCGSA will also implement management actions to inventory existing active private wells. This will include identification of locations and construction information for active wells throughout the Basin to support refinement of the groundwater level MTs and MOs in the 5-year GSP update.

Monitoring improvements are discussed in Section 7, including results of the Dedicated Monitoring Well Program initiated in June 2020.

6.3. REDUCTION OF GROUNDWATER STORAGE

Groundwater storage is the volume of water in the Basin and provides a reserve for droughts or surface water supply shortages. The MT for reduction of groundwater storage is the volume of groundwater that can be withdrawn from a Basin or MA without leading to undesirable results. Undesirable results would involve insufficient stored groundwater to sustain beneficial uses throughout drought or water supply shortage. The storage criteria are closely linked to groundwater levels. The sustainability indicator for groundwater storage addresses the ability of the groundwater Basin to support existing and planned beneficial uses of groundwater, even during drought and surface water supply shortage.

For the each of the two MAs of the Bedford-Coldwater Basin, the water budget has been calculated using the numerical model, as described in Water Budget Section 5. In brief, this has included analyses of the cumulative change in storage for each of the two MAs for the historical and current period, 1990 through 2018, and for simulated future conditions (see **Figures 5-5** and **5-6**). The water budget analyses have shown the dynamic effects of drought and changes in groundwater use and indicate that groundwater storage in the Basin has been sustainably managed relative to storage. The water budget inflow and outflows have been balanced over the long term. Furthermore, as indicated in Section 6.2, none of the water supply wells have been reported as going dry in the Basin during the historical period of record.

6.3.1. Description of Undesirable Results

Given that Bedford-Coldwater Basin has not experienced any impacts to wells related to groundwater storage, the undesirable result associated would be an insufficient supply to support beneficial uses during droughts. Storage is related to groundwater levels. Thus, undesirable results associated with storage would likely be accompanied by one or more

undesirable results associated with groundwater levels, including reduced well yields, subsidence, and depletion of interconnected surface water.

6.3.2. Potential Causes of Undesirable Results

For groundwater storage in the Basin, the basic cause of undesirable results would be an imbalance of the water budget, such that outflows exceed inflows resulting in reduction of groundwater storage. This imbalance could be caused in turn by reduced surface water supplies and associated groundwater recharge. Such reduction could potentially include the following conditions: 1) increased pumping due to disruption of imported water, 2) reduced percolation from Temescal Wash, 3) reduced natural recharge due to increased impervious area (development), or 4) increased pumping due to reduced recycled/non potable discharge and use. Undesirable results also could occur because of changes in land use causing increased demand for groundwater; this would be most problematic in portions of the Basin without access to other water supplies.

6.3.3. Definition of Undesirable Results

Undesirable results are defined with the understanding that the objective of groundwater management is to provide reliable storage for water supply resilience during droughts and shortages. Accordingly, the definition of potential undesirable results for storage reduction includes consideration of how much storage has been used historically (i.e., operating storage) and how much stored groundwater reserve is needed to withstand droughts.

In considering conceptual operating storage or groundwater reserves, it is important to bear in mind that these are not the total amount of groundwater that could potentially be extracted from the Basin. Most wells are in the range of 75 to 700 feet deep.

The depth of the Basin ranges from less than 40 feet in some areas to more than 800 feet in others (see **Figure 3-9**). Groundwater wells used for water supply are generally located in the deeper portions of the Basin. Additional groundwater storage could be utilized, with the foremost assumption that withdrawals and reduction are followed by commensurate recharge and recovery. This could occur as part of enhanced conjunctive use programs.

6.3.4. Potential Effects on Beneficial Uses and Users

Groundwater is a source of water supply in the GSP Area and supplies wells for municipal, industrial, and other beneficial uses. Reduction of groundwater storage would reduce access to that supply with adverse effects on the community, economy, and environmental setting of the Temescal Valley. However, groundwater has been and is being used for the beneficial uses, even during drought.

6.3.5. Sustainable Management Criteria for Groundwater Storage

The general approach to defining sustainability criteria for groundwater storage has involved review of historical cumulative change in storage and expected future storage declines during

droughts. Review of historical change in storage is useful to estimate about how much storage has been used in each Management Area, effectively defining an *operating storage*. Similarly, the approach focuses on the beneficial uses of the Basin and acknowledges much of the pumping occurs in larger municipal wells with dynamic operations. Sustainability criteria for groundwater levels also take into account historical ranges and the management of dynamic operation of municipal wells.

6.3.5.1. Description of Historical Cumulative Change in Storage: 1990 through 2018

The cumulative change in storage by management area for historical and current conditions (1990 through 2018) as simulated by the numerical model is discussed and shown in tables and figures in Section 5. Observations about the historical operating storage for each of the Management Areas are as follows:

Bedford Management Area. The average annual change in groundwater storage was stable over the model period, 1990 through 2018, with an average increase in storage of 73 acre-feet per year (AFY). This increase in storage is due to decreased pumping from 2005 to the end 2019, when pumping in the MA averaged about 1,000 AFY. The change in storage during this same period increased on average about 400 AFY. For the early portion of the model (1990 through 2004), groundwater pumping was approximately 2,500 AFY, which resulted in a slight decline in groundwater storage. The average annual decrease in storage during this period was 22 AFY. This storage response indicates the Basin can support this range of operation, given appropriate natural recharge. Groundwater storage has increased a total of 2,215 acre-feet (AF) over the model period. The simulated increasing trend of groundwater storage in this MA provides an operational range that would support beneficial uses.

Coldwater Management Area. The average annual change in groundwater storage over the model period was an average annual decrease of about 2,000 AFY. Declines in storage in this MA were more pronounced early in the model period, averaging over 3,800 AFY between 1990 and 2004. Recent groundwater storage change has been relatively stable even with a significant drought period from 2014 to 2017. The local agencies pumping from the Coldwater MA have agreed to limit their pumping to a sustainable yield volume based on available recharge. Accordingly, groundwater pumping has declined from an average of over 6,500 AFY between 1990 and 2008 to approximately 3,000 AFY from 2009 through 2018. In the Coldwater MA, the simulated groundwater storage stabilized and largely recovered during the one to two years following droughts, but still showed a general decrease in groundwater storage due to increased groundwater production over the model period. Given the storage stability in the current period (2008 through 2018) and current groundwater management practices, groundwater storage will likely continue to increase on average and recover from short term droughts on the order of one to two years. These groundwater management practices include the existing agreement between local agencies to pump within a sustainable yield.

Ongoing aggregate mining in the Coldwater MA (and to a lesser extent Bedford MA) may impact both the inflows and outflows used to calculate the change in storage. Uncertainty exists about the role in storage changes of open pits used in quarry operations, specifically

their contribution to additional recharge in wet years and/or additional outflow through evaporation or other processes. A potential management action to collect additional data related to quarry operations is discussed in Section 8.

6.3.6. Minimum Threshold

Undesirable results relative to groundwater storage have not occurred in the Basin and numerical modeling of future conditions indicate that groundwater storage can continue to be operated within historical limits. However, given the dynamic nature of the Bedford-Coldwater production wells, additional storage outside of the historical limits may be needed. According to SGMA, the minimum threshold for storage is to be defined as the maximum groundwater volume that can be withdrawn without leading to undesirable results.

GSP Regulations allow the use of the groundwater level sustainability criteria (MTs and MOs) as a proxy for groundwater storage, provided that the GSP demonstrates a correlation between groundwater levels and storage. Groundwater levels and storage are directly related. This is demonstrated by comparison of groundwater level and storage trends, which reveal the same patterns of changes in pumping, response to drought, and recovery, as discussed in Section 5. The relationship of groundwater levels and storage is embodied in the calibrated numerical model.

The rationale for using groundwater levels as a proxy metric for groundwater storage is that the groundwater level MTs and MOs are sufficiently protective to prevent significant and unreasonable results relating to storage. Groundwater level MTs have been defined to protect supply wells (see Section 6.2.6) and are based on the following:

- A broad geographic distribution of Key Wells that are representative of production wells in the Basin;
- MTs that are based on operational parameters for existing water supply wells;
- Analysis of existing municipal supply wells with construction information and setting of MTs to avoid operational failure in these wells; and
- Groundwater level MTs that include two consecutive quarters in two years, providing early warning for storage changes, while also involving two-thirds or more of the Key Wells in each MA, thus involving a broad area, consistent with storage change.

As a practical matter, the availability of groundwater in storage will be constrained by MTs for water levels (including groundwater level proxies for depletion of interconnected surface water). The MTs for groundwater levels will be sufficiently protective of groundwater storage.

To summarize for the Bedford-Coldwater Basin:

> The **Minimum Threshold** for reduction of groundwater storage for all MAs is fulfilled by the minimum threshold for groundwater levels. The **Minimum Threshold** for defining undesirable results relative to chronic lowering of groundwater levels is

defined at each Key Well (two consecutive quarters in two years, providing early warning for storage changes, in two-thirds or more of the Key Wells in each MA).

The Sustainability Goal for the Bedford-Coldwater Basin includes an objective to provide reliable storage for water supply resilience during droughts and shortages. Use of groundwater levels as a proxy also fulfills that objective. No additional MT definition is needed.

6.3.6.1. Relationship of Minimum Threshold to Other Sustainability Indicators

- **Water Levels.** The minimum thresholds for groundwater levels are protective of the beneficial use of the Basin – municipal, industrial, and other water supply; therefore, these levels are protective of and serve as a proxy for groundwater storage and the provision of reliable storage for drought and shortage.
- **Seawater Intrusion.** There is no possibility of seawater intrusion in Bedford-Coldwater Basin. Accordingly, there is no minimum threshold and no relationship with other minimum thresholds.
- **Subsidence.** Subsidence is linked to groundwater levels. Because the storage reduction minimum threshold would not cause water levels to drop below their minimum thresholds, it would not interfere with the subsidence minimum threshold.
- **Water Quality.** Maintenance of groundwater storage within historical and operational ranges would minimize any effects on water quality relative to water quality minimum thresholds. Groundwater quality issues in Bedford-Coldwater Basin are associated primarily with salt and nutrient loading and not likely to be affected by groundwater storage within historical and operational ranges.
- **Interconnected Surface Water.** The minimum thresholds for depletion of surface water flow are linked to groundwater levels near stream reaches with shallow groundwater. Those water levels are generally equal to or higher than the minimum thresholds for water levels in those areas. Thus, it is likely that the interconnected surface water threshold would constrain storage utilization.

6.3.6.2. Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Bedford-Coldwater Basin is located downstream from the Elsinore Valley Subbasin along Temescal Wash. Groundwater flow directions are from the Elsinore Valley Subbasin to the Bedford-Coldwater Basin. The groundwater level MTs for the Bedford-Coldwater Basin would support maintenance of groundwater levels and storage within the operational range in the Bedford MA adjacent to the Elsinore Valley Subbasin. This in turn will support maintenance of operational groundwater storage in the neighboring Elsinore Valley Subbasin.

6.3.6.3. Effect of Minimum Threshold on Beneficial Uses and Users

Beneficial uses and users of groundwater storage include maintenance of interconnected surface water and associated groundwater dependent ecosystems (GDEs) and municipal, industrial and other groundwater users. The MTs for groundwater levels are based generally on operational considerations for wells, which recognizes that groundwater has been and is

being used reasonably for the range of beneficial uses even during droughts. The storage minimum threshold is consistent with the water level minimum threshold, which means that available storage will be adequate to supply beneficial uses as long as water levels remain above their minimum thresholds.

6.3.6.4. Relationship of Minimum Threshold to Regulatory Standards

Other than SGMA, no federal, state or local standards exist for reduction of groundwater storage.

6.3.6.5. How Management Areas Can Operate without Causing Undesirable Results

A storage change in one Management Area would be associated with a change in water levels. That change could affect groundwater flow between that Management Area and an adjoining one. The boundary flow would only change if storage and water levels in the adjoining Management Area did not experience a similar change. Therefore, no incompatibility among Management Areas with respect to storage declines is anticipated.

6.3.6.6. How the Minimum Threshold will be Monitored

Monitoring for the groundwater levels MT, which is the proxy for groundwater storage, will be part of the BCGSA groundwater level monitoring program (as described in Section 7). Data and analytical results, including assessment of change in storage, are presented in GSP Annual Reports.

6.3.7. Measurable Objectives

Measurable Objectives is defined in GSP regulations as an operating range of groundwater storage, allowing changes in groundwater storage with varying hydrologic and surface water supply conditions and as with conjunctive management of surface water and groundwater. The groundwater level MTs provide a protective level that corresponds to the minimum threshold for storage, which would keep groundwater storage within the historical operating range. The 5-Year GSP Update could include consideration of using more of this storage locally as part of ongoing conjunctive use while also protecting shallow wells.

> The **Measurable Objective** for storage is fulfilled by the MO for groundwater levels, which maintains groundwater levels above the historical maximum groundwater depths in each Key Well (as quantified above in **Table 6-1**).

Groundwater conditions with respect to depletion of groundwater storage are already sustainable. Therefore, no interim milestones are needed to achieve sustainability by 2042.

6.3.7.1. Discussion of Monitoring and Management Measures to be Implemented

Management actions to prevent chronic reduction of groundwater storage and to provide groundwater reserves for drought will be the same actions for maintenance of groundwater levels. No other specific management actions for storage have been identified and no specific implementation is warranted.

6.4. SEAWATER INTRUSION

Seawater intrusion does not occur in the Bedford-Coldwater Basin because of its inland location. According to the GSP Regulations, the GSP is not required to establish criteria for such undesirable results that are not likely to occur. Accordingly, the remaining discussion in this section does not address seawater intrusion.

6.5. LAND SUBSIDENCE

Subsidence has not been a known issue in the Bedford-Coldwater Basin and undesirable results have not been reported. Nonetheless, the potential has been recognized that subsidence could occur as a result of groundwater pumping and groundwater level declines, typically in areas underlain by thick layers of fine-grained alluvial sediments.

As described in Section 4.3, available information on vertical land displacement (subsidence) includes estimates from InSAR satellite data systems. InSAR data provide mapping of ground surface elevations across the Basin, presented at regular (typically monthly) intervals.

InSAR data are made available by DWR from the TRE Altamira InSAR Dataset with vertical displacement data beginning in June 2015 and in monthly intervals thereafter until September 2019. The accuracy of the InSAR ground surface elevation change estimates is reported to be ±16 millimeters (mm), or ±0.052 feet (ft) (Towill 2020). While these data do currently represent a relatively short period of record, the InSAR data do not show significant changes in ground surface elevation in the Basin, which is characterized by small changes within the margin of error. Given the short records of these datasets and small vertical displacements, these data have not been analyzed systematically to identify specific areas that might be subject to long-term subsidence. As datasets are updated, that may be warranted in the future.

There are no data relating potential subsidence to water levels or groundwater pumping in the Basin. SGMA allows groundwater level data to be used as a proxy for subsidence; however, relationships between pumping, groundwater levels, and subsidence have not been determined to support that. Subsidence information from DWR InSAR data will be reviewed as it becomes available.

6.5.1. Description of Undesirable Results

Land subsidence is the differential lowering of the ground surface, which can damage structures, roadways, and hinder surface water drainage. Subsidence remains a potential risk and inelastic subsidence is irreversible. Potential undesirable results associated with land subsidence due to groundwater withdrawals include the following:

- Potential damage to building structures and foundations, including water facilities, due to variations in vertical displacement causing potential cracking, compromised structural integrity, safety concerns and even collapse.

- Potential differential subsidence affecting the gradient of surface drainage channels, locally reducing the capacity to convey floodwater and causing potential drainage problems and ponding.
- Potential differential subsidence affecting the grade or drainage of other infrastructure such as railroads, roads, and sewers.
- Potential subsidence around a production well, disrupting wellhead facilities or resulting in casing failure.
- Potential non-recoverable loss of groundwater storage as fine-grained layers collapse.

None of these undesirable results has been observed in the Basin. However, subsidence may be subtle and cumulative over time. Accordingly, the potential for future subsidence cannot be ruled out if regional groundwater levels were to decline below historical lows and minimum thresholds.

6.5.2. Potential Causes of Undesirable Results

As described in Section 4.3, changes in ground surface elevations may be caused by regional tectonism or by subsidence related to declines in groundwater elevations due to pumping. Regarding the former, the InSAR data show a general rising trend in the western portion of the Basin suggesting regional tectonic rise. In contrast, inelastic subsidence associated with groundwater pumping and level declines would generally show a long-term downward trend, with greater subsidence occurring during times of groundwater level decline (e.g., drought) and a flattening trend with no recovery during times of rising groundwater levels and reduced pumping (e.g., wet years).

As groundwater levels decline in the subsurface, dewatering and compaction of predominantly fine-grained deposits (such as clay and silt) can cause the overlying ground surface to settle. Land subsidence due to groundwater withdrawals can be temporary (elastic) or permanent (inelastic). While elastic deformation is relatively minor, fully recoverable, and not an undesirable result, inelastic deformation involves a permanent compaction of clay layers that occurs when groundwater levels in a groundwater basin decline below historical lows. This causes not only subsidence of the ground surface, but also compaction of sediments and loss of storage capacity.

Given the above, the potential for problematic land subsidence is affected by the proportion, overall thickness, and configuration of fine-grained sediments (with greater proportions and thicknesses suggesting greater potential). Because of the variability of local sediments, subsidence also is likely to be geographically variable. Moreover, the potential for subsidence is affected by the history of groundwater level fluctuations, such that areas with previous groundwater level declines may have already experienced some compaction and subsidence.

Subsidence is possible in Coldwater MA, due to the thickness of sediments and larger amount of pumping in this area. However, there is no evidence of thick, laterally continuous fine-grained materials that would be susceptible to subsidence. No data indicate that permanent inelastic subsidence has occurred.

6.5.3. Potential Effects on Beneficial Uses and Users

The lack of any reports of undesirable results is an indication of no noticeable effects. Nonetheless, some subsidence could have occurred because of historical groundwater level declines without being noticed and could have contributed to drainage or flooding problems, which are also affected by multiple and sometimes more noticeable factors including variable weather, changes in streams and drainage systems, land use changes in the watershed, erosion and sedimentation. Accordingly, continued tracking of subsidence is warranted.

6.5.4. Minimum Threshold

According to the GSP Regulations Section 354.28(c)(5), the minimum threshold for land subsidence is defined as the rate and extent of subsidence that substantially interferes with surface land uses. This section first addresses the rate at which subsidence substantially interferes with surface land uses and then describes how available InSAR data can be used to measure rate and extent across the Basin.

> The M**inimum Threshold** for subsidence is defined as a cumulative decline equal to or greater than one foot since 2015, which represents current conditions and the SGMA start date. This corresponds to a rate of decline equal to or greater than 0.2 feet in any five-year period.

The one-foot criterion is reasonable based on standards for flooding and drainage and on empirical data for well casing collapse:

- In the southwestern part of the Sacramento Valley, where documented cumulative subsidence has reached several feet, video surveys of 88 undamaged wells and 80 damaged wells showed that casing damage was uncommon in wells where subsidence was less than one foot (LSCE 2014).
- Ground floor elevations are recommended or required to be at least one foot above the Base Flood Elevation in some jurisdictions (see for example FEMA 2011 and City of Temecula 2020). Subsidence above one foot may cause some buildings to become flooded.
- The minimum freeboard along roadside ditches is often required to be one foot above the maximum anticipated water level (see for example San Diego County 2005). Greater subsidence may cause sewer and stormwater flows to flow in unintended directions.

Subsidence impacts can be relatively rapid and noticeable. However, in the Basin any subsidence in the future is likely to be gradually cumulative as would be its undesirable results. Accordingly, the 0.2 ft per 5-year rate of decline is an appropriate criterion, with the understanding that it will be re-evaluated in the 2027 GSP Update.

Based on available data and using the above criterion, significant and unreasonable subsidence has not occurred since 2015 in the Basin. Moreover, it is unlikely that the criterion

will be exceeded in the future as groundwater pumping will be constrained with the MT set for groundwater levels and storage.

The extent of cumulative subsidence across the Basin will be monitored using the InSAR data provided on DWR's SGMA Data Portal website. The data consist of a closely spaced grid of elevation points approximately 300 feet apart and are characterized by considerable "noise," meaning that adjacent points often have very different readings at the scale of 1-2 inches. These data will be smoothed to provide results at a spatial scale at which subsidence would plausibly occur. These values for cumulative elevation change will then be compared annually with the minimum threshold criterion.

6.5.4.1. Relationship of Minimum Threshold to Other Sustainability Indicators

Subsidence related to groundwater is closely linked to groundwater levels. It is unlikely that significant inelastic subsidence would occur if groundwater levels remain above historical lows, which have been used to define groundwater level MOs. In addition, the operationally defined MT levels will prohibit significant pumping if water levels decline below historical lows. Accordingly, the minimum threshold for groundwater levels is consistent with and supportive of the objective to prevent subsidence undesirable results.

The subsidence MT would have little or no effect on other MTs. Specifically, subsidence MTs would not result in significant or unreasonable groundwater elevations, would not affect pumping and change in storage, would not affect groundwater quality, or result in undesirable effects on connected surface water.

6.5.4.2. Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Bedford-Coldwater Basin is adjacent to the Temescal Basin and Elsinore Valley Subbasin. Groundwater flow directions are from the Elsinore Valley Subbasin to the Bedford-Coldwater Basin and from the Bedford-Coldwater Basin to the Temescal Basin with some drainage into the Temescal Wash. The MTs for the Basin represent current conditions; establishment of MTs and maintenance of groundwater levels would not affect the ability of the either the Temescal Basin or Elsinore Valley Subbasin GSAs to achieve or maintain sustainability, as the flows between the basins are relatively minimal, and therefore groundwater levels and, thus, subsidence, in one basin would not affect the other.

6.5.4.3. Effect of Minimum Threshold on Beneficial Uses and Users

Subsidence has not been reported in the Basin, but subsidence remains a potential undesirable result that may contribute incrementally to reduced drainage, increased flooding, or other undesirable results. The effects of establishing the numerical subsidence MT are beneficial because they support a greater chance of detecting subsidence, supporting management actions to maintain groundwater levels, and preventing significant subsidence.

6.5.4.4. Relationship of Minimum Threshold to Regulatory Standards

There are no federal, state or local standards specifically addressing subsidence. There are standards for flood depth, floodplain encroachment, freeboard in ditches and canals and

slopes of gravity-flow plumbing pipes. These vary somewhat from jurisdiction to jurisdiction, but they are generally similar and were used as the basis for selecting the MT.

6.5.4.5. How Management Areas Can Operate without Causing Undesirable Results

The MTs are consistently conceived and applied across both MAs. Tracking and analysis of InSAR mapping over the next five years (until the 5-Year GSP update) may be revealing about the potential for subsidence in the Basin. Meanwhile, maintenance of groundwater levels at or above historical lows consistent with the water level MOs will tend to maintain current conditions between the successive MAs from upstream to downstream.

6.5.4.6. How the Minimum Threshold will be Monitored

The minimum threshold will be monitored using available InSAR areal data to identify any occurrence and areal extent of subsidence. Over the next few years, this evaluation will involve review of temporal InSAR data to discern seasonal elastic fluctuations and potential inelastic declines. In addition, any areal extent will be examined; this may involve smoothing of elevation changes over the InSAR grid to summarize the results to a spatial scale at which subsidence would plausibly occur. The cell values for cumulative elevation change will then be compared with the minimum threshold criterion.

6.5.5. Measurable Objectives

The Sustainability Goal includes the objective to prevent subsidence. Accordingly, the MO is zero subsidence. Undesirable subsidence results have not been reported, and accordingly, no interim milestones are defined.

6.5.5.1. Representative Monitoring

It is assumed that the InSAR subsidence monitoring programs will continue for the foreseeable future and InSAR data will be available from the DWR website. The GSP monitoring program for subsidence will involve annual download of InSAR data with analysis for signs of cumulative inelastic subsidence.

6.5.5.2. Discussion of Management Actions to be Implemented

Management actions to prevent subsidence will be coordinated with actions relative to maintenance of groundwater levels. These actions involve maintaining groundwater levels above historical low water levels and will prevent significant inelastic subsidence. No other specific management actions for subsidence have been identified and no specific implementation is warranted.

6.6. DEGRADATION OF WATER QUALITY

Degraded water quality can impair water supply and affect human health and the environment. Impacts to drinking water supply wells can result in increased sampling and monitoring, increased treatment costs, use of bottled water, and loss of wells, which may be taken offline because of quality issues. As described in Groundwater Conditions Sections 4.6

and 4.7, elevated concentrations in drinking water of some constituents, such as nitrate, can adversely affect human health.

Consideration of the causes and circumstances of water quality conditions is important in Bedford-Coldwater because general mineral quality is naturally poor, especially in the Bedford MA. Nonetheless, groundwater has been used for beneficial purposes including irrigation, municipal, and domestic purposes. Sustainable management is about use and management of groundwater without causing undesirable results but does not necessarily include reversing natural undesirable conditions. According to SGMA (§10727.2(b)(4)), a GSP may—but is not required to—address undesirable results that occurred before and have not been corrected by the SGMA benchmark date of January 1, 2015.

Salt and nitrate loading also are recognized as sources of groundwater quality deterioration. The sustainability goal to protect groundwater quality is not to reverse undesirable water quality conditions by 2042 but rather to prevent circumstances wherein future management activities might make water quality worse, and insofar as possible to improve water quality in the long run. Implementation of management actions is recognized as needed now and, whether or not the results are perceptible in the short term, such actions will be helpful in the long term.

6.6.1. Potential Causes of Undesirable Results

The quality of groundwater in Bedford-Coldwater Basin is characterized as mineralized, in part reflecting natural hydrogeologic processes (see Groundwater Conditions Section 4.4). Groundwater also has been affected by human activities including historical agriculture and current urban, industrial, and other land uses. While contaminant sources of groundwater quality degradation exist, these are effectively regulated as described in Groundwater Conditions Section 4.6 and regularly tracked as part of other monitoring programs.

As described in the Groundwater Conditions section, TDS and nitrate are constituents of concern for the Basin. While there are elevated natural background TDS concentrations in groundwater, TDS also is an indicator of human impacts including infiltration of urban runoff, agricultural return flows, and treated wastewater discharge. Natural nitrate levels in groundwater are generally very low, and elevated concentrations are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facility discharges.

Other constituents considered to be contaminants have been documented (see Groundwater Conditions Section 4.6.1 and 4.7) but occurrences of these are either under regulation by the Santa Ana Regional Water Quality Control Board (RWQCB) and State Water Resources Control Board (SWRCB) (e.g., perfluorooctanesulfonic acid [PFOS] and perchlorate) or are naturally occurring with no recent exceedances of MCLs and limited potential for mobilization due to management actions. In addition, mining activities are also regulated through the County Planning Department, the Surface Mining and Reclamation Act, and RWQCB discharge permits.

6.6.2. Description of Undesirable Results

The processes and criteria relied on to define Undesirable Results included review of available data and information summarized in the Plan Area and Groundwater Conditions sections and discussions with Bedford-Coldwater stakeholders and local agency representatives.

Undesirable Results are defined in the GSP Regulations (§354.26) as occurring when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the Basin. The GSA is not responsible for local problems or degradation caused by others. While the Bedford-Coldwater Basin includes regulated facilities with soil and groundwater contamination (see Groundwater Conditions Sections 4.4 and 4.6.1), these sites are under regulatory oversight by State and County agencies; the GSA does not have the mandate or authority to duplicate these programs. This GSP avoids management actions that would spread groundwater contamination through managed aquifer recharge, pumping, or other activities.

6.6.3. Potential Effects on Beneficial Uses and Users

Groundwater is a major source of supply in the Basin and supports a range of beneficial uses including municipal, recreational, industrial, and other uses. Beneficial uses of water and respective water quality objectives are defined by the RWQCB in the Santa Ana River Basin Water Quality Control Plan (Basin Plan).

6.6.4. Sustainable Management Criteria for Groundwater Quality

The definition of an Undesirable Result due to degraded water quality—TDS and nitrate concentrations—was evaluated in the context of regulatory objectives in each MA.

The GSA has selected a minimum threshold based on average conditions in monitored supply wells and regulatory limits. The average concentrations are totaled from each well and then divided by the total number of supply wells, to achieve a single value representing average conditions over the entire Basin. While this is slightly different than the suggested methods to determine sustainability, the GSA desired a single quantitative value to guide management. This is because the issues of concern in Bedford-Coldwater are focused on regional nitrate and salt loading, data are insufficient to define plumes or volumes of water, and the position of isocontours is not applicable.

6.6.4.1. Water Quality Monitoring Program

Currently 12 wells are regularly monitored for TDS and/or nitrate in the Basin by GSA member agencies, shown on **Table 6-2**. The wells generally are sampled semi-annually with lab analysis for general minerals and physical parameters. Accordingly, this data set can be used to detect a range of problems quickly, to track trends, allow geochemical investigation, and support focused management actions.

Table 6-2. Bedford-Coldwater Water Quality Monitoring Wells

Local Well Name	Agency
Corona Well 21	Corona
Corona Well 3	Corona
EVMWD Flagler 2A Well	EVMWD
EVMWD Flagler 3A Well	EVMWD
EVMWD Station 71	EVMWD
EVMWD Mayhew Well 2	EVMWD
TVWD Well 1A	TVWD
TVWD Well 4	TVWD
TVWD TP-1	TVWD
TVWD TP-2	TVWD
TVWD MW 2 - Driving Range	TVWD
Glen Ivy Well 1	Glen Ivy

6.6.4.2. Additional Water Quality Programs

In addition to existing monitoring, the BCGSA will conduct the following ongoing water quality coordination activities:

- Periodic review of data submitted to the Department of Pesticide Regulation (DPR), SWRCB Division of Drinking Water (DDW), Department of Toxic Substances Control (EnviroStor), and GeoTracker as part of the Groundwater Ambient Monitoring and Assessment (GAMA) database.
- Continue to participate in Salt and Nutrient Management Plan (SNMP) activities that include the Bedford MA portion of the Basin.
- Coordinate with the RWQCB and Riverside County Division of Environmental Health to discuss constituent trends and concerns in the BCGSA in relation to groundwater pumping.

The purpose of these reviews will be to monitor and summarize the status of constituent concentrations throughout the Basin with respect to typical indicators such as applicable MCLs or secondary MCLs (SMCLs). The GSP Annual Report and 5-Year Update will include a summary of the coordination and associated analyses of conditions. The GSP 5-year updates may include evaluation of whether additional minimum thresholds are needed.

6.6.5. Minimum Thresholds

Minimum Thresholds have been developed for nitrate and TDS using the best available information. MTs for nitrate and TDS are based on current conditions represented by average water quality results from all monitored wells between 2014 and 2019. The average value for each constituent was calculated for each well using results from all samples collected between 2014 and 2019. For wells with one sample, the single value was used; for wells with two or more samples, the average value was used.

These individual well averages were then averaged together for all wells in each MA and all wells in the Basin, as shown in **Table 6-3**. The resulting MA and Basin-wide average concentrations provide a simple metric for evaluating TDS and nitrate concentrations in the Basin. For reference, the MCL for nitrate as N is 10 mg/L and the SMCL for TDS is 1,000 mg/L.

Table 6-3. Summary of Recent Average Total Dissolved Solids (TDS) and Nitrate Concentrations by Management Area

	Bedford MA Average Concentration, 2014 - 2019	Coldwater MA Average Concentration, 2014 - 2019	Basin Wide Average Concentration, 2014 - 2019
Nitrate as N	3 mg/L	2 mg/L	3 mg/L
TDS	788 mg/L	488 mg/L	713 mg/L
Number of Wells	**9**	**3**	**12**

According to GSP regulations Section 354.28(c)(4) the minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the GSA to be of concern for the Basin. In setting minimum thresholds for degraded water quality, the GSA shall consider local, state, and federal water quality standards applicable to the basin. For the Bedford-Coldwater Basin, water quality MTs are based on the total number of wells (currently 12) and set for the entire Basin including both MAs.

> The TDS water quality **Minimum Threshold** Basin-wide is defined as 5-year average concentrations not exceeding the 1,000 mg/L Secondary MCL for TDS.
>
> The nitrate water quality M**inimum Threshold** Basin-wide is defined as 5-year average concentrations not exceeding the 10 mg/L drinking water MCL for Nitrate as Nitrogen.

These MTs are presented with full recognition of data gaps and uncertainties, and with commitment incorporated in this GSP to investigate increasing trends in nitrate and salt loading if they occur, and to coordinate appropriate management actions with regulatory agencies such as the RWQCB.

While the TDS and Nitrate MTs were selected based on the MCL (drinking water standards) to protect the beneficial uses of the Basin, it is recognized that there are other water quality objectives. The Upper Temescal Valley SNMP sets forth anti-degradation goals for the Bedford portion of the Basin, and the RWQCB Basin Plan has additional objectives for the Coldwater MA. As noted in Section 4.5.1, the SNMP objectives for the Bedford area are lower than the MCLs. However, the fundamental approach of this GSP is to protect beneficial uses as identified in the Sustainability Goal (Section 6.1). The BCGSA will work with other agencies to help achieve their objectives for water quality but will not define sustainability based on those objectives.

Given historical and ongoing groundwater use, current water quality conditions are considered sustainable. As described in Section 6.6.6, Measurable Objectives, the approach is to implement management actions that will maintain or reduce TDS and nitrate concentrations in the future.

6.6.5.1. Relationship of Minimum Threshold to Other Sustainability Indicators

Three of the other sustainability indicators (groundwater level declines, storage depletion, subsidence) are directly linked to groundwater levels, while the sustainability indicator for connected surface water-groundwater dependent ecosystems is related to a rate or volume of surface water depletion, also linked to groundwater levels. The MTs for water quality are not known to be directly related to specific groundwater levels or fluctuations in groundwater levels. Nonetheless, general relationships are recognized, for example that contaminants may be mobilized by changing groundwater levels or flow patterns. Accordingly, the water quality MTs will help guide potential projects that alter groundwater levels or flow.

6.6.5.2. Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Bedford-Coldwater Basin is adjacent to the Elsinore Subbasin and Temescal Basin. Given the likelihood of continued flow between these basins remaining relatively similar current conditions, groundwater flow is likely to remain unchanged and groundwater quality in Bedford-Coldwater is unlikely to affect downstream Temescal Basin.

6.6.5.3. Effect of Minimum Threshold on Beneficial Uses and Users

The establishment of the MTs reflects the available data regarding the current condition of the Basin relative to TDS and nitrate concentrations. Establishing the MTs represents no change and recognizes that groundwater has been and is being used reasonably for the range of beneficial uses. The MTs represent a quantified starting point for protection of groundwater quality and for projects and management actions to improve groundwater quality, consistent with a best management practices approach.

6.6.5.4. Relationship of Minimum Threshold to Regulatory Standards

The MTs have been established with direct reference to regulatory standards, most notably the State-established MCLs. Other standards exist (including the Basin Plan Objectives set by the RWQCB and the Salt Nutrient Management Plan) that are lower (more strict) than the MTs. However, the Sustainability Goal and MTs are based on drinking water standards in order to protect local beneficial uses of groundwater.

6.6.5.5. How Management Areas Can Operate without Causing Undesirable Results

For both MAs, the goal is to protect groundwater quality with reference to beneficial uses and all MTs are based on available information and current conditions. It is not known if the current conditions represent equilibrium conditions between the two MAs or if future changes may occur between them. Future implementation of management actions and projects will be guided by monitoring data and by the consistent goal to protect groundwater quality in both MAs.

6.6.5.6. How the Minimum Threshold will be Monitored

The GSP is using the best available data from the BCGSA member agencies. The existing monitoring program will be improved and expanded to include dedicated monitoring wells. These will be included within the regular sampling schedule of the BCGSA and will build on historical records with data on specific constituents and parameters. The data from these dedicated wells will be used to reassess this threshold at the next GSP 5-Year update.

6.6.6. Measurable Objectives

The sustainability goal is to protect groundwater quality with reference to beneficial uses, with general objectives of maintaining groundwater quality, preventing circumstances where future management activities might make water quality worse, and improving groundwater quality in the long term.

6.6.6.1. Description of Measurable Objectives

Measurable Objectives are defined in this GSP using the same metrics and monitoring data as used to define MTs and are established to maintain or improve groundwater quality. Given uncertainties presented by data limitations, a reasonable margin of safety includes the possibility of "negative" monitoring results while positive progress is being made.

> The **Measurable Objective for TDS** is defined as maintaining or reducing 5-year average concentration in the Basin below the TDS Secondary MCL (1,000 mg/L) based on conditions documented in the Annual Reports.
>
> The **Measurable Objective for nitrate** is defined as maintaining or reducing the 5-year average concentration in the Basin below the nitrate as nitrogen MCL (10 mg/L) based on conditions documented in the Annual Reports.

Measurable Objectives will be evaluated in increments of five years and the numeric values will be presented with comparison to current conditions. This comparison will be discussed in the context of actual progress in implementing measures to improve monitoring and management.

6.6.6.2. Discussion of Monitoring and Management Measures to be Implemented

The strategy of this GSP is to identify and implement monitoring and management measures to reduce nitrate and TDS loading. Monitoring and management actions already undertaken are summarized in Plan Area Section 2.1.4. and would be continued. Additional monitoring measures are discussed in following sections.

6.7. DEPLETIONS OF INTERCONNECTED SURFACE WATER

This section builds and extends the discussion in Chapter 4 and the discussion of interconnection of surface water and groundwater. That section provided information on surface water-groundwater connections (both seasonally and with wet years and drought),

identification of potential GDEs, distribution of riparian vegetation, and assessment of animal species that rely on groundwater-supported streamflow.

6.7.1. Description of Undesirable Results

If a stream is hydraulically connected to groundwater, pumping from nearby wells can reduce the amount of stream flow by intercepting groundwater that would have discharged into the stream or by inducing seepage from the stream. Undesirable results associated with stream flow depletion include reduced quality and quantity of aquatic and riparian habitats and reduced water supply to downstream users. Conceptually, adverse habitat impacts can result from decreased rainfall, decreased stream flow and/or lowered groundwater levels. These variables are highly correlated in time: droughts include rainfall reductions, decreased stream flows, and lowered groundwater levels at a time when habitat impacts are usually the most severe. Furthermore, droughts and wet periods are a natural feature of California's climate and are associated with waxing and waning of habitat conditions.

6.7.2. Potential Causes of Undesirable Results

Depletion of interconnected surface water by groundwater pumping can impact a variety of beneficial uses of surface water. A systematic evaluation of each potential impact is warranted, including impacts on downstream water users, habitats around isolated springs and wetlands, and plants and animals that rely on flow or shallow water table conditions along streams.

6.7.2.1. Surface Water Users

There are no known diverters of surface water from Temescal Wash. Lee Lake Dam and reservoir (just upstream of the Basin) were built in the late 19th century on the site of a small natural lake for the purpose of storing and supplying water to what is now the City of Corona (Ellerbee 1918). The lake no longer serves a water supply function, and in recent years it has been operated solely for recreational fishing under the name "Corona Lake".

Although not exactly a diversion, EVMWD obtained a permit that is listed as a diversion to reduce its historical discharges of treated effluent from the Regional Wastewater Reclamation Facility (WRF) to Temescal Wash upstream of the Basin, instead discharging most of that water to Lake Elsinore. Up to 3.87 cubic feet per second (cfs) of wastewater discharges that had been going to the Wash have been diverted to Lake Elsinore since 2008, as part of a lake level management plan (Permit 21165 [Application30502]). On January 24, 2020, the SWRCB approved EVMWD's request for a time extension to generate and divert the full amount of wastewater indicated in the permit. Downstream of the Basin there is no required minimum discharge from Temescal Wash into the Prado Wetlands at the downstream end of the Wash, near Corona. However, there are minimum required discharges of treated wastewater into the wetlands from several wastewater treatment plants in the Corona area north of the Bedford-Coldwater Basin.

6.7.2.2. Isolated Springs and Wetlands

Small off-channel wetlands are included in the Natural Communities Commonly Associated with Groundwater (NCCAG) on-line vegetation geodatabase (DWR et al. 2020). Almost all areas mapped as wetlands are along Temescal Wash and covered by the evaluation of riparian vegetation presented in detail below. A handful of polygons totaling 1.4 acres in the Bedford-Coldwater Basin are located along tributary streams or in low areas west of Temescal Wash. The vegetation is described as "seasonally flooded", and the depth to groundwater at those locations is over 100 feet. The mapped vegetation is thus supported by seasonal ponding of rainfall runoff, not groundwater.

6.7.2.3. Animals Dependent on Groundwater

Animals dependent on groundwater include fish that permanently reside in Temescal Wash or migrate up and down the Wash during the high flow season, amphibians, and birds that inhabit riparian vegetation. Temescal Wash historically supported a steelhead trout run, remnants of which persist as resident rainbow trout in Coldwater Canyon Creek (which enters the Bedford-Coldwater Basin from the Santa Ana Mountains). Currently, perennially ponded areas along the lower reaches of the creek support robust population of invasive and exotic predatory species including bass, bullhead, sunfish, carp, and some slider turtles (Russell 2020). Arroyo chub is another fish that was once present in the Santa Ana River watershed, but it has been extirpated in most streams due to these exotic predators. Riverside County Resource Conservation District (RCRCD) implemented the Temescal Creek Native Fish Restoration Project in the early 2000s, which focused on eliminating nonnative plant and animal species that prey upon or create unfavorable habitat conditions for native fish species (Western Riverside County Regional Conservation Authority 2020). However, flow conditions in Temescal Wash do not currently support native fish (Russell 2020).

Animals dependent on riparian vegetation can also be considered dependent on groundwater. The Western Riverside County Multi-Species Habitat Conservation Plan (MSHCP) evaluates the presence and habitat needs of 146 species. The only ones mapped in the vicinity of the Basin are upland plants and burrowing owls, none of which are dependent on groundwater (Western Riverside County Regional Conservation Authority 2020). The federally threatened California coastal gnatcatcher is a bird species associated with sage scrub environments. The designated critical habitat areas are almost exclusively in upland areas outside the Basin. However, edges of a few mapped habitat areas border the Temescal Wash corridor (see **Figure 4-20**).

The Upper Santa Ana River Habitat Conservation Plan (SARHCP) also covers the Temescal Wash watershed and differs from the Western Riverside County MSHCP primarily in providing Endangered Species Act compliance for an additional set of activities related to water infrastructure construction and operation (USARSRA 2020). Although the SARHCP documents habitat suitability and historical observations of several listed species along Temescal Wash, its main focus is on habitat along the mainstem Santa Ana River. Species with fewer than five historical sightings and little suitable habitat include Arroyo chub, southwestern pond turtle, southwestern willow flycatcher, and yellow-breasted chat. There have been more than 25 historical sightings of Least Bells vireo, but no suitable habitat is mapped along Temescal

Wash. The flow regime in Temescal Wash is characterized as ephemeral (correct in many locations) because flow is "heavily diverted for human use" (incorrect) and that local areas of persistent flows result from agricultural return flows (incorrect). No mention is made of wastewater discharges, which are a larger factor in the flow regime. The surface hydrologic model used to support the SARHCP analysis only extends about one mile up the lowermost channelized reach of Temescal Wash. A groundwater model used to support the SARHCP projected declining water levels in the Prado wetlands area, but the plan includes no mitigation measures related to groundwater.

In summary, Temescal Wash does not appear to be a significant habitat for any listed animal species that would potentially be impacted by groundwater pumping or water levels. However, riparian shrubs and trees and non-listed animal species that use them could potentially be impacted during droughts if lowered groundwater levels cause vegetation die-back or mortality.

6.7.2.4. Riparian Vegetation

The beneficial use of interconnected surface water most likely to be impacted by groundwater pumping is riparian vegetation along Temescal Wash. The Wash traverses three groundwater basins along its 26-mile course from Lake Elsinore to the Prado Wetlands on the Santa Ana River. The entire length of the Wash was evaluated for this GSP to maximize the available information relating vegetation to groundwater and surface flow conditions. The assortment of vegetation types is roughly the same along the entire Wash and includes (in decreasing order of abundance) red willow, California sycamore, Gooddings willow, mulefat and Fremont cottonwood.

The extent and health of riparian vegetation along Temescal Wash was evaluated using three data sets: 1) Google Earth aerial imagery dating back to 1994 (Google Earth 2021), 2) NCCAG mapping of riparian vegetation representing a composite of numerous vegetation mapping efforts around the state (most dating from the early 2000s) (DWR et al. 2020), and 3) TNC's GDE Pulse on-line mapping tool showing vegetation moisture status based on satellite data (TNC 2020).

Inspection of the aerial imagery revealed substantial mortality of riparian trees at many locations along the entire length of Temescal Wash from 2014 to 2016 and little recovery by 2018 (the most recent image). As an example, the evolution of vegetation along the reach that passes through Dos Lagos Golf Course (near Temescal Canyon Road and Cabot Drive) is illustrated by images from 1994, 2006, 2014, 2016, and 2018 in **Figure 6-2**. In 1994, which was just after a prior drought and before urban development, there was moderate coverage of riparian trees in the Temescal Wash channel. Canopy extent and density increased incrementally through 2006 and up to 2014. The 2014 through 2016 drought caused extensive tree mortality evident in the 2016 photo. Only a few trees had recovered by 2018, in spite of wet conditions in 2017.

The health and vigor of riparian vegetation cannot be reliably detected in aerial photographs. However, spectral analysis of light reflected from the vegetation does provide that

information. Two commonly used metrics of vegetation health and vigor are the normalized difference vegetation index (NDVI) and normalized difference moisture index (NDMI), both of which involve ratios of selected visible and infrared wavelengths. NDVI relates to the greenness of vegetation and NDMI relates to transpiration. These metrics detect sub-lethal vegetation stress not visible in normal aerial imagery. TNC compiled these two metrics from historical satellite imagery for riparian vegetation throughout California and incorporated it into the GDE Pulse on-line mapping tool (TNC 2020). The tool evaluates the metrics for every vegetation polygon in the NCCAG maps. For each polygon, the tool displays time series plots of annual summertime NDVI and NDMI from 1985 through 2019. GDE Pulse data for NDVI and NDMI confirmed large declines in both of those metrics during 2013 through 2016 in most vegetation polygons along Temescal Wash. Some uncertainty in the methodology is apparent in occasional large differences in trends between adjoining polygons. Declines during 1984 through 1990 were of similar magnitude but not as abrupt in most locations.

A key question is whether vegetation die-back during the recent drought was due to lowered groundwater levels or reduced surface flow. There reportedly was year-round surface flow in the Wash derived from wastewater discharges prior to the drought, and a combination of reduced discharges and drought conditions killed up to 80 percent of the tree canopy in some locations along the Wash (Russell 2020). A careful comparison of the locations and timing of vegetation changes during the 1990 to 2018 period with the location and timing of changes in surface flow, groundwater pumping, and groundwater levels allows some tentative conclusions to be drawn about which factors contribute to vegetation die-back.

6.7.2.4.1. Groundwater Pumping and Shallow Groundwater Levels 1990 through 2018

Pumping from wells in the Warm Springs and Lee Lake MAs in the Elsinore Valley Subbasin upstream from the Basin and the Bedford MA in the Bedford-Coldwater Basin along Temescal Wash was about three times greater during 1990 through 1993 than during the 2013 to 2016 drought, as shown in **Figure 6-3**. If water levels were only a function of pumping, they would have been lower in the early 1990s than during the recent drought, but that was not the case (except for 1990). Hydrographs of groundwater levels are available for about 22 wells at about 10 locations along the 15-mile length of Temescal Wash in the Elsinore and Bedford-Coldwater Basins. Many of the wells are in clusters at a single location. At five of the locations, water level records date back to the early 1990s. Hydrographs of water levels at selected wells near Temescal Wash are shown in **Figure 6-4**. Many wells with water-level data are production wells with significant, frequent pumping drawdown. Estimation of static water levels in those wells can be inaccurate in years when the well was operated frequently because it can take days for water levels a pumping to recover to background static levels, and pumping schedules do not always allow that much downtime.

Progressive water level declines during 2012 through 2015 were the largest in the period of record for most wells. However, at the two locations with records dating back to 1990 (Gregory and Barney Lee), water levels were as low or lower in 1990 as in the 2012 to 2015 period. 1990 was the final year of another major drought, which can be seen as the

declining trend in the cumulative departure of rainfall during 1984 through 1990. This suggests that low groundwater levels during 1984 through 1990 might also have caused substantial die-back, after which vegetation slowly recovered.

6.7.2.4.2. Surface Flow 1990 through 2018

Surface flow in Temescal Wash is not strongly correlated with vegetation die-back when the full 1990 through 2018 period is considered. Natural flow in Temescal Wash is mostly ephemeral and sporadic, as indicated by flows at various stream gages in the region (see **Figure 4-15**). Large natural flow events occur only in response to storm events in winter. In the absence of a shallow water table, intermittent winter flow events would not be sufficient to sustain riparian vegetation through the dry season.

In contrast, discharges from wastewater reclamation facilities are generally more sustained and have also contributed significant flow to Temescal Wash. Monthly average discharges from four wastewater reclamation facilities along Temescal Wash during 1990 through 2018 are shown in **Figure 6-5** and are described below:

- **Eastern Municipal Water District (EMWD)**. By far the largest discharges have been from EMWD near the upper end of Temescal Wash in the Elsinore Subbasin. EMWD's service area is located outside the Bedford-Coldwater Basin and beyond the jurisdiction of this and neighboring GSPs. The EMWD discharges since 2005 have typically been around 40 to 50 cfs, which is enough to produce flow down the entire length of Temescal Wash. This is confirmed by gaged flows at the outlet of Lee Lake (7 miles downstream of the discharge), which are also shown in the **Figure 6-5**. Peak flows at that location coincided with EMWD discharges and were about 20 cfs smaller, reflecting percolation losses between the discharge point and the lake.
- **Elsinore Valley Municipal Water District (EVMWD) Regional WRF**. The Regional WRF is also located near the upstream end of Temescal Wash. Its discharges shifted primarily from the Wash to Lake Elsinore starting around 2008. A small (0.77 cfs) discharge has been required continuously since then, and larger discharges occasionally resume when lake levels are high. The change in discharge operations pre-dated the drought by about 6 years, and vegetation along the 5-mile reach immediately downstream of the discharge location remained relatively healthy throughout the drought. Therefore, the change in EVMWD discharges did not appear to be a significant contributor to vegetation mortality during 2014 through 2016.
- **Temescal Valley Water District (TVWD) Lee Lake WRF**. The Lee Lake WRF is located about halfway down the Bedford-Coldwater Basin reach of Temescal Wash. Its discharges decreased starting in 2013, which coincided with the start of the drought. The discharges had not been large (about 0.8 cfs) and had already decreased by about half since 2005 due to increased wastewater recycling.
- **City of Corona WRF-3**. This WRF discharges a relatively small (about 0.2 cfs) flow to Temescal Wash upstream of Cajalco Road near the downstream end of the Bedford-Coldwater Basin. Those discharges would not influence vegetation patterns observed upstream.

The hiatus in EMWD discharges between January 2013 and February 2017 coincided with the drought and with the observed vegetation mortality. Because groundwater levels also declined to exceptionally low levels during that time, the cause of vegetation die-back cannot be uniquely determined based solely on information for that time period.

Looking farther back in time, riparian vegetation was generally able to increase in extent during the 1990s and early 2000s, when EMWD discharges were rare and generally small. This indicates that the vegetation was not dependent on those flows to become established. By inference, the mortality during 2014 through 2016 was not caused solely by the interruption in the discharges.

6.7.2.5. Riparian Vegetation Summary

The relationship between groundwater pumping, groundwater levels, and vegetation die-back is not clear-cut. If there were a direct correlation between the variables, one would expect to have seen lower groundwater levels and more die-back during the 1990s than during the 2014 to 2016 period, which was not the case. At a more general level, however, riparian vegetation along Temescal Wash was continuously dense and healthy in the Warm Springs portion of the Elsinore Subbasin, where groundwater pumping was very small throughout 1990 to 2018, large wastewater discharges were immediately upstream, and groundwater levels remained consistently shallow. The greatest impacts were along the downstream end of the Bedford Management Area in the Bedford-Coldwater Basin, where groundwater pumping was relatively intense, local wastewater discharges were relatively small, and groundwater levels experienced large declines during 2012 to 2016 (no data for 1990).

6.7.3. Definition of Undesirable Results

The Sustainability Goal includes an objective to support beneficial uses in the Basin, and specifically those related to interconnected surface water. Consistent with that objective, undesirable results of excessive depletion of surface water are:

> Riparian vegetation die-back or mortality during droughts of a magnitude that disrupts ecological functions or causes substantial reductions in populations of riparian-associated species.

6.7.4. Potential Effects on Beneficial Uses and Users

The analysis presented in this section demonstrates that groundwater conditions are currently sustainable with respect to inter-connected surface water and GDEs. There are no users of surface water in the Basin and there does not appear to be a correlation between groundwater levels and streamflow. Basin outflows appear sufficient to meet the needs of downstream water users. The distribution and health of riparian vegetation does appear to be correlated with groundwater levels, but those levels have recovered since the most recent drought and riparian vegetation is in the process of recovering as well.

6.7.5. Sustainable Management Criteria for Interconnected Surface Water

SGMA requires that the minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results (§354.28(c)(6)). However, GSP Regulations allow GSAs to use groundwater elevation as a proxy metric for any of the sustainability indicators when setting minimum thresholds and measurable objectives (23 California Code of Regulations [CCR] § 354.28(d) and 23 CCR § 354.30(d)).

It would be difficult to define a minimum threshold in terms of flow depletion in this Basin because phreatophytic riparian vegetation appears to be more correlated with areas where depth to water is consistently shallow than with the magnitude or duration of surface flow. Because there are undoubtedly gains and losses of surface flow along Temescal Wash, and the vegetation impacts are associated with a low water table when surface flow is not present, it is reasonable to define the minimum threshold in terms of water levels instead of flow.

6.7.6. Minimum Threshold

Given the above, the minimum threshold is defined here by groundwater levels. As noted previously, wells in the groundwater levels monitoring program are production wells with relatively deep screens that have not been sited and designed for tracking surface water-groundwater interactions. The lack of such shallow monitoring wells is a data gap and a source of uncertainty. Hence, the minimum threshold described here is initial. Nonetheless, it is intended to be protective of GDEs until the monitoring program can be refined to better represent near-stream shallow conditions.

Therefore, in the Bedford-Coldwater Basin:

> The **Minimum Threshold** for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in wells near areas supporting phreatophytic riparian trees is greater than 35 feet for a period exceeding one year.

This threshold corresponds approximately to the depth to water beneath the creek channel near water-level monitoring wells during 2014 through 2016 and is defined for static water levels in the wells listed in Section 6.7.6.5. Given the above uncertainty in the relationships between groundwater pumping, groundwater levels and the health of riparian vegetation, the minimum threshold for interconnected surface water presented here must be considered tentative and subject to revision in future GSP updates. The BCGSA is committed to monitoring vegetation and examining possible management actions to avoid undesirable results. However, given the uncertainty of the relationships between pumping, stream flow, water levels and riparian vegetation health, exceedance of the minimum threshold will first trigger additional study to assess how GSA pumping is affecting shallow water levels.

Undesirable results are considered to commence if water levels along more than half of the total length of reaches in the Basin with dense riparian trees exceed the minimum threshold.

By this definition, undesirable results did occur in the Bedford-Coldwater Basin during the recent drought, because vegetation die-back occurred along about 3.9 miles of the channel, or about 57 percent of the total length of Temescal Wash in the Basin.

6.7.6.1. Relationship of Minimum Threshold to Other Sustainability Indicators

- **Groundwater Levels.** All the wells used to evaluate the minimum threshold (see Section 6.7.6.5) are also representative wells used for compliance with the minimum threshold for groundwater levels. The groundwater level minimum threshold involves two consecutive quarterly water-level measurements rather than a period of one year. For the wells included in both sets of criteria, the interconnected surface water threshold water levels are generally higher than the water-level thresholds. That is, along the GDE stream reaches, the interconnected surface water criteria restrict water-level declines more than the water-level criteria do. This is the logical result of the different objectives of the two sets of criteria.
- **Groundwater Storage.** The minimum threshold for interconnected surface water would similarly be more restrictive than the minimum threshold for groundwater storage near GDE reaches, because the latter is functionally the same as the minimum threshold for water levels.
- **Seawater Intrusion.** Seawater intrusion would not occur in the Basin due to its inland location. No minimum threshold was defined and there is no consistency issue.
- **Land Subsidence.** Significant land subsidence is only likely to occur with groundwater levels below historical minimum levels. The levels specified as minimum thresholds for interconnected surface water are within the historical range and thus unlikely to cause subsidence.
- **Water Quality.** Water quality issues in the Basin are primarily associated with dispersed loading of nitrate and salinity and long-term increases in ambient concentrations of those constituents. Those processes are generally independent of groundwater levels. Groundwater outflow is an important mechanism for salt removal that requires relatively high groundwater levels on a long-term average basis. High levels and groundwater discharge into streams also benefit riparian vegetation and aquatic habitat. Therefore, the minimum threshold for interconnected surface water is consistent with the minimum threshold for water quality.

6.7.6.2. Effect of Minimum Threshold on Sustainability of Adjacent Areas

The areas of interconnected surface water in the Basin are those that are upstream of and adjoining the Temescal Basin. Groundwater and surface water flow is from the Bedford-Coldwater Basin toward the Temescal Basin, consistent with topography. If water levels in the Bedford Management Area were lowered, outflow to the Temescal Basin would decrease. The water levels used to define the minimum threshold for depletion of interconnected surface water are within the historical range of water levels and thus would not cause unreasonable impacts on groundwater availability in the Temescal Basin. By protecting

vegetation along the Temescal Wash—which is a shared waterway between the basins—the minimum threshold will protect those resources for the benefit of both Basins.

6.7.6.3. Effect of Minimum Threshold on Beneficial Uses

Surface diversions are not a source of supply in the Basin; all water uses are supported by imported water or groundwater. With respect to groundwater, this GSP does not propose increases in groundwater pumping above existing amounts, so groundwater levels are expected to remain within the historical range. In areas where the minimum-threshold water level for interconnected surface water is higher than the minimum-threshold for chronic lowering of groundwater levels, the interconnected surface water threshold improves groundwater availability.

The minimum threshold is expected to protect beneficial uses of surface water for riparian habitat maintenance.

6.7.6.4. Relationship of Minimum Threshold to Regulatory Standards

Other than SGMA, there are no local, state, or federal regulations that specifically address stream flow depletion by groundwater pumping. The California and federal Endangered Species Acts protect species listed as threatened or endangered, including California coastal gnatcatcher. The minimum threshold for depletion of surface water is designed to prevent groundwater conditions from impacting those species beyond the level of impact that has historically occurred.

6.7.6.5. How the Minimum Threshold Will Be Monitored

Eight wells that are currently monitored for water levels are near stream reaches where interconnected surface water has been identified. These wells are listed below and shown on **Figure 6-1**.

- TVWD TP-1 and TP-2
- TVWD Well 1 (old well)
- TVWD Well 4
- EVMWD Flagler 2A and 3A
- Corona Non-Potable Wells 1 and 2

The wells listed above are all mostly water supply wells with relatively deep screens. They are useful for relating future conditions to historical ones, but they do not provide a reliable indication of the true water table elevation near the ground surface because shallow wells can have different water levels than deep wells.

Shallow monitoring wells are needed in riparian areas to provide accurate water table information and elucidate the relationship between deep water levels and vegetation conditions. One of the management actions in this GSP is to conduct surveys of Temescal Wash to evaluate the feasibility and need for installing shallow monitoring wells. Over time, minimum threshold groundwater elevations can be refined as a result of these surveys.

6.7.7. Measurable Objective

The measurable objective for interconnected surface water is an amount of depletion that is less than the amount specified as the minimum threshold. Given the uncertainty in the correlation between groundwater levels and vegetation health, no specific rise in shallow groundwater levels or increase in stream flow is identified as providing a preferred set of GDE conditions.

Groundwater conditions with respect to interconnected surface water and most GDE parameters are currently sustainable. Therefore, no interim milestones are needed to achieve sustainability at this time.

6.7.8. Data Gaps

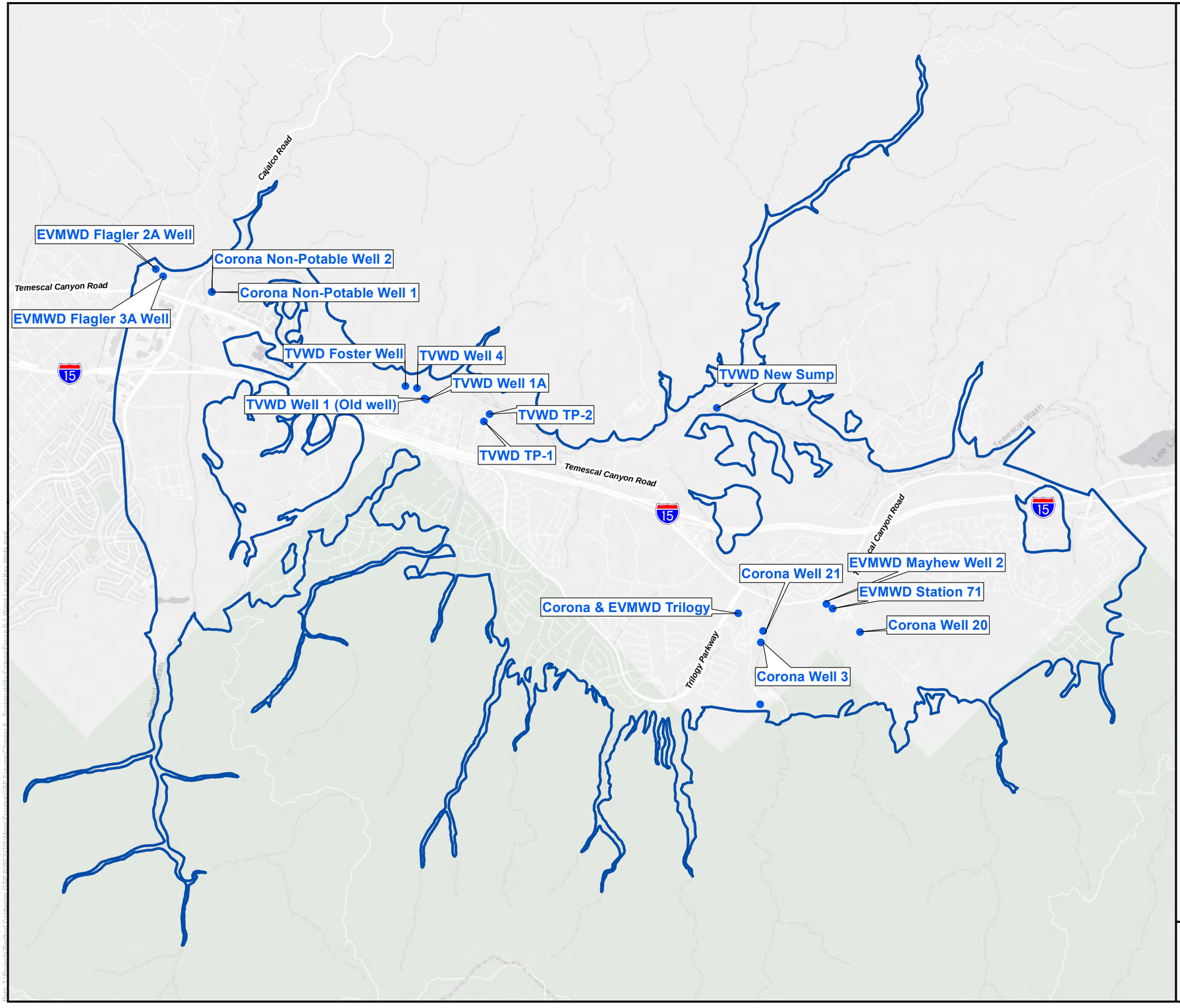
There are several data gaps that might be contributing to the lack of clear relationships between groundwater pumping, groundwater levels and vegetation die-back. These include:

- Wells with water-level data are clustered in a small number of locations. Water levels are unknown in many areas that experienced vegetation die-back.
- Almost all wells with water-level data are also production wells. Water-level drawdown that results from pumping is greater and more persistent near a pumping well than in areas far from the well. Consequently, it is difficult to accurately estimate depth to the water table in areas where there is no nearby pumping.
- The wells with data are not in the creek channel or within the areas with dense riparian vegetation, and the vertical distance between the wellhead and creek channel has not been surveyed at any well locations. The elevation difference can be estimated, but the lack of measured data produces uncertainty in estimating the depth to water at the channel.
- Vertical water-level gradients within the aquifer system are largely unknown. Pumping commonly creates vertical water-level gradients within basin fill materials, such that the true water table near the land surface is higher than the water level in a deep production well at the same location. Some indication of vertical gradients can be gleaned from a study of flow and vegetation along Temescal Wash downstream of EVMWD's Regional WRF in 2007 to 2008 (MWH 2008). Although the WRF is in the Elsinore Subbasin, vertical gradients caused by pumping would be similar in the Bedford MA. Shallow (seven-foot-deep) piezometers were installed in the channel at several locations along a four-mile reach extending downstream from the WRF. Water levels at piezometer TW7, CM2 and TW2 are included in the hydrographs for the Alberhill and Cemetery wells (see **Figure 6-4**). Unfortunately, most of the piezometers are not located near production wells. In terms of depth to water, the piezometer water levels appear generally shallower and more stable than are water levels in the nearest monitored production wells, which is consistent with the presence of vertical gradients caused by pumping at depth.

6.7.8.1. Discussion of Monitoring and Management Measures to be Implemented

Management actions to improve monitoring and management of interconnected surface water in the Basin will include tracking trends in groundwater levels near Temescal Wash,

investigating groundwater/surface water interactions near Temescal Wash and taking action as necessary.



TODD GROUNDWATER

Figure 6-1
Water Level Key Wells





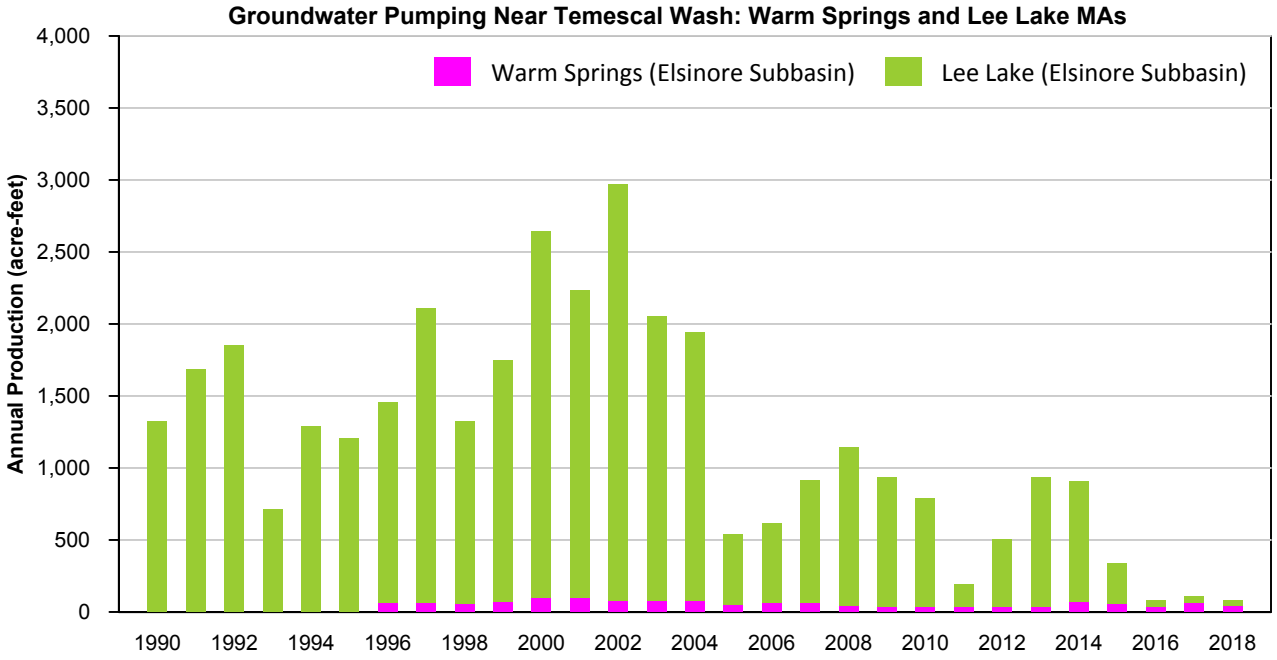


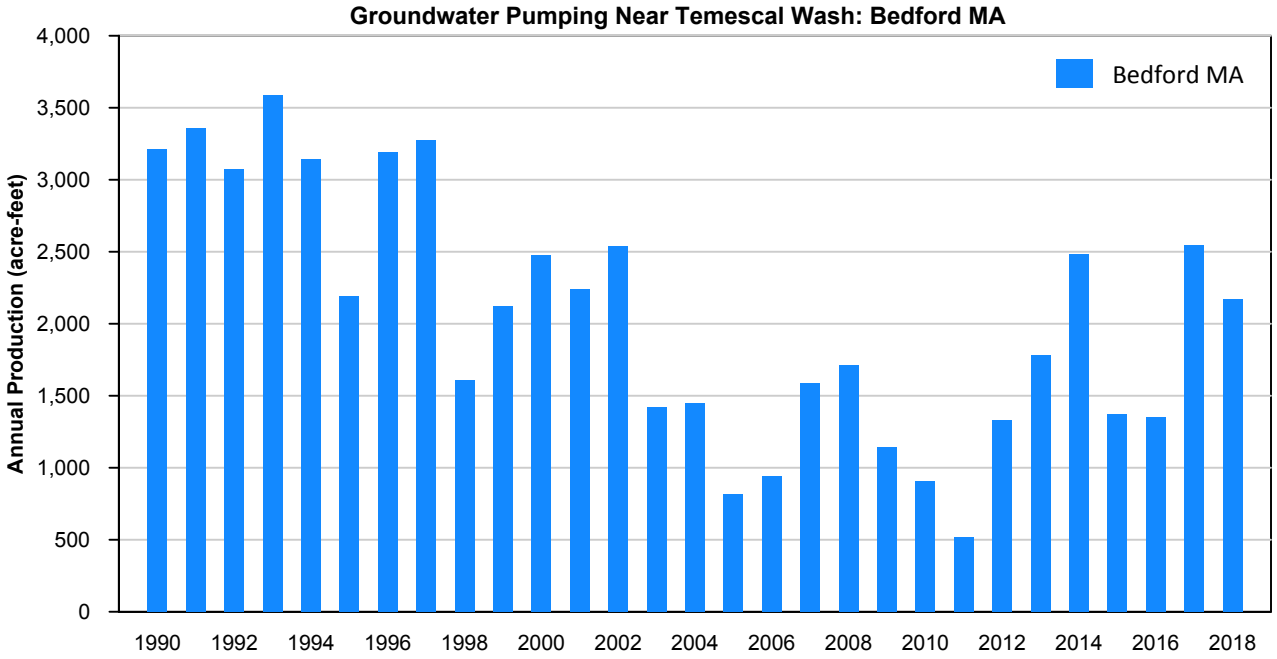




TODD GROUNDWATER

Figure 6-2
Aerial Images of Riparian Vegetation 1994-2018



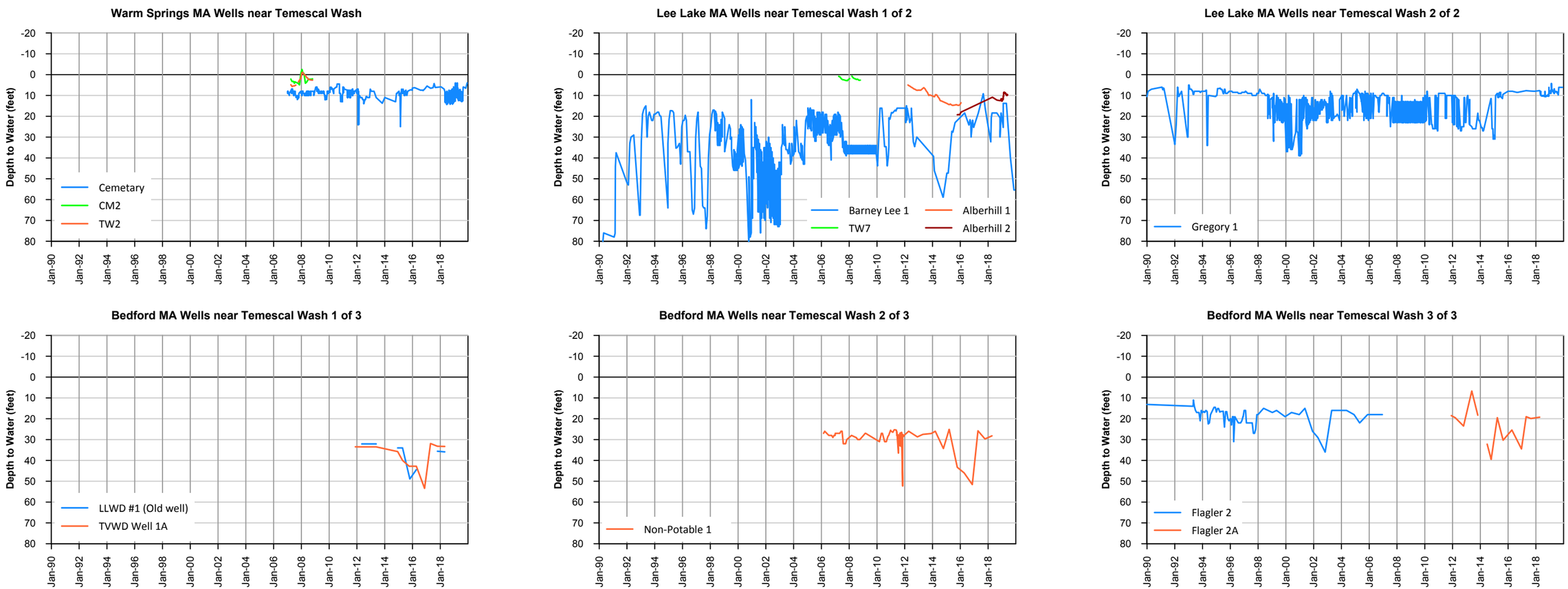


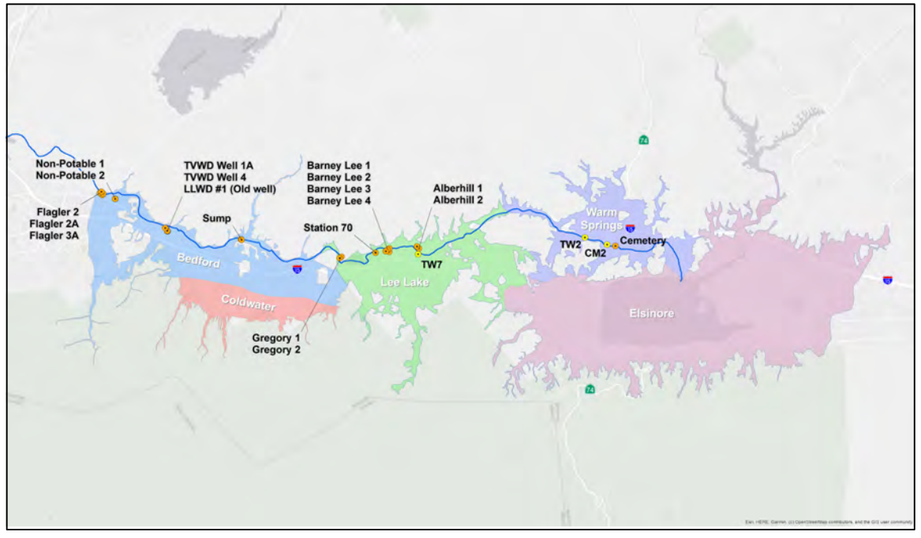
Note:
The Warm Springs and Lee Lake areas in the upper chart are outside the Bedford-Coldwater Basin. These are portions of the Elsinore Subbain upstream of the Bedford-Coldwater Basin.

TODD GROUNDWATER

Figure 6-3
Annual Groundwater Pumping Near Temescal Wash, 1990-2018

Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 6-3 Annual Groundwater Pumping near Temescal Wash, 1990-2018.ppt

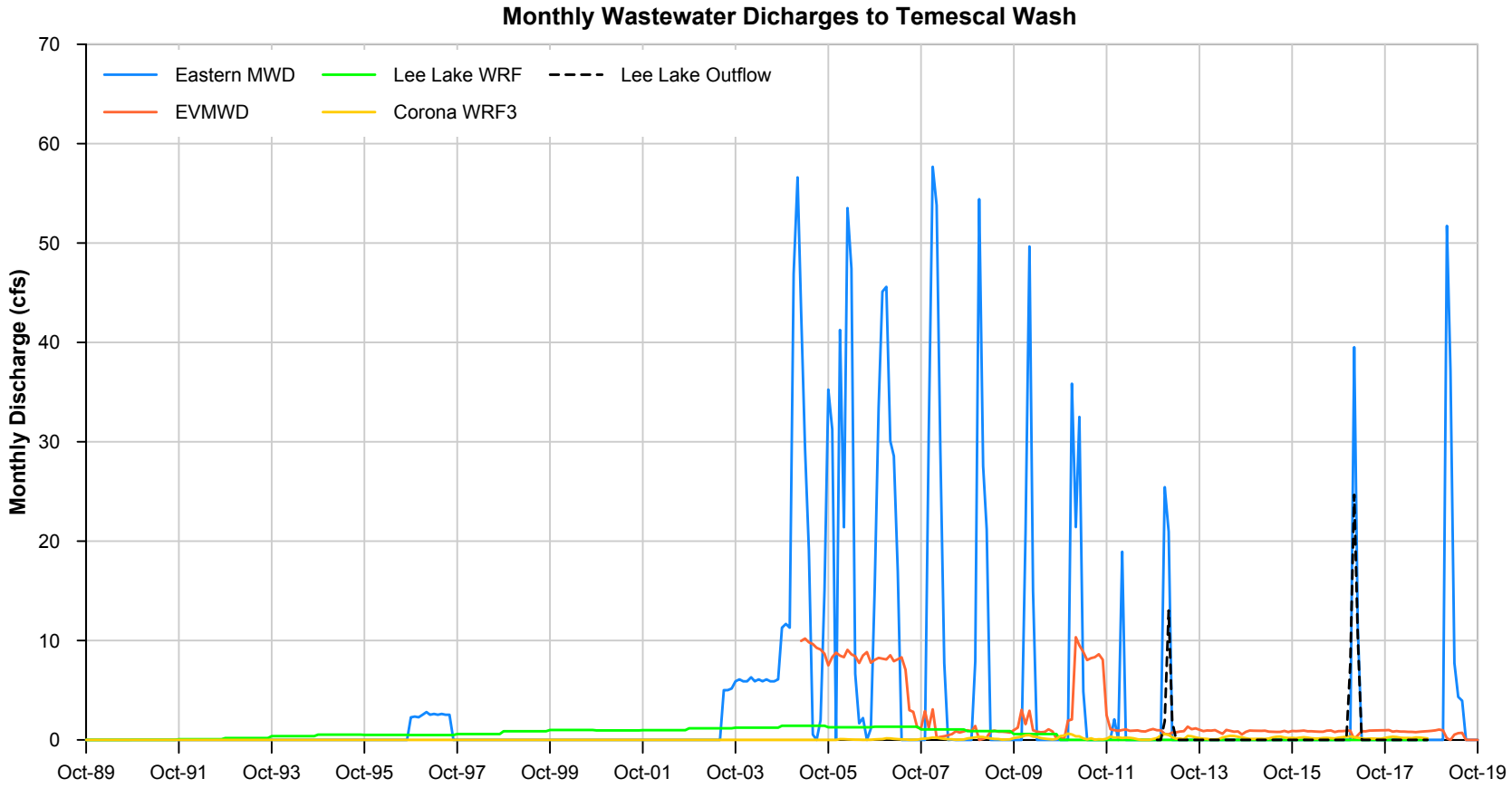




TODD GROUNDWATER

Figure 6-4
Water Levels in Wells Near Temescal Wash

Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 6-4 Water Levels in Wells Near Temescal Wash.gpj



TODD GROUNDWATER

Figure 6-5
Wastewater Discharges to Temescal Wash 1989-2019

Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 6-5 Wastewater Discharges to Temescal Wash 1990-2018.gpj

7. MONITORING NETWORK

The overall objective of the monitoring network for this Groundwater Sustainability Plan (GSP) is to yield representative information about water conditions in the Bedford-Coldwater Subbasin (Basin) as necessary to guide and evaluate GSP implementation. Specifically, monitoring network objectives are to:

- Build on the existing monitoring network data to represent the entire Basin,
- Reduce uncertainty and provide better data to guide management actions, document the water budget, and better understand how the surface water/groundwater system works,
- Monitor groundwater conditions relative to sustainability criteria, and
- Identify and track potential impacts on groundwater users/uses and better communicate the state of the Basin.

With the intent to provide sufficient data for demonstrating short-term, seasonal, and long-term trends in groundwater and related surface conditions, this GSP builds on existing monitoring programs (summarized in Chapter 2, Plan Area) that provide historical information and a context for monitoring. Data gaps are addressed in terms of information needed for understanding the basin setting, evaluation of the efficacy of Plan implementation, and the ability to assess whether the Basin is being sustainably managed.

This GSP Section describes the monitoring network as enhanced to fulfill Sustainable Groundwater Management Act (SGMA) requirements and explains how it will be implemented. This includes description of the monitoring protocols for data collection, the development and maintenance of Bedford-Coldwater Groundwater Sustainability Agency (BCGSA) data management system (DMS), and the regular assessment and improvement of the monitoring program.

7.1. DESCRIPTION OF MONITORING NETWORK

The monitoring network for GSP implementation has been established to document groundwater and related surface conditions as relevant to the sustainability indicators: groundwater levels, storage, land subsidence, water quality, and interconnected surface water[7]. The components of the monitoring network are presented in **Table 7-1**.

[7] Seawater intrusion is noted, but no risk of seawater intrusion exists in this inland basin.

Table 7-1. Bedford Coldwater Monitoring Network Summary

Monitored Variable	Type of Measurement	Locations	Data Interval	Data Collection Agency	Database Storage Agency	Notes
Groundwater levels						
Bedford-Coldwater Basin	Depth to water, feet	17 monitored wells (see Table 6-1), plus two new dedicated monitoring wells	Continuous to Annual	City of Corona, Elsinore Valley Water District (EVMWD), and Temescal Valley Water Disrict (TVWD)	Bedford-Coldwater Groundwater Sustainability Agency (BCGSA)	Data from all sources compiled into unified groundwater elevation database. Continuous data recorded with and on data logging transducers.
Groundwater storage						
Rainfall	Rain gauge, daily total, inches	Lake Elsinore, Santiago Peak, and Riverside	Daily and Monthly	NOAA, Orange County, and UC Riverside CIMIS	BCGSA	Download from web annually for annual water budget and model update
Rainfall (Interpolated)	Interoplated spatially from point data	Basin-wide		PRISM Climate Group	BCGSA	Rainfall gauges are not within the basin, and PRISM data helps interpolate in regions with climatic variation
Reference ET (ET_0)	Daily ETo, inches	Lake Elsinore and Riverside	Daily	NOAA, UC Riverside CIMIS	DWR	Download from web
Stream flow	Daily average flow, cfs	Three active USGS gages near Beford-Coldwater Basin	Daily	USGS	USGS	Download from web
Wastewater pond water budgets	WWTP effluent discharge, evaporation, percolation, AF	Corona and TVWD	Monthly	Corona and TVWD	BCGSA	
Recycled water use	Recycled water delivery, AF	Basin-wide	Monthly	Corona and TVWD	BCGSA	Recycled water use is a relatively small but increasing supply
Imported Water	Volume imported water AF	Imported to Bedford Colwater	Monthly	Corona, EVMWD, and TVWD	BCGSA	
Land Use Maps	Maps of Land Use	Basin-wide		DWR (2014, 2016, and future) and Riverside County (1993 and 2000)	DWR and Riverside County	DWR data is statewide, remotely sensed, and includes agriculture by crop
Municipal Water Use	Metered water use by sector	EVMWD, Corona, and TVWD	Monthly	Corona, EVMWD, and TVWD	BCGSA	Annual data reported in by BCGSA agencies and to Western Municipal Water District as Watermaster for the watershed, includes imported, groundwater, and recycled water use
Groundwater pumping						
Community Water Systems	Estimated	Basin-wide	Annual	Santa Ana Watermaster	BCGSA	Annual estimates provided in water budget updates of Annual Report
Groundwater Production	Annual Volume, AFY	Basin-wide	Annual	Santa Ana Watermaster, Corona, EVMWD, and TVWD	Western Municipal Water District as Watermaster and BCGSA	Annual data for all pumpers reported to Santa Ana Watermaster, monthly production data for BCGSA agencies availble from those agencies.
Rural domestic, commercial, industrial	Estimated	Basin-wide	Annual	Santa Ana Watermaster, Corona, EVMWD, and TVWD	BCGSA	Annual estimates provided in water budget updates of Annual Report
Subsidence						
Subsidence	InSAR satellite mapping of ground displacement	Basin-wide	Annual change	DWR (InSAR)	DWR SGMA Data Portal	Download annually, smooth InSAR raster datasets, compare cumulative elevation change since 2015 against Minimum Threshold criterion.
Groundwater quality						
Groundwater Quality	Major and minor ions and contaminants	14 monitored wells	Quarterly/ Semi-annual	Corona, EVMWD, TVWD, SWRCB GAMA , DDW, RWQCB	BCGSA	Wells with water qualtiy data may be added or removed over time
Interconnected Surface Water and GDEs						
Groundwater Depth to Water	Depth to water, feet	8 monitored wells	Continuous to Annual	Corona, EVMWD, and TVWD	BCGSA	Measurements are sparse, but groundwater in some areas may be shallow enough to support riprarian vegetation

7.1.1. Chronic Lowering of Groundwater Levels

As described in Plan Area Section 2, 19 wells in the Basin with elevation data are monitored by the BCGSA or its member agencies. **Figure 7-1** shows the 19 wells that will be part of the groundwater level monitoring program. Of these 17 have been actively monitored within the past five years and 2 new wells (BCGSA MW-1 and MW-2) are being installed as part of GSP development. The new wells are currently being installed and are expected to be part of the network by 2022. Their planned locations are shown on **Figure 7-1**. The distribution of existing monitoring wells is uneven, with most monitoring wells clustered in the Coldwater Management Area (MA) and along the Temescal Wash in the Bedford MA. The new monitoring wells were designed to fill key data gaps in the northwestern portion of the Basin and to monitor water levels related to the potential effects of the Glen Ivy Fault. All the wells in the GSP monitoring network are listed in **Table 7-2** and will continue to be monitored by the BCGSA or its member agencies. (Glen Ivy Well 1 also is listed as a planned water quality monitoring well).

Data for GSP implementation collected by the BCGSA and/or its member agencies will be compiled by the BCGSA into the DMS developed as part of the GSP. Benefits of these efforts will accrue over the next few years and will support review and update of the monitoring program in the 2027 Five-Year GSP Update. Additional groundwater elevation data from previous investigations may be used to supplement the current monitoring program.

7.1.1.1. Spatial and Vertical Coverage

Figure 7-1 shows locations of wells in the groundwater level monitoring program, while **Table 7-2** provides a summary of relevant monitoring wells. All monitoring wells are owned by the City of Corona (Corona), Elsinore Valley Municipal Water District (EVMWD), and Temescal Valley Water District (TVWD).

Well density has been a consideration in identifying new dedicated monitoring well sites and adding existing wells to the monitoring program. California Department of Water Resources (DWR) guidance (DWR 2016d) generally recommends a monitoring well density of 4 wells per 100 square miles (mi^2), which would equate to 0.44 wells for the 11 mi^2 Basin. The BCGSA monitoring program is consistent with this guidance. Many of the active wells are clustered in the Coldwater MA.

Data on vertical groundwater gradients generally are lacking, as discussed in the Hydrogeologic Conceptual Model, Section 3. Vertical gradients also have not been distinguished because most monitoring data are from public supply wells, which generally have long screen zones and have not been designed to assess or monitor vertical gradients in the Basin.

7.1.1.2. Monitoring Frequency

SGMA and the California Statewide Groundwater Elevation Monitoring (CASGEM) program require collection of static groundwater elevation measurements at least two times per year to represent seasonal low and seasonal high groundwater conditions. Currently, the 17 water

level wells are monitored at least quarterly, and most are monitored either monthly or continuously. Data logging transducers have been installed for measuring groundwater elevation data in most of the groundwater monitoring wells. These transducers collect water level measurements at least monthly, and data are either transmitted to data collection and operation systems or downloaded quarterly.

7.1.2. Reduction of Groundwater in Storage

As described in GSP Section 6.3, groundwater level Minimum Thresholds (MTs) are used as a proxy metric for groundwater in storage. Accordingly, the monitoring of groundwater levels described above in Section 7.1.1 also pertains to tracking sustainability for groundwater in storage.

In addition, GSP regulations require annual evaluation and reporting of change in groundwater in storage.

For the GSP, the numerical groundwater model has been used to quantify the water budget and change in storage (see Water Budget, Chapter 5) using available information from the Monitoring Well Network. The numerical model (described in **Appendix G**) fulfills data and reporting standards described in Title 23 of the California Code of Regulations (CCR), Section 352.4.

As described in Plan Area Section 2.1.4.1 and summarized in **Table 7-1**, the BCGSA monitoring program provides information needed to update the water budget and assess annual change in groundwater storage. This program compiles and reviews information on climate (rainfall and evapotranspiration), stream flow, imported water deliveries, wastewater percolation and water recycling, and groundwater pumping (municipal, industrial, and other). Groundwater in storage will be assessed annually by estimating storage changes as the product of groundwater level change (feet), basin area (acres) and storativity values for each MA.

7.1.2.1. Spatial Coverage

Evaluation of change in groundwater in storage involves several of the monitored variables listed in **Table 7-1**; monitoring locations are described in the table. **Table 7-1** identifies climate stations and stream gage locations. While the closest climate stations and stream gages are located outside the Basin, they are still sufficient to provide information about local conditions.

7.1.2.2. Surface Water Monitoring

There are three active stream flow monitoring gages near the Basin. These gages are monitored by the United States Geological Survey (USGS). Data from these gages will continue to be collected by the BCGSA.

7.1.2.3. Monitoring Frequency

Table 7-1 describes the data interval for the monitored variables that contribute to evaluation of groundwater in storage. Groundwater in storage will be assessed annually using the numerical model, which will be recalibrated during each five-year GSP update.

7.1.3. Seawater Intrusion

There is no monitoring for seawater intrusion and no gaging of tidal influence. The Basin is located over 20 miles inland from the Pacific Ocean, and its lowest elevations are around 1,000 feet above sea level. No risk of seawater intrusion exists in the Basin given its location and therefore no monitoring is needed.

7.1.4. Subsidence

The monitoring program will review Interferometric Synthetic Aperture Radar (InSAR) satellite-based data to identify and evaluate land subsidence in the Basin (see **Table 7-1**). These data will be used to monitor the rate and extent of ground surface elevation change as applicable and with reference to the MT and Measurable Objective (MO), which are described in Sustainability Criteria Sections 6.4. These data represent measurements of ground surface displacement and thus are directly applicable to scientific assessment of potential subsidence.

7.1.4.1. Spatial Coverage

The InSAR data provide adequate coverage of the Bedford Coldwater Basin including both MAs, as described in Groundwater Conditions Section 4.3 and Sustainability Criteria Section 6.4. InSAR data are available for the entire Basin (and beyond), as shown with recent InSAR information from DWR on **Figure 4-10**. InSAR data will be cross-checked, and in conjunction with local groundwater level and pumping data will be used to assess relationships between groundwater levels, pumping, and subsidence data.

7.1.4.2. Monitoring Frequency

Assuming continued data availability, the monitoring program will involve annual download of InSAR data with analysis for any signs (rate and extent) of cumulative inelastic subsidence. To date there have been no reports or other indications of subsidence in the Basin. While data will be reviewed annually, at this time detailed analysis relative to the Minimum Threshold and Measurable Objective is planned as part of the five-year GSP update. The reporting will be consistent with GSP Regulations.

7.1.5. Degraded Water Quality

In addition to the general monitoring objectives listed above, specific objectives for the GSP water quality monitoring program include the following:

- Collect groundwater quality data from the principal aquifer to identify and track trends of any water quality degradation,
- Map the movement of degraded water quality,

- Define the three-dimensional extent of any existing degraded water quality impact,
- Assess groundwater quality impacts to beneficial uses and users, and
- Evaluate whether management activities are contributing to water quality degradation.

Figure 7-2 shows the location of the existing wells that are sampled for water quality. The existing water quality monitoring programs for the Basin are described in Plan Area Section 2.1.4, Groundwater Conditions Section 4, and Sustainability Criteria Section 6.6. To summarize, the BCGSA monitoring program relies on other agencies and their annual or semi-annual measurements, including Corona, EVMWD, TVWD, the Santa Ana Regional Water Quality Control Board (RWQCB), and State Water Resources Control Board Division of Drinking Water (SWRCB-DDW). The BCGSA agencies currently monitor 12 wells periodically for general minerals, physical parameters, and selected constituents of concern. In addition, one private well (Glen Ivy Hot Springs) is sampled regularly, and water quality data are provided to the SWRCB-DDW. Two new dedicated monitoring wells will be added to the monitoring network as part of GSP development. These wells (BCGSA MW-1 and MW-2) are shown on **Figure 7-2**. As described in Groundwater Conditions Section 4 and discussed in depth in Section 6.6, a broad suite of inorganic constituents is sampled and analyzed and known regulated contamination sites are tracked. Total dissolved solids (TDS) and nitrate have been identified as the key constituents of concern for which sustainability criteria have been defined.

7.1.5.1. Spatial and Vertical Coverage

The current monitoring network in the Basin contains spatial and vertical gaps. **Figure 7-2** shows the spatial distribution of wells currently monitored, including the new dedicated monitoring wells that will be sampled regularly.

As with the groundwater level monitoring program, existing wells in the BCGSA groundwater quality monitoring program will be evaluated relative to 23 CCR § 352.4 requirements for well information. The new dedicated monitoring wells are designed to meet requirements while addressing data gaps in the water quality monitoring program as well as the water level monitoring program.

Vertical coverage is discussed in Groundwater Conditions Section 4.9, which indicates that the water quality monitoring programs in the Basin do not reveal vertical differences in water quality. Otherwise, vertical differences in water quality are uncertain; this reflects the fact that most monitored wells are pumping wells with long screens.

As stated in Section 6.6, the BCGSA will continue to improve and expand the monitoring program if needed to address spatial and vertical coverage.

7.1.6. Depletion of Interconnected Surface Water

The minimum threshold for depletion of interconnected surface water is defined by groundwater levels monitored near dense riparian vegetation along the Temescal Wash. At

this time, wells in the groundwater level monitoring program are production wells with relatively deep screens that have not been sited and designed for tracking surface water-groundwater interactions. The lack of shallow monitoring wells has been identified as a data gap.

7.1.6.1. Spatial and Vertical Coverage

Figure 7-1 is a map showing locations of key wells currently selected for groundwater levels and those located along selected stream reaches can be used to monitored groundwater-surface water interaction. The identification of key stream reaches is described in Sustainability Criteria Section 6.7 and has addressed all management areas. **Table 7-2** provides a summary of the monitoring wells in the network.

The scientific rationale for identification of wells for inclusion in the shallow groundwater level monitoring program has involved the following:

- Location adjacent to riparian vegetation along Temescal Wash.
- Length, completeness, and reliability of historical groundwater level record with measurements.
- Regular access to the well for measurements.

The selected wells are all water supply wells with relatively deep screens and therefore do not provide the needed vertical (shallow) coverage. The BCGSA will investigate the connection between shallow groundwater, surface water, and riparian vegetation as indicated in Section 8, Projects and Management Actions. These investigations will focus on identifying the need for additional shallow groundwater monitoring near areas of interconnected surface water.

7.1.6.2. Temporal Coverage and Monitoring Frequency

The monitoring for groundwater levels adjacent to areas of riparian vegetation in Temescal Wash will be implemented as part of the overall groundwater level monitoring program as described in Section 7.1.1. Monitoring of existing wells in the program will be continued, serving as the Key Wells for monitoring relative to the Minimum Thresholds defined in GSP Sustainability Criteria Section 6. Once sited and installed, the periods of record for new dedicated shallow wells will be established. Groundwater level data will be reviewed annually (for each annual report) with reference to the Minimum Threshold. Detailed analyses of the relationships among deep and shallow groundwater level data, stream flow, and riparian conditions will be provided in the Five-Year Update (or sooner if extreme drought conditions and riparian mortality occur; see GSP Section 6.7).

7.2. PROTOCOLS FOR DATA COLLECTION AND MONITORING

This section focuses on groundwater level monitoring (including regional and surface water-oriented) and groundwater quality sampling by BCGSA. Other data (e.g., climate, streamflow, municipal pumping, subsidence) are compiled by other agencies.

This section describes general procedures for documenting wells in the monitoring program and for collecting consistently high-quality groundwater elevation and groundwater quality data. In general, the methods for establishing location coordinates (and reference point elevations for elevation monitoring) follow the data and reporting standards described in the GSP Regulations (23 CCR § 352.4) and the guidelines presented in USGS Groundwater Technical Procedures (Cunningham and Schalk 2011 and USGS 2021). These procedures are summarized below.

7.2.1. Field Methods for Monitoring Well Data

Background data for each monitoring well is required for its inclusion in the monitoring program. These data are generally available for wells in the network described on **Table 7-2** and shown on **Figures 7-1**. As part of GSP implementation, location and elevation data will be acquired where missing, revised if conditions at a monitored well change, and added when new wells are brought into the program. The methods for acquiring these data follow:

- Location coordinates will be surveyed with a survey grade global positioning system (GPS) device. The coordinates will be in Latitude/Longitude decimal degrees and reference the North American Datum of 1983 (NAD83) datum.
- Reference point elevations will also be surveyed with a survey grade GPS device with elevation accuracy of approximately 0.5 feet.
    - During surveying, the elevations of the reference point and ground surface near the well will be measured to the nearest 0.5 foot.
    - All elevation measurements will reference North American Vertical Datum of 1988 (NAVD88) vertical datum.

7.2.2. Field Methods for Groundwater Elevation Monitoring

Reference points and ground surface elevations will be documented as described above prior to groundwater elevation monitoring in the field. Field methods for collection of depth-to-water measurements are described below:

1. Measurements in all wells will be collected within a three-day window whenever possible.
2. Active production wells should be turned off prior to collecting a depth to water measurement.
3. The standard period of time that a well needs to be off before a static measurement is taken is at least 24 hours (48 hours recommended).
4. To verify that the wells are ready for measurement, BCGSA field staff will coordinate with well operators and/or owners as necessary.
5. Coordination with well operators/owners should occur approximately four days prior to the expected measurement date.
6. Depth to groundwater measurements collected by either electric sounding tape (Solinst or Powers type sounders), by steel tape methods, or data logging transducers. Depth-to-water measurement methods are described in DWR's

Groundwater Elevation Monitoring Guidelines (DWR 2010). Depth to groundwater will be measured and reported in feet to at least 0.1 foot.

7.2.3. Field Methods for Groundwater Quality Monitoring

Groundwater sampling is conducted by trained professionals from the three agencies in the BCGSA or specialty contractors. Sampling follows standard monitoring well sampling guidelines such as those presented in the National Field Manual for the Collection of Water-Quality Data (USGS 2021).

Generally, the wells have been pumped prior to sample collection, or are purged. Purging is conducted until field instruments indicate that water quality parameters (pH, oxidation-reduction potential (ORP), specific conductance, and temperature) have stabilized and turbidity measurements are below five Nephelometric Turbidity Unit (NTUs). The pumping or purging prior to sample collection demonstrates that the sample collected is representative of formation water and not stagnant water in the well casing or well filter pack. For groundwater, field temperature and conductivity are recorded while the well is being purged to ensure that physical parameters have stabilized before collecting a sample.

All groundwater samples are collected in laboratory-supplied, pre-labeled containers and include prescribed preservatives. The filled sample containers will then be placed in an ice-filled cooler for storage and transported to the laboratory for analysis under chain of custody procedures.

All field measurements are recorded in a field logbook or worksheets and the sample containers are labeled correctly and recorded on the chain-of-custody form. The applicable chain-of-custody sections are completed and forwarded with the samples to the laboratory. Upon receipt of the samples at the laboratory, laboratory personnel complete the chain-of-custody.

Quality assurance and quality control (QA/QC) assessment of field sampling includes use of field blanks. Field blanks identify sample contamination that is associated with the field environment and sample handling. These samples are prepared in the field by filling the appropriate sample containers with the distilled water used for cleaning and decontamination of all field equipment. One field blank per sampling event is collected.

Samples are sent to a State-certified laboratory that has a documented analytical QA/QC program including procedures to reduce variability and errors, identify and correct measurement problems, and provide a statistical measure of data quality. The laboratory conducts all QA/QC procedures in accordance with its QA/QC program. All QA/QC data are reported in the laboratory analytical report, including: the method, equipment, and analytical detection limits, the recovery rates, an explanation for any recovery rate that is less than 80 percent, the results of equipment and method blanks, the results of spiked and surrogate samples, the frequency of quality control analysis, and the name of the person(s) performing the analyses. Sample results are reported unadjusted for blank results or spike recovery.

7.3. REPRESENTATIVE MONITORING

To allow quantification and tracking of sustainability criteria, representative monitoring sites, or wells, have been identified for 1) regional groundwater level monitoring and 2) for monitoring shallow groundwater conditions where surface water-groundwater connection is likely and tied to groundwater dependent ecosystems (GDEs). These Key Wells are shown on **Figure 7-1** and listed in **Table 7-2**. These have been designated by BCGSA as the point at which sustainability indicators are monitored. Information on the quantitative values for MTs, MOs, and interim milestones is included in Sustainability Criteria Section 6.

As discussed in Sustainability Criteria Section 6.3, change in groundwater in storage is closely related to groundwater levels, which can serve as a proxy for monitoring change in storage. Moreover, groundwater level MTs and MOs are sufficiently protective to ensure prevention of significant and unreasonable results relating to storage. Accordingly, continued monitoring of wells for groundwater levels also serve to track sustainability for storage.

As discussed in Section 6.4, the definition of undesirable results and the quantification of the MT and MO for subsidence are based on InSAR information on vertical displacement of the ground surface; these spatial and temporal data are publicly available from DWR.

Section 6.5 discusses seawater intrusion, which is not possible in this inland basin.

Section 6.6 describes undesirable results and defines sustainability criteria for water quality. MTs and MOs are quantified in terms of the percentage of wells with concentrations exceeding the local and state goals for nitrate and TDS based on current conditions. The BCGSA water quality monitoring wells shown on **Figure 7-2** and listed in **Table 7-2** are sampled regularly to identify water quality problems and to track water quality trends.

Table 7-2. Wells in the Bedford-Coldwater Groundwater Sustainability Agency Monitoring Network

Local Well Name	State Well Number	CASGEM Identification Number	Well Owner	Production Well	Management Area	X Coordinate (feet State Plane CA Zone 6, NAD 83)	Y Coordinate (feet State Plane CA Zone 6, NAD 83)	Ground Surface Elevation (feet)	Reference Point Elevation (feet)	Completion Date	Total Well Depth (feet)	Screen Interval Depths (feet)	Water Level Monitoring Well (Yes/No)	Interconnected Surface Water Monitoring Well (Yes/No)	Water Quality Monitoring Well (Yes/No)
Corona Well 20	005S006W11D001	Not Applicable	City of Corona	Yes	Coldwater	6,187,462.780	2,220,777.903	1,147.58	1,149.48	10/2/1998	660	200 to 580	Yes	No	Yes
Corona Well 21	005S006W03J005	Not Applicable	City of Corona	Yes	Coldwater	6,185,101.479	2,224,408.672	1,128.00	1,128.49	5/22/1998	660	200 to 580	Yes	No	Yes
Corona Well 3	005S006W03K001	Not Applicable	City of Corona	Yes	Coldwater	6,184,790.810	2,222,918.852	1,137.70	1,143.57	1/26/1935	543	100 to 530	Yes	No	No
Corona Non-Potable Well 1	004S006W16G004S	46729	City of Corona	Yes	Bedford	6,179,815.144	2,245,270.386	808.92	809.34	Unknown	Unknown	Unknown	Yes	Yes	Yes
Corona Non-Potable Well 2	004S006W16G005S	46730	City of Corona	Yes	Bedford	6,179,827.292	2,245,270.240	808.77	808.90	Unknown	Unknown	Unknown	Yes	Yes	Yes
Corona & EVMWD Trilogy	005S006W03H001S	Not Applicable	Corona & EVMWD	Yes	Coldwater	6,184,906.094	2,224,253.480	1,101.86	1,101.86	2/5/2016	579	250 to 360 and 390 to 450	Yes	No	No
EVMWD Flagler 2A Well	004S006W16C003S	46732	Elsinore Valley Municipal Water District	Yes	Bedford	6,179,006.482	2,247,223.539	791.71	796.96	3/30/2005	105	51 to 92	Yes	Yes	Yes
EVMWD Flagler 3A Well	004S006W16C002S	46733	Elsinore Valley Municipal Water District	Yes	Bedford	6,179,002.084	2,246,859.661	794.16	795.72	3/18/2005	100	51 to 90	Yes	Yes	Yes
EVMWD Station 71	005S006W11C001	Not Applicable	Elsinore Valley Municipal Water District	Yes	Bedford	6,187,370.000	2,222,025.759	1,166.45	1,168.53	7/22/1971	600	239 to 588	Yes	No	Yes
EVMWD Mayhew Well 2	005S006W11G001	Not Applicable	Elsinore Valley Municipal Water District	Yes	Coldwater	6,187,322.670	2,222,291.946	1,241.00	1,242.33	10/27/1989	740	300 to 730	Yes	No	Yes
TVWD Well 1 (Old well)	004S006W22P003S	Not Applicable	Temescal Valley Water District	No	Bedford	6,182,456.123	2,237,346.855	894.00	881.40	Unknown	100	40 to 80	Yes	Yes	No
TVWD Well 1A	Not Available	Not Applicable	Temescal Valley Water District	Yes	Bedford	6,182,464.822	2,237,273.854	895.00	882.68	Unknown	100	40 to 80	Yes	No	Yes
TVWD Well 4	004S006W22P004S	Not Applicable	Temescal Valley Water District	Yes	Bedford	6,182,523.828	2,237,795.159	883.00	878.97	Unknown	100	40 to 80	Yes	Yes	Yes
TVWD TP-1	Not Available	Not Applicable	Temescal Valley Water District	Yes	Bedford	6,183,364.598	2,235,315.457	901.46	902.29	6/18/2015	103	39 to 99	Yes	Yes	Yes
TVWD TP-2	Not Available	Not Applicable	Temescal Valley Water District	Yes	Bedford	6,183,683.778	2,235,349.830	902.37	902.62	5/18/2017	90	30 to 85	Yes	Yes	Yes
TVWD Foster Well	004S006W22N002	Not Applicable	Temescal Valley Water District	Yes	Bedford	6,182,288.775	2,238,133.791	871.74	872.94	6/9/2015	93	38 to 88	Yes	No	Yes
TVWD New Sump	004S006W35G002	47928	Temescal Valley Water District	Yes	Bedford	6,189,460.269	2,229,866.527	955.71	953.57	Unknown	74	Unknown	Yes	No	Yes
BCGSA MW-1	Not Available Yet	Not Applicable	Bedford-Coldwater GSA	No	Bedford	6,181,386.544	2,228,000.186	Not Available Yet	Not Available Yet	Construction Planned Mid-2021	Not Available Yet	Not Available Yet	Yes	No	Yes
BCGSA MW-2	Not Available Yet	Not Applicable	Bedford-Coldwater GSA	No	Coldwater	6,181,488.573	2,231,333.213	Not Available Yet	Not Available Yet	Construction Planned Mid-2021	Not Available Yet	Not Available Yet	Yes	No	Yes
Glen Ivy Well 1	Not Available	Not Applicable	Glen Ivy Hot Springs	Yes	Coldwater	6,183,187.330	2,221,453.024	Unknown	Unknown	Unknown	Unknown	Unknown	No	No	Yes

7.4. DATA MANAGEMENT SYSTEM (DMS)

The BCGSA has been collecting and compiling groundwater data including water levels, water quality, and water use for the GSP. Before the creation of the GSA, the individual agencies of the BCGSA (Corona, EVMWD, and TVWD) monitored water levels and water quality independently. These data from other sources are compiled in relational databases, which consists of Access databases and ESRI geodatabases that have the capabilities for queries to quickly check and summarize data. As part of the GSP, the DMS has been modified to be practicable, usable, and intuitive for the purpose of GSP preparation and implementation. **Appendix K** details the final DMS. The databases include easy to update tables and other datasets that assist in comparison of real time conditions and sustainability goals.

7.5. ASSESSMENT AND IMPROVEMENT OF MONITORING NETWORK

The BCGSA has actively engaged in assessment and improvement of its monitoring network. This process has been intensified as part of the GSP, given the need to identify data gaps and to assess uncertainty in setting and tracking sustainability criteria. Monitoring improvements are a major part of GSP implementation and will be reviewed and updated for each five-year GSP update.

7.5.1. Identification and Description of Data Gaps

The limited data gaps that have been identified in this GSP are summarized in **Table 7-3** according to major monitored variable and described in terms of insufficient number of monitoring sites and utilization of monitoring sites that are unreliable (including those that do not satisfy minimum standards). Data gaps also are described in terms of the location and reason for data gaps in the monitoring network, and local issues and circumstances that limit or prevent monitoring. Data gaps listed in **Table 7-3** do not include gaps in understanding, which build on the monitoring network but also require investigation and analysis. These planned studies are described as Projects and Management Actions in GSP Chapter 8.

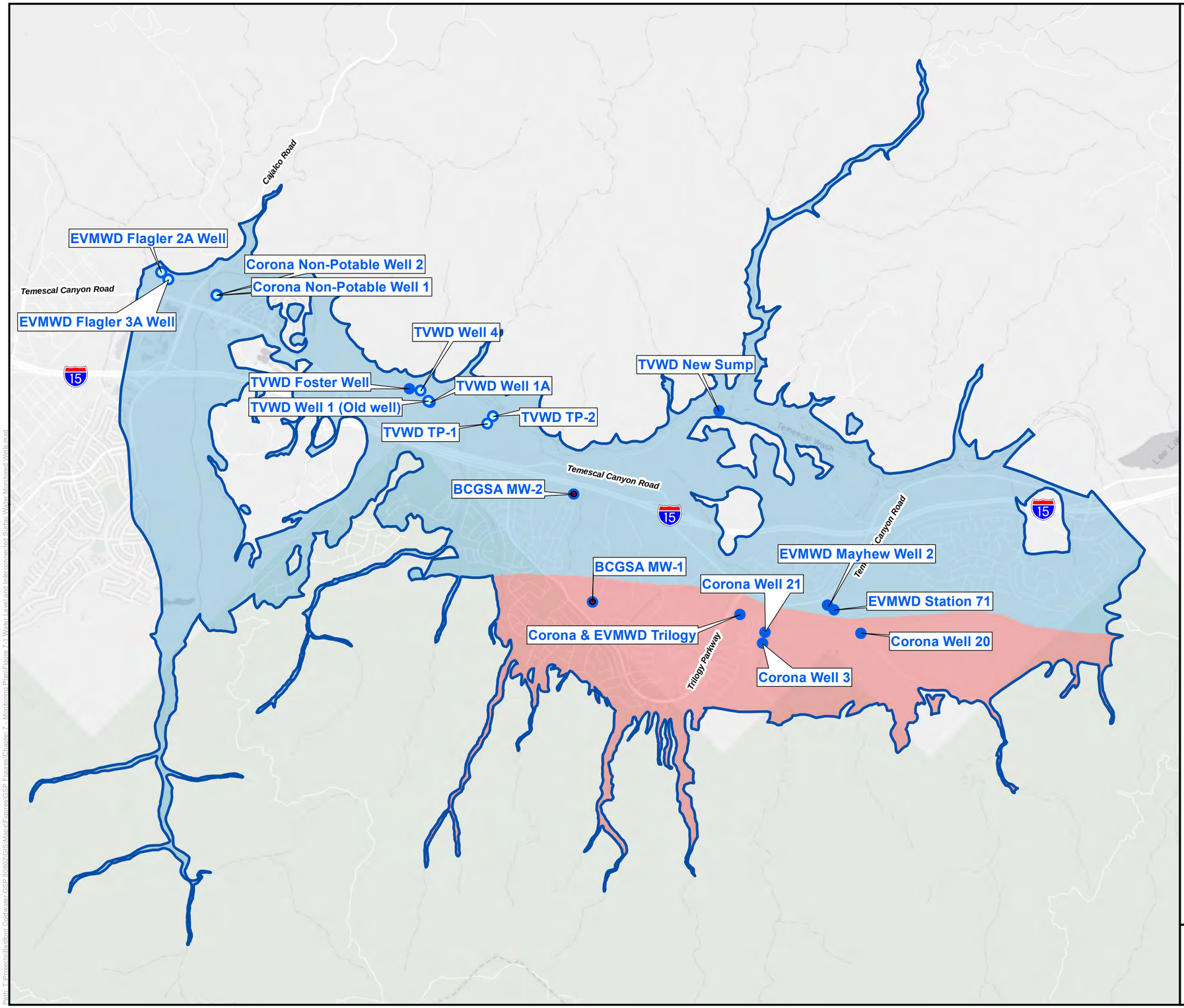
Table 7-3. Identification and Description of Data Gaps

Monitored Variable	Insufficient Sites	Local Issues
Regional Groundwater levels	No	The water level network has historically relied on production wells, but new dedicated wells have been installed and the production wells are well suited to monitoring conditions related to water supply for municipal, industrial, and other beneficial uses.
Stream flow	No	
Groundwater extraction	No	Most pumping is reported; there may be unreported pumping but it is assumed to be de minimis.
Groundwater quality	No	Water quality sampling in the Basin is typically tied to regulatory requirements. The BCGSA will perform regular monitoring of the well network and collect water quality data from all available sources.
Shallow groundwater levels	Yes	No shallow dedicated groundwater monitoring wells in Basin. Long well screens in monitoring wells limit vertical groundwater quality characterization.

7.5.2. Description of Steps to Fill Data Gaps

Monitoring data gaps have been identified for shallow groundwater level measurements.

Additional shallow groundwater level monitoring is required to better monitor interconnected surface water and GDEs in the Basin. The management actions the BCGSA will undertake towards filling this data gap are described in Section 8, Projects and Management Actions.



- Water Level Monitoring Well
- Water Level and Interconnected Surface Water Monitoring Well
- Bedford-Coldwater Basin
- Bedford Management Area
- Coldwater Management Area

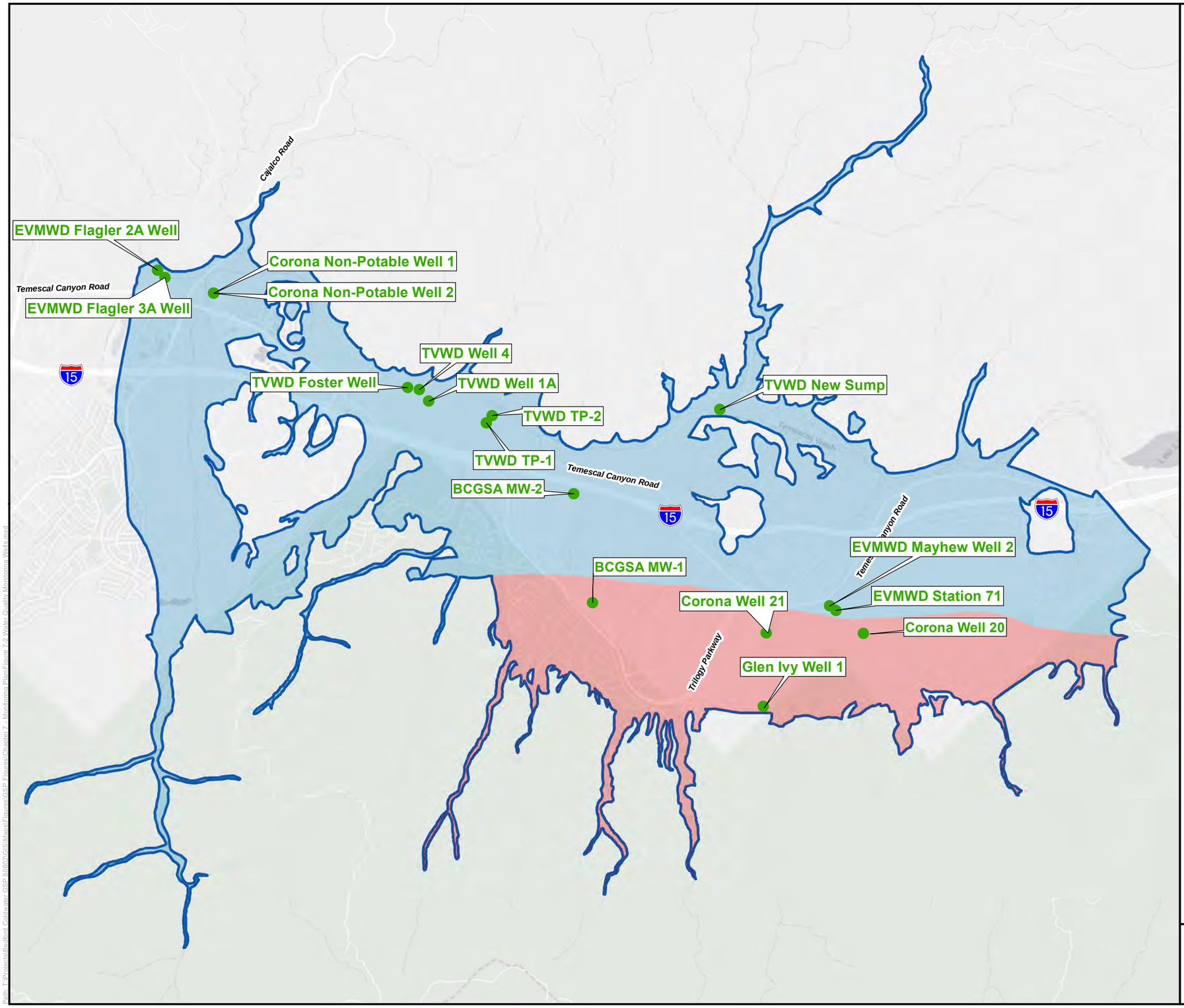
N

0 1,750 3,500

Scale in Feet

TODD GROUNDWATER

Figure 7-1
Water Level and Interconnected Surface Water Monitoring Wells



Water Quality Monitoring Well
Bedford Management Area
Coldwater Management Area
Bedford-Coldwater Basin

N

0 1,750 3,500
Scale in Feet

TODD GROUNDWATER

Figure 7-2
Water Quality Monitoring Wells

8. PROJECTS AND MANAGEMENT ACTIONS

During the preparation of the Groundwater Sustainability Plan (GSP) for the Bedford-Coldwater Subbasin (Basin), five (5) specific management actions (Actions) and three (3) projects (Projects) were identified to achieve the sustainability goal. The Actions are generally focused on data collection, storage and reporting of information necessary to monitor sustainability, and assessment of when Actions may be necessary (i.e., when minimum thresholds (MTs) are approached or exceeded). The projects are generally designed to reduce uncertainty in areas where data gaps have been identified during development of the GSP.

The Projects and Actions will be implemented by a combination of personnel resources from the three agencies within the plan area (Elsinore Valley Municipal Water District [EVMWD], City of Corona [Corona], and Temescal Water District [TVWD]) and contracted resources as described in Section 9. The Projects and Actions in the GSP are as follows:

- **Action 1** – Provide for Collection, Compilation, and Storage of Information Required for Annual Reports and Submit Annual Reports;
- **Action 2** – Routinely Record Groundwater Levels and Take Action if Necessary;
- **Action 3** – Monitor Selected Groundwater Quality Constituents and Coordinate with the Regional Water Quality Control Board as Appropriate;
- **Action 4** – Track Trends in Groundwater Levels near Temescal Wash and Take Action as Necessary;
- **Action 5** – Review Interferometric Synthetic Aperture Radar (InSAR) Data on the California Department of Water Resources (DWR) DataViewer During 5-Year Updates;
- **Project 1** – Investigate Groundwater/Surface Water Interaction at Temescal Wash and Install Monitoring Wells;
- **Project 2** – Initiate a Survey of Active Private Wells; and
- **Project 3** – Evaluation of the Effects of Aggregate Pits on Groundwater Flow and Quality.

The Projects and Actions are described in the following sections. Further details regarding each project and management action are summarized in **Table 8-1** through **Table 8-8** at the end of this section. A periodic 5-year update of the GSP is described in Chapter 9.

8.1. ACTION 1 – PROVIDE FOR COLLECTION, COMPILATION, AND STORAGE OF INFORMATION REQUIRED FOR ANNUAL REPORTS AND SUBMIT ANNUAL REPORTS

The Sustainable Groundwater Management Act (SGMA) requires Groundwater Sustainability Agencies (GSAs) to submit annual reports to DWR each April 1st following adoption of a GSP. The report provides information on groundwater conditions and the status of implementation of the GSP over the prior water year. Action 1 will facilitate gathering the required information

and producing the annual report (with the exception of collecting and compiling water levels, which is facilitated under Action 2).

As required by Title 23 of the California Code of Regulations (CCR), Section 356.2, the annual report produced by the Bedford-Coldwater GSA (BCGSA) will include the following components for the preceding water year:

(a) General information, including an executive summary and a location map depicting the Basin.
(b) A detailed description and graphical representation of the following conditions of the Basin:
    (1) Groundwater elevation data from monitoring wells identified in the monitoring network and collected as part of Action – 2 will be analyzed and displayed as follows:
        (A) Groundwater elevation contour maps for the principal aquifer in the Basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.
        (B) Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.
    (2) Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.
    (3) Surface water or imported water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.
    (4) Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data collection methods will be evaluated and modified as necessary as part of this Action.
    (5) Change in groundwater in storage shall include the following:
        (A) Change in groundwater in storage maps for each principal aquifer in the basin.
        (B) A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the Basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.

(c) A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.

Action 1 also provides for production and transmittal of the annual report described above.

8.2. ACTION 2 – ROUTINELY RECORD GROUNDWATER LEVELS AND TAKE ACTION IF NECESSARY

Each agency will collect static groundwater elevation data at the wells they own and operate. Depth to groundwater measurements will be collected at a minimum frequency of once per month, except in cases where a production well is active and shutting the well down to collect a static water level will cause operational problems due to interrupted supply. In these cases, quarterly measurements will be made. Several wells in the basin are monitored continuously via supervisory control and data acquisition (SCADA). In these cases, care will be taken to document the depth and elevation of the transducer, as well as the accuracy of the transducer, which can be expressed either as a percentage of full scale or in absolute terms. Depth to groundwater measurements from a known elevation under static (non-pumping) conditions using an electric probe will be periodically compared to transducer readings to determine the elevation of the transducer such that groundwater elevation hydrographs can be produced from SCADA records. The BCGSA administrator will be responsible for facilitating collection of groundwater elevation data in the proper format. Field methods for collection of depth to groundwater information are specified in Section 7.

The BCGSA administrator and each agency will note trends in depth to groundwater information, and agencies will coordinate to reduce pumping rates or durations if a trend toward the MT is observed. Agencies will curtail pumping in the affected area if a MT is reached.

8.3. ACTION 3 – MONITOR SELECTED GROUNDWATER QUALITY CONSTITUENTS AND COORDINATE WITH THE REGIONAL WATER QUALITY CONTROL BOARD AS APPROPRIATE

Each agency will collect groundwater samples at the wells they own and operate and deliver to a common laboratory for analysis. Field methods for collection of groundwater samples are specified in Section 7. Groundwater sampling results will be delivered to the BCGSA administrator who will compile and report results.

The BCGSA administrator will note trends in groundwater quality, and the BCGSA will coordinate with the Regional Water Quality Control Board as appropriate if a trend toward the MT is observed. The BCGSA administrator will be responsible for compiling groundwater quality data and adding it to the GSA Data Management System (DMS) in standardized format.

8.4. ACTION 4 – TRACK TRENDS IN GROUNDWATER LEVELS NEAR TEMESCAL WASH AND TAKE ACTION AS NECESSARY

Each agency will collect groundwater elevations at the wells they own and operate in the vicinity of Temescal Wash as described in Sections 6 and 7. Depth to groundwater measurements will be collected at a minimum frequency of once per month, except in cases where a production well is active and shutting the well down to collect a static water level will cause operational problems due to interrupted supply. Several wells in the Basin are monitored continuously via SCADA. SCADA records will be corrected for groundwater elevation as described in Section 8.2. Field methods for collection of depth to groundwater information are specified in Section 7.

The BCGSA administrator and each agency will note trends in depth to groundwater information, and agencies will coordinate to reduce pumping rates or durations if a trend toward the MT regarding interconnected surface water at Temescal Wash is observed. Agencies will curtail pumping in the affected area if an MT is reached.

8.5. ACTION 5 – REVIEW INSAR DATA ON THE DWR DATAVIEWER ANNUALLY AND COMPILE DURING 5-YEAR UPDATES

In other basins in California, extensive groundwater withdrawals from aquifer systems have caused land subsidence. Land subsidence can damage to structures such as wells, buildings, and highways. They also can create problems in the design and operation of facilities for drainage, flood protection, and water conveyance. Two factors generally needed for groundwater withdrawals to cause subsidence are 1) relatively large declines in groundwater levels combined with 2) relatively thick sequences of collapsible clays (such as ancestral lake deposits). Neither of these conditions exist in the Basin, and subsidence due to groundwater withdrawals has not been observed or expected. DWR has developed SGMA DataViewer to include updated subsidence information to help GSAs, water managers, and others to implement SGMA. The BCGSA will review the DataViewer information during the annual update and summarize the findings in the 5-year update.

8.6. PROJECT 1 – INVESTIGATE GROUNDWATER/SURFACE WATER INTERACTION AT TEMESCAL WASH

As noted in Section 6.7.8, there are several data gaps related to depletions of interconnected surface water along Temescal Wash. Data gaps include lack of water level data in certain areas, lack of dedicated monitoring (vs. production) wells, lack of wells within or near the wash channel, and uncertainty regarding vertical gradients. The objective of Project 1 is to address these data gaps and improve protection of a potentially groundwater-dependent ecosystem (GDE) along Temescal Wash. Project 1 will be initiated in two phases: an initial feasibility study and permitting review, and a second phase of installation of monitoring facilities and on-going vegetation and shallow groundwater monitoring.

The BCGSA will develop a request for proposals (RFP) from qualified firms to conduct the initial study to evaluate the interaction of surface water and groundwater and the relationship of groundwater elevation on the health of riparian vegetation in Temescal Wash. The purpose of this study is to reduce uncertainty regarding the riparian habitat and ultimately to improve the MT and protect groundwater-dependent ecosystems. The study may involve field biological surveys, review of historical surface flows, review of historical photographs and remote sensing data, and investigation and field studies regarding evapotranspiration and root depth of riparian vegetation in and around Temescal Wash. An outcome of the first phase of the project is to identify appropriate locations and associated permitting requirements for monitoring wells along Temescal Wash. The work will result in recommendations for future riparian monitoring protocols and permitting requirements for installation of piezometers or drive points close to the wash itself.

Although the second phase of the project will be dependent on the results of the initial phase, the following work is anticipated:

1. Install four shallow monitoring wells along Temescal Wash, spread out along the wash, one or two near pumping wells to ascertain vertical gradients, others upstream near dense riparian vegetation.
    a. During 5-year GSP updates, relate those water levels to production well water levels and stream flow, and refine MTs.
2. Conduct a survey for perennial pools along the entire length of the Temescal Wash in the Basin. Ideally, this would be done sometime during August to October in a normal year and again in a dry year.
    a. If pools are found, a fisheries biologist should survey the fish species present in them.
3. The next time water levels start approaching the interconnected surface water MTs, conduct a vegetation survey along the Wash to look for drought stress.
    a. If stress correlates with increased depth to water, start reducing pumping (Management Action 4).

8.7. PROJECT 2 – INITIATE A SURVEY OF ACTIVE PRIVATE WELLS

As noted in Section 6, there are very few known active private wells in the Basin. Because there are records (DWR and other sources) of many more wells than are known to exist and be active, it is believed that most have been abandoned, destroyed, or are no longer equipped or used, as residential users have been connected to municipal water supplies. Known active private wells are for non-potable uses and are of similar depths and construction to the monitored municipal supply wells. During the recent drought, the Basin was not marked by reports of significant water level decline impacts to shallow production wells.

Nevertheless, there still remains some uncertainty about the existence, use, and construction characteristics of local, active, private (non-municipal) wells. For this reason, the BCGSA will

initiate a survey of active private wells in order to confirm that the MTs are protective of the use of private wells being put to beneficial use.

8.8. PROJECT 3 – EVALUATION OF THE EFFECTS OF AGGREGATE PITS ON GROUNDWATER FLOW AND QUALITY

Significant aggregate (sand and gravel) resources mining occurs south of Corona within and along Temescal Wash and north of Lake Elsinore which has been active since the late 1940s (CDMG 1991). In 2007, the State of California reported that the active mines in local areas other than Temescal Valley are "nearly exhausted" and that the fast-growing county now relies on Temescal Valley for much of its aggregate needs. As a result, the Temescal Valley Production District has become the largest sand and gravel production district in the United States, having produced about 12 million tons of aggregate in 2005. Per a 2007 report issued by the California Geological Survey, the region's 50-year aggregate demand is 1,122 million tons. As of 2007, a total of approximately 355 million tons were being supplied by permitted aggregate resources; 32 percent of the forecast demand. Data indicate that approximately 6,000 million tons of mineral resources are secured within the region (County of Riverside 2015).

Current surface mining permits (SMPs) include:

- SMP-133 (Coldwater Aggregates) which expires in 2040;
- SMP-139 (Mayhew Aggregates and Mining Reclamation) does not have an expiration date as an inert landfill site;
- SMP-143R2 (Foster's Sand and Gravel) which expires in 2065; and
- SMP-202 (Chandlers Palos Verdes Sand and Gravel Company) which expires in 2036.

These permits note the ultimate use of the mining pits as stormwater recharge basins (KWC 2017), and therefore the mining pits will clearly have an impact on groundwater management (albeit at least 18 years into the future). The surface aggregate mining involves deepening and widening open pits as the mining operation expands. In doing so, the pits encounter groundwater. As groundwater levels rise and fall, the bottoms of the pits are exposed. Therefore, it is clear that there is communication between the surface water in the pits and the adjacent groundwater body which currently exists and will continue well into the future.

Groundwater modeling conducted as part of the GSP development (Section 5 and **Appendix G**) and groundwater sampling from wells near the pits suggest that the pits may have an effect on the local water budget and on groundwater quality in ways that are not completely understood. For example, model calibration efforts suggest consumptive use near the pits is higher than recorded pumping of adjacent wells, and the Corona Well 21 was shut down due to a high heterotrophic plate count (a measure of bacteria in water), potentially as a result of groundwater under the influence of surface water from the aggregate pits.

Therefore, to improve further modeling involving aggregate mines or simulation of proposed stormwater capture in the mines, a project is proposed to evaluate and improve the

hydrogeologic conceptual model in the vicinity of the mines. The BCGSA will initiate the investigations after adoption of the GSP by issuing an RFP to qualified firms. Although details of the study of aggregate mining's effect on groundwater are yet to be determined, it is anticipated that the study may involve detailed review of the aggregate pit water budget (pumping, evapotranspiration, precipitation, and surface water flow infiltration), historical remote sensing images, historical hydrograph and streamflow information review, monitoring well construction, and/or interviews with local mine managers.

Table 8-1. Action 1 – Provide for Collection, Compilation, and Storage of Information Required for Annual Reports and Submit Annual Reports

Description of the Project or Management Action - §354.44(a)	**Project/management action benefits - §354.44(b)(5)**
Routinely collect, compile, and store groundwater extractions by water use sector, groundwater extractions measurement methods and accuracy, surface water sources, and total water use and methods used to determine total water use. Prepare annual reports.	Collection of this information is required for annual reporting, but it will also assist in evaluation of trends and relationship to the sustainability of the management areas.
Description of the measurable objective(s) addressed - §354.44(b)(1)	**How the project/management action will be accomplished - §354.44(b)(6)**
Maintain groundwater elevations above the historical minimum elevation and maintain groundwater levels within the historical operating range.	The information will be collected by BCGSA agency personnel for the facilities (including wells) that they own and manage. This information will be transmitted to the a contracted BCGSA administrator on a monthly basis who will compile and store the information and complete annual reports. Information from private well owners which exceed de minimis levels will be compiled by the administrator.
Circumstances and criteria for implementation - §354.44(b)(1)(A)	**Legal authority - §354.44(b)(7)**
Information gathering will be implemented immediately upon GSP adoption.	CWC § 10725.4 (a)(1) provides GSAs the authority to determine the need for groundwater management and (2) to prepare and adopt a groundwater sustainability plan and implementing rules and regulations.
Process to provide the public notice of implementation - §354.44(b)(1)(B)	**Estimated cost and funding source - §354.44(b)(8)**
Notice of implementation with be provided in the public review period of the GSP and adoption of the GSP. Implementation of the management action will be internal and not affect landowners or water users in the Basin.	$126,000 Annual cost. Funding source to be contributions from BCGSA member agencies
Quantification of methods to mitigate overdraft, if overdraft conditions are identified - §354.44(b)(2)	**Management of groundwater extractions and recharge - §354.44(b)(9)**
If overdraft is identified, the management action will be to curtail pumping as agreed upon by BCGSA staff.	The BCGSA will manage reductions in pumping rates or duration if trends indicate historical maximum groundwater levels will be reached. Individual agencies will be responsible for monitoring their wells and informing the BCGSA if this trend becomes apparent.
Permitting and regulatory process - §354.44(b)(3)	**Supporting information and science - §354.44(c)**
No additional permitting or regulatory processes will be required.	The BCGSA will utilize BMPs and data formats specified by the DWR.
Timeframe for expected project/management action start and completion, accrual of benefits - §354.44(b)(4)	**Level of uncertainty - §354.44(d)**
Information gathering will be implemented immediately upon GSP adoption and will continue until the next 5-year update.	Level of uncertainty will be identified during the process of evaluating measurement methods and accuracy.

Table 8-2. Action 2 – Routinely Record Groundwater Levels and Take Action if Necessary

Description of the Project or Management Action - §354.44(a)	**Project/management action benefits - §354.44(b)(5)**
Routinely measure and record water levels in selected wells identified in the monitoring plan. Monitor trends and reduce pumping if a trend toward a minimum threshold is observed. Curtail pumping in the event of reaching a minimum threshold.	Regular water level monitoring will benefit the maintenance of sustainability by decreasing the uncertainty regarding sustainable depths to groundwater in order to avoid undesirable results.
Description of the measurable objective(s) addressed - §354.44(b)(1)	**How the project/management action will be accomplished - §354.44(b)(6)**
Maintain groundwater elevations above the historical minimum elevation and maintain groundwater levels within the historical operating range.	Static groundwater levels will be collected and compiled by BCGSA agency personnel for the wells they own and manage at a minimum frequency of monthly. Transducers will be utilized where practical. This information will be transmitted to the BCGSA administrator who will compile and store the information and complete annual reports. In cases where active production wells are monitored, frequency may be reduced to quarterly to minimize water supply interruption.
Circumstances and criteria for implementation - §354.44(b)(1)(A)	**Legal authority - §354.44(b)(7)**
Water level monitoring will be implemented once the GSP is adopted. The minimum threshold is defined at each key well by either the depth to groundwater equivalent to the current pump intake or 10 feet above the bottom of the deepest screen section, whichever is shallower. Undesirable results are indicated when exceedances occur in two consecutive quarters in each of two consecutive years in at least two thirds of key wells in each management area. If a trend toward the minimum threshold is observed, pumping rates or durations will be reduced in the affected areas.	CWC § 10725.4 (a)(1) provides GSAs the authority to determine the need for groundwater management and (2) to prepare and adopt a groundwater sustainability plan and implementing rules and regulations.
Process to provide the public notice of implementation - §354.44(b)(1)(B)	**Estimated cost and funding source - §354.44(b)(8)**
Notice of implementation with be provided in the public review period of the GSP and adoption of the GSP. Implementation of the management action will be internal and not affect landowners or water users in the Basin.	$110,000 Annual cost. Funding source to be contributions from BCGSA member agencies
Quantification of methods to mitigate overdraft, if overdraft conditions are identified - §354.44(b)(2)	**Management of groundwater extractions and recharge - §354.44(b)(9)**
Pumping will be reduced if a trend toward a minimum threshold is identified.	The BCGSA will manage reductions in pumping rates or duration if trends indicate historical maximum groundwater levels will be reached. Individual agencies will be responsible for monitoring their wells and informing the BCGSA if this trend becomes apparent.
Permitting and regulatory process - §354.44(b)(3)	**Supporting information and science - §354.44(c)**
No additional permitting or regulatory processes will be required.	The BCGSA will use the water level monitoring to add to existing data of historical maximum depths to water.
Timeframe for expected project/management action start and completion, accrual of benefits - §354.44(b)(4)	**Level of uncertainty - §354.44(d)**
Water level monitoring will be ongoing, beginning with adoption of the GSP. The benefit of more consistent data and understanding of groundwater levels will increase with time and continued monitoring.	There is inconsistency of data in some areas of the Basin which regular standardized monitoring will mitigate.

Table 8-3. Action 3 – Monitor Selected Groundwater Quality Constituents and Coordinate with the Regional Water Quality Control Board as Appropriate

Description of the Project or Management Action - §354.44(a)	**Project/management action benefits - §354.44(b)(5)**
Routinely monitor water quality throughout the Basin as described in the monitoring plan. If a significant upward concentration trend is observed in areas that contribute to potable supply, cooperate with the Regional Water Quality Control Board for appropriate action. If a minimum threshold is observed in areas that contribute to potable supply, cooperate with the Regional Water Quality Control Board for appropriate.	Regular water quality monitoring will benefit the Basin by serving as an early warning system to identify trends toward potential groundwater quality concerns in order to avoid undesirable results.
Description of the measurable objective(s) addressed - §354.44(b)(1)	**How the project/management action will be accomplished - §354.44(b)(6)**
Maintain or reduce the 5-year average concentrations of nitrate and total dissolved solids based on conditions assessed in each 5-year update.	Groundwater samples will be collected BCGSA agency personnel for wells they own and operate. This information will be transmitted to the BCGSA administrator who will compile and store the information and complete annual reports.
Circumstances and criteria for implementation - §354.44(b)(1)(A)	**Legal authority - §354.44(b)(7)**
Water quality monitoring will be implemented once the GSP is adopted. The minimum threshold for nitrate is defined as 5-year average concentrations (Basin-wide) not exceeding the 10 mg/L drinking water MCL for Nitrate as Nitrogen. The minimum threshold for TDS is defined as 5-year average concentrations (Basin-wide) not exceeding the 1,000 mg/L Secondary MCL for TDS. If significant upward concentration trends toward the minimum thresholds are observed in areas that contribute to potable supply, the GSA will coordinate with the Regional Water Quality Control Board as appropriate..	CWC § 10725.4 (a)(1) provides GSAs the authority to determine the need for groundwater management and (2) to prepare and adopt a groundwater sustainability plan and implementing rules and regulations.
Process to provide the public notice of implementation - §354.44(b)(1)(B)	**Estimated cost and funding source - §354.44(b)(8)**
Notice of implementation with be provided in the public review period of the GSP and adoption of the GSP. Implementation of the management action will be internal and not affect landowners or water users in the Basin.	$24,000 Annual cost. Funding source to be contributions from BCGSA member agencies
Quantification of methods to mitigate overdraft, if overdraft conditions are identified - §354.44(b)(2)	**Management of groundwater extractions and recharge - §354.44(b)(9)**
Overdraft will not be a factor in this management action.	Groundwater extractions and recharge will not be a factor in this management action.
Permitting and regulatory process - §354.44(b)(3)	**Supporting information and science - §354.44(c)**
No additional permitting or regulatory processes will be required.	Analysis shall be conducted by a certified laboratory with the State of California through the California Water Boards Environmental Laboratory Accreditation Program (ELAP). The BCGSA will incorporate data from the RWQCB when assessing water quality concentration trends.
Timeframe for expected project/management action start and completion, accrual of benefits - §354.44(b)(4)	**Level of uncertainty - §354.44(d)**
Water quality monitoring will be ongoing, beginning with adoption of the GSP. The benefit of more consistent data of groundwater quality will increase with time and continued monitoring.	Uncertainty when assessing potential water quality concerns may be communicated to the Regional Water Quality Control Board.

Table 8-4. Action 4 – Track Trends in Groundwater Levels near Temescal Wash and Take Action as Necessary

Description of the Project or Management Action - §354.44(a)	**Project/management action benefits - §354.44(b)(5)**
Routinely track water levels in wells located near Temescal Wash and take action as specified.	Regular water level monitoring at Temescal Wash will benefit the Basin by decreasing the uncertainty of sustainable groundwater depths relating to riparian vegetation health.
Description of the measurable objective(s) addressed - §354.44(b)(1)	**How the project/management action will be accomplished - §354.44(b)(6)**
The measurable objective is the amount of surface water depletion that is less than the amount specified as the minimum threshold. Given the weak correlation between groundwater levels and vegetation health, no specific rise in shallow groundwater levels or increase in stream flow is identified as providing a preferred set of GDE conditions.	Static groundwater levels will be collected and compiled agency personnel who own and operate individual wells at a minimum frequency of monthly. Transducers will be utilized where practical. This information will be transmitted to the GSA administrator who will compile and evaluate trends toward the minimum threshold. If a trend toward the minimum threshold is observed, pumping rates or durations will be reduced in the affected area. Should a minimum threshold occur, pumping will be curtailed in the affected area.
Circumstances and criteria for implementation - §354.44(b)(1)(A)	**Legal authority - §354.44(b)(7)**
The minimum threshold is defined as more than two-thirds of monitored wells near Temescal Wash with static water levels lower than 35 feet below the adjacent channel elevation for a period of more than one year. If a trend toward the minimum threshold is observed, pumping rates or durations will be reduced in affected areas. If the minimum threshold is met, pumping will be curtailed in the affected area until groundwater levels recover.	CWC § 10725.4 (a)(1) provides GSAs the authority to determine the need for groundwater management and (2) to prepare and adopt a groundwater sustainability plan and implementing rules and regulations.
Process to provide the public notice of implementation - §354.44(b)(1)(B)	**Estimated cost and funding source - §354.44(b)(8)**
Notice of implementation with be provided in the public review period of the GSP and adoption of the GSP. Implementation of the management action will be internal and not affect landowners or water users in the Basin.	$2,000 Annual cost. Funding source to be contributions from BCGSA member agencies. The majority of costs for this MA is covered under MA-2
Quantification of methods to mitigate overdraft, if overdraft conditions are identified - §354.44(b)(2)	**Management of groundwater extractions and recharge - §354.44(b)(9)**
Transducers installed in wells near Temescal Wash where practical and/or manual measurements will be performed on selected wells.	The BCGSA will manage reductions in pumping rates or duration if trends indicate historical maximum groundwater levels will be reached. Individual agencies will be responsible for monitoring their wells and informing the BCGSA if this trend becomes apparent.
Permitting and regulatory process - §354.44(b)(3)	**Supporting information and science - §354.44(c)**
No additional permitting or regulatory processes will be required.	The BCGSA will use the water level monitoring to add to existing data of historical maximum depths to water.
Timeframe for expected project/management action start and completion, accrual of benefits - §354.44(b)(4)	**Level of uncertainty - §354.44(d)**
Water level monitoring at Temescal Wash will be ongoing, beginning with adoption of the GSP. The benefit of more consistent data and understanding of the groundwater levels will increase with time and continued monitoring.	There is uncertainty regarding the relationship between water levels in production wells adjacent to Temescal Wash and the health of the riparian vegetation in the wash. For this reason, a specific project will be developed in an attempt to resolve this data gap and update the minimum threshold as required.

Table 8-5. Action 5 – Review InSAR Data on the SGMA Dataviewer During Updates

Description of the Project or Management Action - §354.44(a)	**Project/management action benefits - §354.44(b)(5)**
Interferometric synthetic aperture radar (InSAR) data will be reviewed on the SGMA Dataviewer during 5-year updates. If a subsidence trend is observed, the GSA will initiate studies to evaluate the causes of subsidence and/or potential errors.	Undesirable results relating to land subsidence have not been observed in the Basin, however subsidence may be subtle and cumulative over time. The benefit of regular monitoring of subsidence will be to potentially identify subsidence concerns early and initiate studies to evaluate the causes before undesirable results occur.
Description of the measurable objective(s) addressed - §354.44(b)(1)	**How the project/management action will be accomplished - §354.44(b)(6)**
The measurable objective for the land subsidence affecting land uses sustainability indicator is zero subsidence, acknowledging measurement error and other uncertainties.	InSAR data will be monitored annually and compiled on a 5-year basis by the GSA during completion of 5-year updates.
Circumstances and criteria for implementation - §354.44(b)(1)(A)	**Legal authority - §354.44(b)(7)**
Subsidence monitoring will be implemented once the GSP is adopted. The minimum threshold is defined as a rate of decline equal to or greater than 0.2 feet in any 5-year period with 2015 as the baseline condition. If a subsidence trend is observed, studies will be initiated to evaluate the causes of subsidence.	CWC § 10725.4 (a)(1) provides GSAs the authority to determine the need for groundwater management and (2) to prepare and adopt a groundwater sustainability plan and implementing rules and regulations.
Process to provide the public notice of implementation - §354.44(b)(1)(B)	**Estimated cost and funding source - §354.44(b)(8)**
Notice of implementation with be provided in the public review period of the GSP and adoption of the GSP. Implementation of the management action will be internal and not affect landowners or water users in the Basin.	$4,000 Funding source to be contributions from BCGSA member agencies
Quantification of methods to mitigate overdraft, if overdraft conditions are identified - §354.44(b)(2)	**Management of groundwater extractions and recharge - §354.44(b)(9)**
Overdraft will not be a factor in this management action.	Groundwater extractions and recharge will not be a factor in this management action.
Permitting and regulatory process - §354.44(b)(3)	**Supporting information and science - §354.44(c)**
No additional permitting or regulatory processes will be required.	The BCGSA will use InSAR data available on the SGMA Dataviewer to monitor for future potential subsidence.
Timeframe for expected project/management action start and completion, accrual of benefits - §354.44(b)(4)	**Level of uncertainty - §354.44(d)**
Subsidence monitoring will begin with adoption of the GSP and will be reported during 5-year updates. The benefit of more consistent data will increase with time and continued monitoring.	Many factors may contribute to subsidence, therefore if a trend is observed, studies will be initiated to evaluate the cause(s) before further action is considered.

Table 8-6. Project 1 – Investigate Groundwater/Surface Water Interaction at Temescal Wash

Description of the Project or Management Action - §354.44(a)	**Project/management action benefits - §354.44(b)(5)**
Phase 1 includes field studies and review of historical remote sensing and surface flow data in order to better understand the relationship between groundwater elevations and health of riparian habitat in Temescal Wash. Phase I will also include siting and identifying permitting requirements for new facilities to monitor shallow groundwater along Temescal Wash. Phase 2 will include installation of monitoring wells or drive points and on-going monitoring.	Technical studies and monitoring of shallow groundwater at Temescal Wash will benefit the Basin by decreasing the uncertainty of sustainable groundwater depths relating to riparian vegetation health and improving the minimum threshold for groundwater/surface water interaction.
Description of the measurable objective(s) addressed - §354.44(b)(1)	**How the project/management action will be accomplished - §354.44(b)(6)**
The measurable objective is the amount of surface water depletion that is less than the amount specified as the minimum threshold. Given the weak correlation between groundwater levels and vegetation health, no specific rise in shallow groundwater levels or increase in stream flow is identified as providing a preferred set of GDE conditions.	The GSA will develop a request for proposal from qualified firms to conduct an initial study to evaluate the interaction of surface water and groundwater and the relationship of groundwater elevation on the health of riparian vegetation in Temescal Wash. The study may involve field biological surveys, review of historical surface flows, and/or review of historical photographs and remote sensing data. The work will result in recommendations for future monitoring and permitting requirements for installation of piezometers of drive points. A second phase will involve installation of monitoring facilities and on-going monitoring of groundwater and vegetation.
Circumstances and criteria for implementation - §354.44(b)(1)(A)	**Legal authority - §354.44(b)(7)**
The minimum threshold is defined as more than two-thirds of monitored wells near Temescal Wash with static water levels lower than 35 feet below the adjacent channel elevation for a period of more than one year. If a trend toward the minimum threshold is observed, pumping rates or durations will be reduced in affected areas. If the minimum threshold is met, pumping will be curtailed in the affected area until groundwater levels recover.	CWC § 10725.4 (a)(1) provides GSAs the authority to determine the need for groundwater management and (2) to prepare and adopt a groundwater sustainability plan and implementing rules and regulations.
Process to provide the public notice of implementation - §354.44(b)(1)(B)	**Estimated cost and funding source - §354.44(b)(8)**
Notice of implementation with be provided in the public review period of the GSP and adoption of the GSP. Implementation of the management action will be internal and not affect landowners or water users in the Basin.	$514,000 One-occurrence cost. Funding source to be contributions from BCGSA member agencies
Quantification of methods to mitigate overdraft, if overdraft conditions are identified - §354.44(b)(2)	**Management of groundwater extractions and recharge - §354.44(b)(9)**
Pumping will be reduced if a trend toward a minimum threshold is identified.	The BCGSA will manage reductions in pumping rates or duration if trends indicate historical maximum groundwater levels will be reached. Individual agencies will be responsible for monitoring their wells and informing the BCGSA if this trend becomes apparent.
Permitting and regulatory process - §354.44(b)(3)	**Supporting information and science - §354.44(c)**
Permitting or regulatory processes will be evaluated in the initial study.	Review of historical remote sensing and biological surveys will be utilized.
Timeframe for expected project/management action start and completion, accrual of benefits - §354.44(b)(4)	**Level of uncertainty - §354.44(d)**
The project will start within 6 months of adoption of the GSP with the development of a request for proposal. The project is expected to last approximately two years. Benefits of the project will be to improve monitoring and required action to protect groundwater-dependent ecosystems.	There is uncertainty regarding the relationship between water levels in production wells adjacent to Temescal Wash and the health of the riparian vegetation in the wash. The reason for this project is to reduce that uncertainty and improve minimum thresholds regarding GDEs, and ultimately, protection of GDEs

Table 8-7. Project 2 – Initiate a Survey of Private Wells

Description of the Project or Management Action - §354.44(a)	**Project/management action benefits - §354.44(b)(5)**
Field studies and review of information in order to better understand the location and construction characteristics of local private wells	Further information regarding private wells in the subbasin will benefit achievement of the sustainability goal by decreasing the uncertainty related to the construction characteristics and location of the private wells.
Description of the measurable objective(s) addressed - §354.44(b)(1)	**How the project/management action will be accomplished - §354.44(b)(6)**
Maintain groundwater elevations above the historical minimum elevation and maintain groundwater levels within the historical operating range [such that private wells are not adversely affected.	The GSA will initiate a survey of private wells in order to confirm that the minimum thresholds are protective of the use of private wells for beneficial use.
Circumstances and criteria for implementation - §354.44(b)(1)(A)	**Legal authority - §354.44(b)(7)**
The private well survey will be initiated after adoption of the GSP when resources are available.	CWC § 10725.4 (a)(1) provides GSAs the authority to determine the need for groundwater management and (2) to prepare and adopt a groundwater sustainability plan and implementing rules and regulations.
Process to provide the public notice of implementation - §354.44(b)(1)(B)	**Estimated cost and funding source - §354.44(b)(8)**
Notice of implementation with be provided in the public review period of the GSP and adoption of the GSP. Implementation of the management action will be internal and not affect landowners or water users in the Basin.	$60,000 One-occurrence cost. Funding source to be contributions from BCGSA member agencies
Quantification of methods to mitigate overdraft, if overdraft conditions are identified - §354.44(b)(2)	**Management of groundwater extractions and recharge - §354.44(b)(9)**
Overdraft will be mitigated by reduction in pumping if identified.	The BCGSA will manage reductions in pumping rates or duration if trends indicate historical maximum groundwater levels will be reached. Individual agencies will be responsible for monitoring their wells and informing the BCGSA if this trend becomes apparent.
Permitting and regulatory process - §354.44(b)(3)	**Supporting information and science - §354.44(c)**
Permitting or regulatory processes are not required for the survey of private wells	Existing well construction reports, well logs, and knowledge of local personnel
Timeframe for expected project/management action start and completion, accrual of benefits - §354.44(b)(4)	**Level of uncertainty - §354.44(d)**
The project will start after adoption of the GSP and will be conducted by the GSA administrator. Benefits of the project will be to improve understanding and protection of local wells.	There is uncertainty regarding the exact location and design of local private wells. The reason for this project is to reduce that uncertainty and improve protection of private wells.

Table 8-8. Project 3 – Evaluation of the Effects of Aggregate Pits on Groundwater Flow and Quality

Description of the Project or Management Action - §354.44(a)	**Project/management action benefits - §354.44(b)(5)**
The GSA administrator will initiate the investigations after adoption of the GSP by issuing an RFP to qualified firms. Although the details of the study of aggregate mine's effect on groundwater are yet to be determined, it is anticipated that the study may involve detailed review of the aggregate pit water budget (pumping, evapotranspiration, precipitation, and surface water flow infiltration), historical remote sensing images, historical hydrograph and streamflow information review, monitoring well construction, and/or interviews with local mine managers.	The benefits of investigating the interconnectivity of surface water within the open pit aggregate mines and adjacent groundwater will improve the hydrologic conceptual model and benefit the GSA in understanding methods to maintain sustainability in the vicinity of the mines.
Description of the measurable objective(s) addressed - §354.44(b)(1)	**How the project/management action will be accomplished - §354.44(b)(6)**
The measurable objective is the amount of surface water depletion that is less than the amount specified as the minimum threshold.	The GSA Administrator will develop a request for proposals from qualified firms and manage progress of the contractor.
Circumstances and criteria for implementation - §354.44(b)(1)(A)	**Legal authority - §354.44(b)(7)**
The project will be implemented prior to the first 5-year update after the GSP has been adopted.	CWC § 10725.4 (a)(1) provides GSAs the authority to determine the need for groundwater management and (2) to prepare and adopt a groundwater sustainability plan and implementing rules and regulations.
Process to provide the public notice of implementation - §354.44(b)(1)(B)	**Estimated cost and funding source - §354.44(b)(8)**
Notice of implementation with be provided in the public review period of the GSP and adoption of the GSP. Implementation of the management action will be internal and not affect landowners or water users in the Basin.	$165,000 One-occurrence cost. Funding source to be contributions from BCGSA member agencies
Quantification of methods to mitigate overdraft, if overdraft conditions are identified - §354.44(b)(2)	**Management of groundwater extractions and recharge - §354.44(b)(9)**
Overdraft will not be a factor in this management action.	The BCGSA will manage reductions in pumping rates near the aggregate mines if appropriate based on investigations
Permitting and regulatory process - §354.44(b)(3)	**Supporting information and science - §354.44(c)**
If piezometers or monitoring wells will be installed as part of the project, well permits will be acquired from the County of Riverside Department of Environmental Health.	The BCGSA will use data gathered during the project and existing best practices to develop methods of avoiding undesirable results around the aggregate mines.
Timeframe for expected project/management action start and completion, accrual of benefits - §354.44(b)(4)	**Level of uncertainty - §354.44(d)**
The project is expected to be completed before the first 5-year update after the GSP has been adopted. Benefits will increase over time with a greater understanding of the relationship between aggregate mining and the local groundwater system.	There is uncertainty about the water budget in the vicinity of the aggregate mines. The project will seek to fill these data gaps.

9. PLAN IMPLEMENTATION

The official adoption of the Groundwater Sustainability Plan (GSP) by the Bedford Coldwater Groundwater Sustainability Authority (BCGSA) will initiate Plan implementation. After submittal of the GSP to the California Department of Water Resources (DWR) and during the DWR review period, the BCGSA will continue to communicate with stakeholders via the BCGSA's website and begin implementing the projects and management actions (Actions) described in Section 8. The Plan will be implemented to sustainably manage groundwater in the Bedford-Coldwater Subbasin (Basin) under the authority of the BCGSA and its member agencies.

9.1. PLAN IMPLEMENTATION RESOURCES AND RESPONSIBILITIES

Resources to implement the GSP will be derived from three different sources: a contracted GSP Administrator, personnel from the three BCGSA agencies (City of Corona [Corona], Elsinore Valley Municipal Water District [EVMWD], Temescal Valley Water District [TVWD]), and contracted firms qualified to perform specialized services.

The GSP Administrator will be generally responsible for facilitating (though not necessarily performing) all aspects of GSP implementation through the first 5 years, including annual reporting and a 5-year update described in a following section. After 5 years, the BCGSA may elect to renew the term of the Administrator or issue a new RFP for GSP administration.

Personnel from the three BCGSA agencies will be responsible for collection of information from their respective facilities or within their area of influence in the Basin. This will include depth to groundwater measurements, collection of groundwater quality samples, groundwater extractions, use of surface water supplies, and total water use. This information will be reported to the GSP Administrator for compilation, quality control and standardization, ultimately, storage in the BCGSA Data Management System (DMS).

For specialized studies such as biological surveys or other specialized work that cannot be accomplished by the Administrator, the Administrator will be responsible for coordinating with the BCGSA to develop RFPs and facilitating consultant selection by the BCGSA. After the consultant is selected by the BCGSA, the Administrator will be responsible for management of the specialty consultant, including monitoring/reviewing the work and providing recommendations regarding consultant progress payments. **Table 9-1** provides examples of GSP implementation tasks and the anticipated responsible party.

Table 9-1. Example GSP Implementation Responsibilities

GSP Task	Responsible Party
Collect information on groundwater extractions by water use sector, surface water sources, and total water use and report this data to the Administrator	Agency Personnel
Collect and compile static water levels in wells and report this information to the Administrator	Agency Personnel
Complete annual reports	GSP Administrator/Specialty Consultant
Coordinate appropriate action if measurement thresholds are exceeded	GSP Administrator
Maintain Data Management System (DMS)	GSP Administrator
Monitor selected groundwater quality all active production wells. Coordinate with RWQCB if action required	GSP Administrator
Review Interferometric Synthetic Aperture Radar (InSAR) data annually from the DWR DataViewer, and during 5-year updates	GSP Administrator
Complete 5-year updates including groundwater modeling updates	GSP Administrator/Specialty Consultant
Develop RFPs and manage specialty contractors	GSP Administrator
Maintain BCGSA website with periodic stakeholder communication	GSP Administrator
Conduct private well survey	GSP Administrator
Develop quarterly JPA board updates and cost estimates	GSP Administrator
Identify and apply for potential grant funding	GSP Administrator
Project No 2: Private Well Survey	GSP Administrator
Project No 1: Investigation of Interconnected Surface Water	Specialty Consultant
Project No 3: Investigation of Aggregate Pits	Specialty Consultant

9.2. PLAN IMPLEMENTATION COSTS

The costs associated with implementing the GSP can be considered either continually ongoing (operating) costs, or GSP implementation costs associated with specific management actions and projects. Estimated costs for both of these categories are provided below.

9.2.1. Operating Expenses

The cost of operating the BCGSA includes staff expenses, coordination between member agencies, maintenance of the BCGSA website and DMS site, legal expenses, auditing expenses, insurance, bank fees, and other administrative costs. These costs are estimated at approximately $60,000 annually (2021 dollars) based on experience since the BCGSA was formed.

9.2.2. GSP Implementation Costs

Implementation costs include costs to implement management actions and projects. As detailed in Tables 8-1 through 8-8 and summarized in Table 9-2, total annual costs (2021 dollars) are estimated at approximately $266,000 per year, while estimated one-occurrence costs for recommended projects and the first 5-year periodic GSP update is approximately $990,000.

Table 9-2. GSP Implementation Cost Estimates

Management Action and Projects	Estimated Annual Costs
Action 1 - Provide for Collection, Compilation, and Storage of Information Required For Annual Reports and Submit Annual Reports	$126,000
Action 2 - Routinely Record Groundwater Levels and Take Action if Necessary	$110,000
Action 3 - Monitor Selected Groundwater Quality Constituents and Coordinate with the Regional Water Quality Control Board as Appropriate	$24,000
Action 4 - Track Trends in Groundwater Levels near Temescal Wash and Take Action as Necessary (field costs included in Action 2)	$2,000
Action 5 - Review InSAR Data on the DWR DataViewer During Annual and 5-Year Updates	$4,000
Total Estimated Annual Implementation (Non-Operating) Costs	$266,000
Project 1 – Investigate Groundwater/Surface Water Interaction at Temescal Wash and Install Monitoring Wells	$514,000
Project 2 – Initiate a Survey of Active Private Wells	$60,000
Project 3 – Evaluation of the Effects of Aggregate Pits on Groundwater Flow and Quality	$165,000
First Periodic 5-year GSP Update	$251,000
Total Estimated One-Occurrence Costs (First 5 years)	$990,000

9.2.3. Funding Methods for Operating Expenses and GSP Implementation Costs

The funding method for operating expenses and GSP implementation costs is by contributions by BCGSA member agencies (Corona, EVWMD, and TVWD). This is the same mechanism utilized to fund development of the GSP (with significant supplemental contribution though

California Proposition 1 Grant funding). The estimated costs are well within budget projections for the next several years provided to the BCGSA Board of Directors.

9.3. ANNUAL REPORTING

The BCGSA is required to submit an annual report to DWR by April 1st of each year following adoption of the GSP. The first annual report will be due in April of 2022. The annual report will be facilitated by implementing Actions 1 and 2, which provide for collection of the required information and production of the annual report. The annual report will include the following components as described in GSP Regulations for the preceding water year:

- General information – Executive summary, location map.
- Detailed description and graphical representation of the following components of the Basin:
    - Groundwater elevation data from monitoring wells within the monitoring network;
    - Groundwater extraction data for the preceding water year;
    - Surface water supply used or available for use;
    - Total water use; and
    - Change in groundwater storage.
- Description of progress towards implementing the Plan – implementation of projects or management actions since the previous annual report.

It is currently anticipated that the annual reports will be produced by the GSP Administrator or Specialty Consultant. The costs associated with producing these reports will be incorporated into the annual budget of the BCGSA.

9.4. NEW INFORMATION AND CHANGES

The GSP has been developed based on the best available information. However, it is recognized that during implementation of the GSP, new information on groundwater conditions, changes in land use or climate, and or changes in the regulatory environment can be expected. Changes in GSP administration may also be appropriate based on experience. When these changes occur, the BCGSA will react with appropriate changes in GSP administration, data collection, and/or groundwater management methods. If the changes are significant, stakeholders and the BCGSA Board of Directors will be kept informed of these changes via Board minutes, the BCGSA website, and emails to stakeholders.

9.5. PERIODIC EVALUATIONS

BCGSA will evaluate the GSP at least every five years and provide an assessment to DWR as required by SGMA Regulations. The assessment will provide an update on the progress of achieving sustainability goals in the Basin and will include the following:

- A description of current groundwater conditions for each sustainability indicator applicable to the Basin relative to measurable objectives and minimum thresholds.
- A description of the implementation of any projects or management actions and their effect on groundwater conditions.
- Any revisions to the basin setting, management areas, or the identification of undesirable results and the setting of minimum thresholds and measurable objectives.
- An evaluation of the basin setting as a result of any significant changes, new information, or changes in water use.
- A description of the monitoring network within the Basin, including any data gaps and areas of the Basin that are represented by data that does not satisfy the requirements of SGMA requirements outlined in Title 23 of the California Code of Regulations (CCR) Sections 352.4 and 354.34(c).
- A description of significant new information that has been made available since GSP adoption, amendment, or last five-year assessment.
- A description of relevant actions taken by the BCGSA, including a summary of regulations or ordinances related to the GSP.
- Information describing any enforcement or legal actions taken by the BCGSA to continue the sustainability goals of the Subbasin.
- A description of completed or proposed GSP amendments.

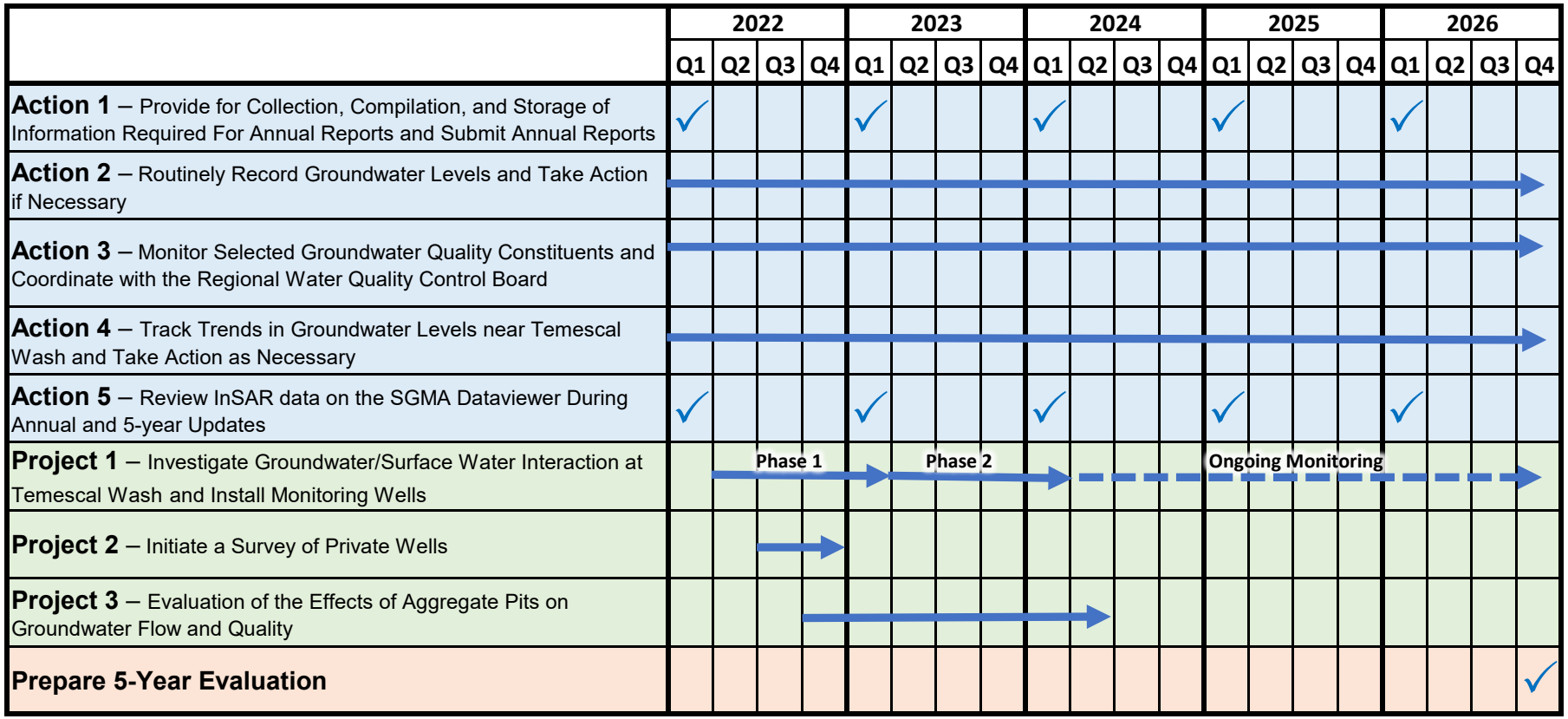
As with the annual reports, the GSP Administrator/Specialty Consultant will be responsible for completion of the five-year assessment with assistance from BCGSA staff. Both annual reports and periodic updates will be available to the public via the BCGSA website as well as the DWR SGMA website.

The cost of the periodic updates is dependent on the complexity of changes occurring in the Basin since the adoption of the GSP but are estimated to be in the range of $250,000 per update (2021 dollars).

9.6. SCHEDULE FOR IMPLEMENTATION

The BCGSA has committed to implementing the GSP upon adoption and completing the projects and management actions necessary to monitor and maintain sustainability within the first 5 years of initiation of the GSP. A preliminary schedule for implementation is shown in **Figure 9-1**. The GSP Administrator will conduct the survey of private wells and develop RFPs for surface/groundwater and aggregate pit studies within the first year of GSP implementation.

Figure 9-1. Schedule for GSP Implementation



10. REFERENCES

Bedford-Coldwater Groundwater Sustainability Agency (BCGSA), 2017, Notice of Election to Become a Groundwater Sustainability Agency for the Bedford-Coldwater Subbasin (Basin No. 8-.004.002), March 29, available at: https://www.bedfordcoldwatergsa.com/wp-content/uploads/2018/07/Resolution_Final.pdf

Carollo Engineers and Todd Groundwater, 2021, Draft Elsinore Valley Subbasin Groundwater Sustainability Plan, May.

California Department of Mines and Geology (CDMG), 1991, Mineral Land Classification of the Temescal Valley Area, Riverside County, California, Special Report 165, available at: https://www.conservation.ca.gov/cgs/Documents/Publications/Special-Reports/SR_165-MLC-Report.pdf

California Department of Water Resources (DWR), 2010, California Statewide Groundwater Elevation Monitoring (CASGEM) Program Procedures for Monitoring Entity Reporting, December 2010, available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/CASGEM/Files/CASGEM-Procedures-for-Monitoring-Entity-Reporting-Final-121610_ay_19.pdf

California Department of Water Resources (DWR), 2016a, Groundwater Sustainability Plan (GSP) Annotated Outline, December 2016, available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Groundwater-Sustainability-Plans/Files/GSP/GSP-Annotated-Outline.pdf

California Department of Water Resources (DWR), 2016b, Bulletin 118, Interim Update 2016, California's Groundwater, Working Toward Sustainability, December 22, available at: https://data.cnra.ca.gov/dataset/75eb6072-6810-471d-ba73-d8eadec36564/resource/2b9cbe00-55f6-420e-9aa7-8e61cb5ee1fc/download/b118-interim-update-2016_ay_19.pdf

California Department of Water Resources (DWR), 2016c, Best Management Practices for the Sustainable Management of Groundwater, Water Budget, December 30, available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-4-Water-Budget_ay_19.pdf

California Department of Water Resources (DWR), 2016d, Best Management Practices for the Sustainable Management of Groundwater, Monitoring Networks and Identification of Data Gaps, December 30, available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps_ay_19.pdf

California Department of Water Resources (DWR), 2017, California DWR Land Use Viewer, available at: https://gis.water.ca.gov/app/CADWRLandUseViewer/, last accessed September 2019.

California Department of Water Resources (DWR), 2019a, SGMA 2019 Basin Prioritization, Spreadsheets and CNRA Open Data, available at: https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization, last accessed September 2019.

California Department of Water Resources (DWR), 2019b, California DWR Well Completion Report Map Application, available at: https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37, last accessed September 2019.

California Department of Water Resources (DWR), 2019c, SGMA Data Viewer Map Application, available at: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub, last accessed September 2019.

California Department of Water Resources (DWR), 2020, DWR SGMA Data Viewer, Land Subsidence, TRE InSAR Dataset, available at https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer, last accessed January.

California Department of Water Resources (DWR), 2021, State of California Household Water Supply Shortage Reporting System, available at https://mydrywatersupply.water.ca.gov/report/publicpage, last accessed March 2021.

California Department of Water Resources (DWR), California Department of Fish and Wildlife, and The Nature Conservancy, 2020, Natural communities commonly associated with groundwater (NCCAG), Statewide digital vegetation maps of vegetation and wetlands overlying groundwater basins, available at https://gis.water.ca.gov/app/NCDatasetViewer/, accessed July 2020.

City of Temecula, 2020, Municipal Code Title 15, May, available at: http://qcode.us/codes/temecula/view.php?topic=15-15_10

Corona and Elsinore Valley Municipal Water District (EVMWD), 2008, Agreement Concerning Water Production from Coldwater, December.

County of Riverside, 2015, Environmental Impact Report No. 521 Public Review Draft Section 4.14, February, available at: https://planning.rctlma.org/Portals/14/genplan/general_plan_2015/DEIR%20521/DEIR%20No.%20521.pdf

Cunningham, W.L., and Schalk, C.W., comps., 2011, Groundwater technical procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods, April, available at: https://pubs.usgs.gov/tm/1a1/.

Drever, J.I., 1988, The Geochemistry of Natural Waters, 2nd Edition, Prentice-Hall, 1988, available at: https://hwbdocuments.env.nm.gov/Los%20Alamos%20National%20Labs/TA%2000/7181.pdf

EIP Associates, 2020, City of Corona General Plan 2020-2040, Adopted March 17, available at: https://www.coronaca.gov/home/showpublisheddocument/17292/637396648435970000

Ellerbee, R.L., 1918, History of Temescal Valley, Publications of the Historical Society of Southern California, Volume 11, pp.18-19, available at https://books.google.com/books?pg=RA2-PA3&lpg=RA2-PA12&dq=History+of+Temescal+Valley&id=E8M1AAAAIAAJ&ots=0MqluE3mYR#v=onepage&q=History%20of%20Temescal%20Valley&f=false

Federal Emergency Management Agency (FEMA), 2011, NFIP Flood Insurance Manual, May 1, available at: https://www.fema.gov/sites/default/files/2020-09/fema_flood-insurance-manual-full-edition_april-oct2020.pdf

Google Earth, 2021, Historical aerial imagery online maps and data, available at https://earth.google.com/web/, last accessed March 2021.

Kennedy/Jenks Consultants, 2008a, Updated Integrated Regional Water Management Plan Report, Western Municipal Water District, May, available at: https://www.wmwd.com/DocumentView.aspx?DID=350

Kennedy/Jenks Consultants, 2008b, Water Use Efficiency Master Plan, Western Municipal Water District, November, available at: https://www.wmwd.com/DocumentView.aspx?DID=351

KWC Engineers, 2016, City of Corona 2015 Urban Water Management Plan, July, available at: https://www.coronaca.gov/home/showdocument?id=4318

KWC Engineers, 2017, Strategic Planning Summary Report for the Coldwater & Mayhew Canyons, County of Riverside, California, Report for the City of Corona, January.

Lee Lake Water District (now Temescal Valley Water District, TVWD), 2007, Lee Lake Water District Recycled Water Master Plan.

Lee Lake Water District (now Temescal Valley Water District, TVWD), 2014, Lee Lake Water District Water System Master Plan Update.

Luhdorff and Scalmanini Consulting Engineers (LSCE), Borchers JW, Grabert VK, Carpenter M, Dalgish B, Cannon D, 2014, Land subsidence from groundwater use in California, report prepared by LSCE with support by the California Water Foundation, available at: http://californiawaterfoundation.org/wp-content/uploads/PDF/1397858208-SUBSIDENCEFULLREPORT_FINAL.pdf.

Morton, Douglas M., Weber, F. Harold, Jr., 2003, Preliminary Geologic Map of the Elsinore 7.5' Quadrangle, Riverside County, California: U. S. Geological Survey Open-File Report 03-281, available at: http://pubs.usgs.gov/of/2003/0281.

MWH, 2004, Elsinore Valley Municipal Water District, Coldwater Basin Recharge Feasibility Study, March.

MWH, 2008, Temescal Wash hydrologic monitoring report, prepared for Elsinore Municipal Water District, Lake Elsinore, CA, June.

MWH, 2016, Elsinore Valley Municipal Water District Urban Water Management Plan, Final, June, available at: http://leapshydro.com/wp-content/uploads/2017/11/Urban-Water-Management-Plan-2016.pdf

National Conservation Easement Database (NCED), 2019, Database of location and information regarding conserved land and easements, available at: https://www.conservationeasement.us/, last accessed September 2019.

Natural Resources Conservation Service (NRCS), 2019, SSURGO soil survey online map database available at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx, last accessed September 2019.

Norris, Robert M. and Webb, Robert W., 1990, Geology of California, Second Edition, John Wiley & Sons.

PRISM Climate Group, 2018, Oregon State University, available at: http://prism.oregonstate.edu, last accessed June 2018.

Raftelis Financial Consultants, Inc., 2016, Temescal Valley Water District Comprehensive Water, Recycled Water, and Wastewater Cost of Service Study Draft Report, December 7, available at: https://www.temescalvwd.com/images/userImages/TVWD_Rate_Report.pdf

Riverside County Planning Department, 2015, County of Riverside General Plan, December 8, available at: https://planning.rctlma.org/General-Plan-Zoning/General-Plan

Riverside County Planning Department, 2018, Temescal Canyon Plan, available at: https://rctlma.org/Portals/14/genplan/2019/ap/TCAP_062618.pdf

Riverside-Corona Resource Conservation District (RCRCD), 2020, Native Fish Studies and Propagation, available at https://www.rcrcd.org/native-fish-studies-and-propagation, last accessed November 2020.

RMC and Woodard & Curran, 2017, 2015 Urban Water Management Plan, Temescal Valley Water District, December, available at: https://www.temescalvwd.com/pdf/TVWD_UWMP_Public%20Draft%20w%20Appendices.pdf

Russell, Kerwin, 2020, Natural Resources Manager, Riverside County Resource Conservation District, e-mails to Gus Yates, Senior Hydrologist, Todd Groundwater, dated August 1 and 3.

SAIC, 2007, Draft Coldwater Groundwater Basin Summary of the Hydrologic Inventory and Change in Groundwater Storage, October 23.

San Diego County, 2005, Drainage Design Manual, July, available at: http://www.sandiegocounty.gov/dpw/floodcontrol/floodcontrolpdf/drainage-designmanual05.pdf

State Water Resources Control Board (SWRCB), 2019, Groundwater Ambient Monitoring and Assessment (GAMA) Program Groundwater Information System online map and database, available at: https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/, last accessed September 2019.

State Water Resources Control Board (SWRCB), 2020, Response Levels Lowered for Water Systems Statewide as PFAS Investigation Continues, available at: https://www.waterboards.ca.gov/press_room/press_releases/2020/pr02062020_pfoa_pfos_response_levels.pdf

The Nature Conservancy, 2020, GDE Pulse on-line vegetation mapping tool, available at https://groundwaterresourcehub.org/sgma-tools/gde-pulse/, last accessed May 2020.

Thomasson, H.G., Jr., F.H. Olmsted and E.F. LeRoux, 1960, Geology, water resources and usable ground-water storage capacity of part of Solano County, California. Water-Supply Paper 1464. U.S. Geological Survey, 1960, available at: https://pubs.usgs.gov/wsp/1464/report.pdf

Todd Engineers and AKM Consulting Engineers (Todd and AKM), 2008, AB3030 Groundwater Management Plan, prepared for City of Corona, June.

Towill, Inc. 2020, InSAR Data Accuracy for California Groundwater Basins CGPS Data Comparative Analysis, January 2015 to September 2019, March 23, available at https://data.cnra.ca.gov/dataset/5e2d49e1-9ed0-425e-9f3e-2cda4a213c26/resource/a1949b59-2435-4e5d-bb29-7a8d432454f5/download/insar-data-accuracy-report-towill.pdf

United States Geological Survey (USGS), 2004, Preliminary Digital Geologic Map of the Santa Ana 30' x 60' Quadrangle, Southern California, Version 2.0 compiled by D.M. Morton, Open-File Report 99-172, available at: http://pubs.usgs.gov/of/1999/of99-172/

United States Geological Survey (USGS), 2006, Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangles, California, Version 1.0 compiled by Douglas M. Morton and Fred K. Miller, Open-File Report 2006-1217, available at: http://pubs.usgs.gov/of/2006/1217/

United States Geologic Survey (USGS), 2018, National Water Information System Web Interface, Station: USGS 11070500 SAN JACINTO R NR ELSINORE CA, available at: https://waterdata.usgs.gov/nwis/uv?site_no=11070500, Station: USGS 11071900 TEMESCAL C A CORONA LK NR CORONA CA, , available at: https://waterdata.usgs.gov/ca/nwis/uv?site_no=11071900, Station: USGS 11072100 TEMESCAL C AB MAIN ST A CORONA CA, , available at: https://waterdata.usgs.gov/ca/nwis/uv?site_no=11072100, groundwater elevation information for wells surrounding Bedford-Coldwater Basin, last accessed July 3, 2018.

United States Geologic Survey (USGS), 2019, National Elevation Dataset (NED) for Riverside County, available at: https://nationalmap.gov/elevation.html, last accessed November 2019.

United States Geological Survey (USGS), 2021, National Field Manual for the Collection of Water-Quality Data (NFM), available at: https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm?qt-science_center_objects=0#qt-science_center_objects, last accessed February 2021.

Upper Santa Ana River Sustainable Resources Alliance (USARSRA), 2020, Upper Santa Ana River Habitat Conservation Plan, available at: http://www.uppersarhcp.com/Default.aspx, last accessed March 2021.

Western Riverside County Regional Conservation Authority, 2020, Western Riverside County multi-species habitat conservation plan, available at: https://www.wrc-rca.org/habitat-conservation/, last accessed March 2021.

Wildermuth Environmental, Inc. (WEI), 2015a, Fifth Annual Report of the Coldwater Basin Operating Committee, July.

Wildermuth Environmental, Inc. (WEI), 2015b, Draft Feasibility Investigation (Phase I) to Develop a Potable Water-Supply from the Bedford Basin, prepared for the City of Corona, Elsinore Valley Water District, and Lee Lake Water District, August.

Wildermuth Environmental, Inc. (WEI), 2016, Fourth Annual Report of the Coldwater Basin Operating Committee, November.

Wildermuth Environmental, Inc. (WEI), 2017a, Salt and Nutrient Management Plan for the Upper Temescal Valley, Final September.

Wildermuth Environmental, Inc. (WEI), 2017b, Sixth and Seventh Annual Report of the Coldwater Basin Operating Committee, December.

Wildermuth Environmental, Inc. (WEI), 2019, Eighth Annual Report of the Coldwater Basin Operating Committee, December.

APPENDIX A

Joint Powers Agreement forming the Bedford-Coldwater Groundwater Sustainability Agency

JOINT POWERS AGREEMENT

by and among

THE CITY OF CORONA,
a California general law city,

ELSINORE VALLEY MUNICIPAL
WATER DISTRICT,
a municipal water district

and

TEMESCAL VALLEY WATER DISTRICT,
a California water district

for the formation of a joint powers authority and management of

THE BEDFORD-COLDWATER SUB-BASIN
OF THE ELSINORE BASIN

TABLE OF CONTENTS

		Page
1.	RECITALS	2
2.	DEFINITIONS	2
3.	CERTIFICATION	3
4.	CREATION OF SEPARATE AGENCY	3
5.	PURPOSES AND MEMBER RESPONSIBILITIES	4
6.	POWERS	4
7.	OBLIGATIONS OR LIABILITIES OF AUTHORITY	6
8.	DESIGNATION OF ADMINISTERING MEMBER/ADMINISTRATOR	6
9.	ORGANIZATION	6
10.	SPECIAL PROJECTS AND PROJECT COMMITTEES	8
11.	FISCAL AGENT, DEPOSITORY AND ACCOUNTING	9
12.	ACCOUNTABILITY, REPORTS AND AUDITS	9
13.	OPERATING BUDGET AND EXPENDITURES	9
14.	CONTRIBUTIONS/BUDGETS	9
15.	ASSESSMENTS FOR EXTRAORDINARY COSTS	12
16.	STAFFING	13
17.	DISPUTE RESOLUTION	13
18.	WITHDRAWAL	14
19.	TERM AND TERMINATION	15
20.	INDEMNIFICATION/CONTRIBUTION	15
21.	INSURANCE	16
22.	CLAIMS	16
23.	ENTIRE AGREEMENT REPRESENTED	16
24.	HEADINGS	16

Page

25. NOTICES 16

26. CONSTRUCTION 17

27. NO THIRD PARTY BENEFICIARIES INTENDED 17

28. WAIVERS 17

29. CONFLICT WITH LAWS OR REGULATIONS/SEVERABILITY 17

30. FURTHER ASSURANCES AND OBLIGATION OF GOOD FAITH DEALING 17

31. COUNTERPARTS 18

32. AMENDMENT 18

33. CUA ASSIGNMENT 18

JOINT POWERS AGREEMENT BY AND AMONG THE CITY OF CORONA, ELSINORE VALLEY MUNICIPAL WATER DISTRICT, AND TEMESCAL VALLEY WATER DISTRICT FOR THE FORMATION OF A JOINT POWERS AUTHORITY AND MANAGEMENT OF THE BEDFORD-COLDWATER SUB-BASIN OF THE ELSINORE BASIN

THIS JOINT POWERS AGREEMENT ("Agreement") is entered into as of February 28, 2017, by and between the CITY OF CORONA ("Corona"), a California General Law City organized and existing under the laws of the State of California, ELSINORE VALLEY MUNICIPAL WATER DISTRICT ("EVMWD"), a Municipal Water District organized under Water Code §§ 71000 et seq., and the TEMESCAL VALLEY WATER DISTRICT ("TVWD"), a California Water District organized under California Water Code §§ 34000 et seq., hereinafter collectively referred to as "Members", with reference to the following:

A. WHEREAS, in September 2014, the Governor signed three bills (SB 1168, SB 1319, and AB 1739) into law creating the Sustainable Groundwater Management Act of 2014 ("SGMA"); and

B. WHEREAS, SGMA generally requires the formation of one or more Groundwater Sustainability Agencies ("GSA" or "GSAs") responsible for implementing sustainable groundwater management and preventing "undesirable results" in groundwater basins and sub-basins designated as a medium or high priority basin by the California Department of Water Resources ("DWR") in its Bulletin 118 inventory of California groundwater basins; and

C. WHEREAS, DWR has designated the Bedford-Coldwater Sub-Basin (the "Sub-Basin"), as a medium priority groundwater basin under Bulletin 118; and

D. WHEREAS, each of the Members overlies a portion of the Sub-Basin and exercises water management, water supply or land use authority within a portion of the Sub-Basin; and

E. WHEREAS, the Members are local agencies that can exercise powers related to groundwater management within their jurisdictional boundaries and qualify individually to serve as a GSA within portions of the Sub-Basin per Water Code Section 10723; and

F. WHEREAS, under SGMA, a combination of local agencies may elect to form a joint powers authority ("JPA") to serve as the GSA for all or portions of the Sub-Basin through a joint powers agreement; and

G. WHEREAS, the Members intend by this Agreement to create a JPA to implement SGMA in the entire Sub-Basin, and are authorized to enter into this Agreement pursuant to the Joint Exercise of Powers Act, Government Code §§ 6500 et seq., for the purpose of acting as a separate public agency that can carry out all obligations, and exercise all powers, of a GSA in all areas of the Sub-Basin; and

H. WHEREAS, under SGMA, a GSA, including a JPA composed of one or more SGMA-eligible local agencies, must file a notice of intent with DWR by June 30, 2017 indicating the GSA's intent to undertake sustainable groundwater management within all or portions of a groundwater basin; and

I. WHEREAS, the governing boards of each of the three Members have formally agreed to: (1) enter into this Agreement; (2) form a JPA that can jointly exercise the powers common to the Members and fulfill all legal obligations imposed by SGMA; and (3) authorize the JPA to promptly file all necessary documentation with DWR so as to permit the JPA to become the exclusive GSA for the entire Sub-Basin; and

J. WHEREAS, the Members further intend by this Agreement to provide for the management and funding commitments reasonably anticipated to be necessary for the above purposes and for the purpose of ensuring that the Sub-Basin is sustainably managed in accordance with the timelines established by SGMA; and

K. WHEREAS, the Members understand that Corona has entered into a Water Enterprise Management Agreement and a Wastewater Enterprise Management Agreement, both dated as of February 6, 2002, with the Corona Utility Authority ("CUA") for the maintenance, management and operation of those utility systems (collectively "the CUA Management Agreements"). To the extent that this Agreement is deemed to be a "material contract" under either of the CUA Management Agreements, Corona enters into this Agreement on behalf of the CUA and subject to the terms of the applicable CUA Management Agreements.

ACCORDINGLY, IT IS AGREED BY ALL MEMBERS:

1. RECITALS: The foregoing recitals are incorporated as terms of this Agreement.

2. DEFINITIONS: Unless otherwise required by the context, the following terms shall have the following meanings:

a. "Administering Member" shall mean the Member designated by the Authority Board to provide administration, operation and staffing of the Authority so as to ensure the Authority complies with this Agreement and all legal requirements. The Board is not required to designate an Administering Member, and a Member so designated is not required to accept the designation.

b. "Administrator" shall mean the individual selected to act as the chief executive of the Authority, and the person responsible for its day to day operations. The Administrator may, but it is not required to be, an employee of one of the Members.

c. "Authority" and "JPA" as used herein shall, unless otherwise noted, mean the "Bedford-Coldwater Groundwater Sustainability Authority," the separate public agency created by this Agreement and Government Code Sections 6507 and 6508, and the entity charged by this Agreement with becoming the exclusive GSA for the Sub-Basin.

d. "Board" or "Board of Directors," shall, unless otherwise indicated, mean the Board of Directors of the Authority.

e. "DWR" shall mean the California Department of Water Resources.

f. "Effective Date" shall mean the date on which all Members have signed this Agreement.

g. "Fiscal Year" shall run from July 1 through June 30.

h. "Groundwater Sustainability Agency" or "GSA" shall mean a groundwater sustainability agency as defined in SGMA, Water Code § 10721.

i. "Groundwater Sustainability Plan," "Plan," or "GSP" shall have the same meaning as provided in SGMA, Water Code § 10721.

j. "Member" shall mean any of the individual signatories to this Agreement, and "Members" shall collectively mean two or more of the signatories to this Agreement.

k. "SGMA" shall mean the Sustainable Groundwater Management Act of 2014, as amended, and any regulations of DWR or the State Water Resources Control Board that implement SGMA.

l. "Special Projects" shall mean projects that are consistent with, and within the scope of activities, authorized by this Agreement, but which are undertaken by fewer than all the Members in the name of the Authority in accordance with the procedures outlined in Sections 10 and 14.

m. "Sub-Basin" shall mean the Bedford-Coldwater Sub-Basin of the Elsinore Groundwater Basin, Sub-Basin No. 8-004.2, as identified in the most recent modifications of Bulletin 118 by DWR.

n. "SWRCB" shall mean the California State Water Resources Control Board.

3. CERTIFICATION: Each Member, as a signatory to this Agreement, certifies and declares that it is a public agency, as defined by Government Code § 6500, that is authorized to enter into a joint powers agreement to contract with each other for the joint exercise of any common power under Article 1, Chapter 5, Division 7, Title 1 of the Government Code or any power otherwise granted to one or more of the Members by SGMA.

4. CREATION OF SEPARATE AGENCY: There is hereby created, per Government Code §§ 6507 and 6508, an agency separate from the parties to the Agreement, and which is responsible for the administration of this Agreement, to be known as the "**BEDFORD-COLDWATER GROUNDWATER SUSTAINABILITY AUTHORITY**." Within thirty (30) days of the Effective Date of this Agreement, the Members, and/or the Authority shall: (a) cause a notice of this Agreement to be prepared and filed with the office of the California Secretary of State as required by Government Code § 6503.5; (b) file a copy of this Agreement with the State Controller per Government Code § 6503.6; and (c) file a copy of this Agreement with the Local Agency Formation Commission ("LAFCO") for Riverside County per Government Code § 6503.6.

5. PURPOSES AND MEMBER RESPONSIBILITIES: The Authority is formed with the purpose and intent of jointly creating a separate legal entity to fulfill the role and legal obligations of a GSA required by SGMA, to include complying with SGMA and ensuring sustainable groundwater management throughout the Sub-Basin, so that the Members may collaboratively and cost effectively develop, adopt, and implement a GSP for the Sub-Basin in

accordance with pertinent regulatory timelines. The geographic boundaries of the GSA that will be formed by the Authority, which will encompass the entire Sub-Basin, are as depicted in the map attached hereto as Exhibit "A," which is incorporated herein by reference. The Authority may also represent the Members, as appropriate, in discussions and transactions with other local agencies, to include (but not limited to) the development of inter-basin coordination agreements with other GSAs in Riverside County, and agreements with other local agencies or groundwater sustainability agencies as may be required to ensure compliance with SGMA for the Sub-Basin.

6. POWERS: The Members intend that the Authority provide for the joint exercise of powers common to the Members as such powers relate to the management of the Sub-Basin, and for the exercise of such additional powers as are conferred by law in order to meet the requirements of SGMA. The Members are each SGMA-eligible local agencies empowered by the laws of the State of California to exercise the powers specified in this Agreement, and such other powers as are granted to GSAs by SGMA. These common powers shall be exercised for the benefit of any one or more of the Members or otherwise in the manner set forth in this Agreement. Subject to the limitations set forth in this Agreement, the Authority shall have the powers to perform all acts necessary to accomplish its purposes as stated in this Agreement, as authorized by law, including but not limited to the following:

a. To make and/or assume contracts and to employ agents, employees, consultants and such other persons or firms as the Board may deem necessary, to the full extent of the Authority's power, including, but not limited to, engineering, hydrogeological, and other consultants, and with attorneys and accountants and financial advisors, for the purpose of providing any service required by the Authority to accomplish its purposes, or to otherwise take such actions as are necessary to ensure the Sub-Basin is managed in accordance with the requirements of SGMA;

b. To conduct all necessary research and investigations, and to compile appropriate reports and collect data from all available sources to assist in preparation and implementation of a GSP, and to support the development of such other agreements as may be necessary to ensure the Sub-Basin can be sustainably managed;

c. To cooperate, act in conjunction with, and contract with the United States, the State of California, or any agency thereof, the County of Riverside, or such other entities or persons as the Board may deem necessary to ensure that the Authority fulfills its obligations under SGMA;

d. To apply for, accept and receive licenses, permits, water rights, approvals, agreements, grants, loans, gifts, contributions, donations or other aid from any agency of the United States, the State of California or other public or private person or entity necessary for fulfilling the purposes of SGMA in the Sub-Basin;

e. To acquire by grant, purchase, lease, gift, devise, contract, construction, eminent domain or otherwise, and hold, use, enjoy, sell, let, and dispose of, real and personal property of every kind, including lands, water rights, structures, buildings, rights-of-way, easements, and privileges, and construct, maintain, alter, and operate any and all works or

improvements, within or outside the agency, necessary or proper to carry out any of the purposes of the Authority as specified in this Agreement and/or the requirements of SGMA;

f. To enforce the requirements of SGMA within the Sub-Basin to the extent authorized by law including, but not limited to, the imposition and collection of civil penalties as authorized by SGMA;

g. To sue and be sued in its own name;

h. To provide for the prosecution of, defense of, or other participation in actions or proceedings at law or in public meetings in which the Members, pursuant to this Agreement or otherwise pertaining to management of the Sub-Basin, may have an interest, and to employ counsel or other expert assistance for that purpose;

i. To adopt an initial operating budget and initial Member contributions within ninety (90) days of the execution of this Agreement, and an annual budget and Member contributions, by March 31 of each subsequent Fiscal Year;

j. To incur debts, liabilities or obligations, subject to the limitations provided in this Agreement;

k. To impose fees authorized by SGMA (Water Code §§ 10730-10731), without any limitation on a Member's separate ability to impose fees within its jurisdiction, to fund the cost of furthering the purposes of this Agreement, complying with SGMA, and sustainably managing groundwater within the Sub-Basin;

l. To adopt rules, regulations, policies and procedures for governing the operation of the GSA and adoption and implementation of the GSP consistent with the powers and purposes of the Authority and as authorized by SGMA;

m. To investigate legislation and proposed legislation affecting SGMA and the Sub-Basin and make appearances regarding such matters;

n. Subject to the limitations imposed by this Agreement, to take such actions as are deemed necessary by the Board to achieve the purposes stated above and to provide for the sustainable management of the Sub-Basin; and

o. To adopt and revise bylaws, rules, ordinances, and resolutions in a manner authorized by law and not inconsistent with the terms of this Agreement.

Any power necessary or incidental to the foregoing powers shall be exercised by the Authority in the manner provided for under the legal authority applicable to the City of Corona except as otherwise provided by law or in this Agreement.

7. OBLIGATIONS OR LIABILITIES OF AUTHORITY: No debt, liability or obligation of the Authority shall constitute a debt, liability or obligation of any of the Members, except as otherwise provided in this Agreement or unless otherwise required by law.

8. DESIGNATION OF ADMINISTERING MEMBER/ADMINISTRATOR: The powers of the Authority provided in this Agreement shall be exercised in the manner provided by this Agreement. The Board may designate an Administering Member and/or an Administrator to provide all or a portion of the administrative (or other) services required by this Agreement, SGMA, or other legal authority. However, whether or not the Board decides to designate an Administering Member, each Member shall nevertheless be responsible, when requested by the Board, for designating staff from their agency to coordinate with the Board and other Members, and for otherwise ensuring the Authority has sufficient staffing and administrative support to comply with this Agreement and other legal obligations.

9. ORGANIZATION:

a. Additional Members: The Board may allow additional members to join the Authority. Additional Members must be local agencies capable of being designated as a GSA under SGMA. The Board may set whatever conditions it deems necessary as a precondition to addition of the new Member, to include requiring the additional Members to reimburse the other Members for a proportionate share of the costs already incurred by the existing Members.

b. Bylaws: The Board shall adopt bylaws governing the management of the Authority within 180 days of the Effective Date. The bylaws shall require the Board to develop a conflict of interest code for the Authority compliant with California law, and to otherwise ensure that the Board operates in a manner that is fully compliant with the Brown Act, the Joint Exercise of Powers Act, Government Code §§ 6500 et seq., SGMA, and all other applicable legal requirements.

c. Committees: The Board may create committees as authorized by law.

d. Governing Board: The Authority shall be governed by a Board of Directors which shall be composed of one (1) elected representative of each Member, appointed by each Member. The governing body of each Member shall determine in its sole discretion the person it will appoint to the Authority Board of Directors. The Board of Directors shall receive no compensation from the JPA for serving on the Board of the JPA.

e. Meetings: Regular meetings of the Board may be held quarterly, or as the Board determines necessary, on such dates and times and at such locations as the Board shall fix by resolution. Special meetings of the Board shall be called in accordance with Government Code § 54956. All meetings of the Board shall comply with the provisions of the Ralph M. Brown Act (Government Code §§ 54950 et seq.).

f. Officers: The officers of the Authority shall be a Chairperson, and Vice-Chairperson, and such other officers as the Board shall designate. The election of officers will take place at the first meeting of the JPA Board, and subsequently in the first Board meeting of each new Fiscal Year unless the time of election is otherwise designated in the Authority bylaws. The officers or persons who have charge of, handle or have access to any property of the Authority shall be designated in the bylaws, and such officers and persons shall comply with all applicable requirements of Government Code § 6505.1.

g. Quorum: Two-thirds (2/3) of the Board of Directors shall constitute a quorum in order to conduct business.

h. Rules: The Board may adopt such other rules, policies, and regulations as it deems proper consistent with all applicable laws, this Agreement, and the Authority's bylaws.

i. Term: The Authority Board Members shall serve without terms and at the pleasure of the legislative body which appointed them.

j. Treasurer: The Treasurer of the Board shall be formally designated by a resolution adopted by the Board of Directors stating the effective date of the appointment and the term of the appointment.

k. Voting: Each Director shall have one vote. A simple majority of the quorum shall be required for the adoption of a motion, resolution, contract authorization or other action of the Board, except that:

(1) A majority vote of less than a quorum may vote to adjourn;

(2) Any of the following actions shall require a unanimous vote of the entire Board:

(a) Adoption, modification or alteration of the GSP, or of the GSA boundaries;

(b) Adoption of assessments, charges or fees;

(c) Adoption or modification of ramp-downs or curtailments;

(d) Initiation/settlement of enforcement actions;

(e) Adoption of an initial budget;

(f) Adoption or modification of the annual budget, as further described in Section 14, below;

(g) Initiation/termination or settlement of any litigation or threatened litigation that involves the Authority;

(h) Admission of additional Members to the Authority;

(i) Appointment, employment, or dismissal of the Authority's Administrator and/or Legal Counsel;

(j) Designating an Administrator or Administering Member;

(k) Setting the amounts of any contributions or fees to be made or paid to the Authority by any Member, including extraordinary costs as defined in Section 15;

(l) Acquisition by grant, purchase, lease, gift, devise, contract, construction, or otherwise, and hold, use, enjoy, sell, let, and dispose of, real and personal property of every kind, including lands, water rights, structures, buildings, rights-of-way, easements, and privileges, and construct, maintain, alter, and operate any and all works or improvements, within or outside the agency, necessary or proper to carry out any of the purposes of the Authority;

(m) Replacement of the annual special audit required by Government Code § 6505(f) with an audit covering a two year period;

(n) Amendments or modifications of this Agreement;

(o) Adoption or modification of bylaws or other binding rules governing the operations of the JPA Board;

(p) Adoption of ordinances;

(q) Issuance of bonds or other indebtedness;

(r) Allocating funding received from grants, loans, or from other alternative sources, in a manner that does not result in equal sharing of alternative funding among the Members;

(s) To apply for, accept and receive licenses, permits, water rights, approvals, agreements, grants, loans, gifts, contributions, donations or other aid from any agency of the United States, the State of California or other public or private person or entity necessary for fulfilling the purposes of SGMA in the Sub-Basin.

10. SPECIAL PROJECTS AND PROJECT COMMITTEES:

a. With the prior approval of the entire Board, Members may undertake Special Projects in the name of the Authority, utilizing the legal powers granted to the Authority under SGMA, the Joint Exercise of Powers Act, or other applicable legal authorities. All Members shall be given the opportunity to participate in Special Projects, but shall not be required to participate.

b. A Member considering a new project, other than a groundwater extraction project, where the project is reasonably likely to affect groundwater management in the Sub-Basin shall consult with the other Members before individually undertaking the project to determine whether that individual project might otherwise be better accomplished as an Authority Special Project.

c. Members electing to participate in a Special Project shall enter into a Special Project Agreement in accordance with Section 14.a(4) of this Agreement. Such Special Project Agreement shall provide that: (a) no Special Project undertaken pursuant to such agreement shall conflict with the terms of this Agreement or the GSP; (b) the Members to the Special Project Agreement shall indemnify, defend and hold harmless the Authority, and Members

of the Authority who are not participating in the Special Project, against any costs liabilities, or expenses of any kind arising as a result of the Special Project; (c) all benefits and liabilities attributable to a Special Project shall solely be the benefits and liabilities of the Members that have entered into the Special Project Agreement, and non-participating Members shall have no rights, and incur no obligations or liabilities, in the Special Project.

11. FISCAL AGENT, DEPOSITORY AND ACCOUNTING: The "Treasurer" appointed by the Board is designated as the fiscal agent and depository for the Authority per Government Code §§ 6505.5 and 6505.6. The Treasurer of the Authority shall be the treasurer of one of the Authority's Members, or a certified public accountant designated by the Board, or an officer or employee designated per Government Code § 6505.6. The Treasurer shall be the depositary and have custody of all money of the Authority, from whatever source, subject to the applicable provisions of any indenture or resolution providing for a trustee or other fiscal agent. All funds of the Authority shall be held in the operating fund established by Section 14, or such other separate accounts as may be necessary, in the name of the Authority and not commingled with the funds of any Member or any other person or entity. Full books and accounts shall be maintained for the Authority in accordance with generally accepted accounting principles applicable to governmental entities per Government Code §§ 6505 et seq., and any other applicable laws of the State of California.

12. ACCOUNTABILITY, REPORTS AND AUDITS: There shall be strict accountability of all funds, and an auditor designated by the Board shall report any and all receipts and disbursements to the Board with such frequency as shall reasonably be required by the Board. The Authority will utilize the services of an outside independent certified public accountant to make an annual audit of the accounts and records of the Authority as required by Government Code § 6505, unless the Members, elect to conduct the audit for a two (2) year period. In each case, the minimum requirements of the audit shall be those prescribed by the State Controller for special districts pursuant to Government Code § 26909, and shall conform to generally accepted accounting principles. The outside independent certified public accountant selected by the Authority as auditor shall be formally designated by a resolution adopted by the Board of Directors stating the effective date of the appointment and the term of the appointment.

13. OPERATING BUDGET AND EXPENDITURES: The Board shall adopt a budget as specified in the bylaws and as set forth in Section 14, below. Unless otherwise required by this Agreement or applicable law, the Authority's Treasurer shall draw checks or warrants or make payments as specified in the bylaws of the Authority. The Authority may, consistent with the bylaws, invest any money in the treasury that is not needed for its immediate necessities.

14. CONTRIBUTIONS/BUDGETS: Unless otherwise provided in this Agreement, the Members shall equally share in the costs of the JPA. The Authority shall establish an operating fund. The fund shall be used to pay all administrative, operating and other expenses incurred by the Authority, and shall be funded by equal Member's contributions for payment of costs of the Authority. The Board may direct that any surplus funds be returned to the Members, per Government Code § 6512, in proportion to the contributions made by each Member.

a. Authority Budgets: Authority budgets shall be established as follows:

(1) General Operating Budget. No more than ninety (90) days following the first meeting of the Board, and annually thereafter in the month of March or other mutually agreed upon timeframe, a general operation budget (the "Operating Budget") shall be adopted by the Board. The Operating Budget shall be prepared in sufficient detail to constitute an operating outline for the purpose of establishing rates and/or contributions to be billed to and paid by the Members. The operating rates and/or contributions to be billed to and paid by each Member shall be based upon an equal contribution by each Member. The Operating Budget shall outline anticipated revenues and planned expenditures to be made during the ensuing Budget year by functional category such as operations and maintenance, administration, projects, programs, planning, study and any applicable contributions to operate related reserves. For the purpose of the Operating Budget, operating shall mean any financial activity related to exchange transactions, as defined by applicable generally accepted accounting principles ("GAAP") associated with the principal activity of the JPA. The Operating Budget shall be adopted by unanimous approval of the Board. The rates and contributions approved by the Board shall be paid by the Members pursuant to Section 14.c below.

(2) Non-Operating Budget. No more than ninety (90) days following the first meeting of the Board, and annually thereafter in the month of March or other mutually agreed upon timeframe, a non-operating budget (the "Non-Operating Budget") shall be adopted by the Board. The Non-Operating Budget shall be prepared in sufficient detail to constitute a non-operating outline for the purpose of establishing rates and/or contributions to be billed to and paid by the Members. These rates and/or contributions shall be based upon equal contributions by each Member. At a minimum, the Non-Operating Budget shall outline anticipated revenues and planned expenditures for non-operating financial activities for the ensuing Fiscal Year, inclusive of any amount necessary for servicing debt. For the purpose of the budget, Non-Operating shall mean any financial activity related to non-exchange transactions, as defined by applicable GAAP. Examples of non-exchange transactions include investment income, contributed capital from Members for capital debt service, interest expense, and return of capital to Members. The Non-Operating Budget shall be adopted by unanimous approval of the Board. The rates and contributions approved by the Board shall be paid by the Members pursuant to Section 14.c below.

(3) Capital Project Budget. No more than ninety (90) days following the first meeting of the Board, and annually thereafter in the month of March, or other mutually agreed upon timeframe, a capital project budget (the "Capital Project Budget") shall, if applicable, be adopted by the Board. The Capital Project Budget, if applicable, shall be prepared in sufficient detail to constitute a capital project outline to assess contributions to be paid by the Members and expenditures to be paid by the Members during the ensuing year for capital projects needed for major repair, replacement, expansion and efficiency of any capital improvements constructed or installed by or on behalf of the Authority. These contributions shall be based upon equal contribution by each Member, subject to unequal contribution amounts for Special Projects, as addressed in Sections 10 and 14.a.(4). The Capital Project Budget shall be adopted by unanimous approval of the Board. The contributions approved by the Board shall be paid by the Members pursuant to Section 14.c below.

(4) Special Project Budgets. In addition to the Operating Budgets, the Non-Operating Budgets, and the Capital Project Budget, the Board may budget at any time for the study, implementation or construction of any Special Project, program or study proposed to be undertaken by the Authority for matters not deemed to be of general benefit to all Members. A Special Project budget and written Special Project Agreement of the Members who consented to participation in the Special Project shall be established for each Special Project, which budget and agreement shall determine the respective obligations, functions, and rights of the Members involved and of the Authority. The directors of the Board representing the Members who will be involved in financing and implementing the Special Project shall be and constitute a "Special Project Committee," for purposes of administration and implementation of the Special Project. No Special Project shall be acquired or constructed by the Board without the consent of each of the governing boards of the participating Members. Ratification of the Special Project budget by each of the participating Members shall constitute consent for the acquisition and construction of the Special Project. Notwithstanding the foregoing, no debt shall be incurred by the Authority for a Special Project without the unanimous consent of the Board. Any rates and contributions approved by the Special Project Committee and approved by the participating Members shall be paid by the participating Members pursuant to Section 14.c below.

Where the Board has approved one or more Special Projects, annually thereafter in the month of March (or other mutually agreed upon timeframe), a Special Project budget shall be developed by each Special Project Committee if required by the applicable Special Project Agreement, Each Special Project budget shall include, without limitation, the following:

(i) Administrative expenses;

(ii) Studies and planning costs;

(iii) Engineering and construction costs;

(iv) The allocation of costs, including debt service costs, if any, among participating Members;

(v) Annual maintenance and operating expenses for the project; and

(vi) A formula for allocating annual maintenance and operating expenses, if any.

All actions by a Special Project Committee shall be deemed actions of the Authority and shall be taken in the name of the Authority, provided, only the participating Members shall have rights and obligations in the Special Project as herein provided.

b. Failure to Obtain Budget Approvals. In the event a budget acceptable to the Board is not approved prior to the start of a Fiscal Year the Authority shall continue to operate at the level of expenditure as authorized below:

(1) General Operating Budget. The Operating Budget shall be at the expenditure level authorized by the last approved Operating Budget increased by the Consumer Price Index ("CPI") with a minimum increase of no less than two percent (2%). The CPI shall mean the change in CPI for Urban Wage Earners and Clerical Workers for the Los Angeles County, Orange County, and Riverside County areas for the all items category for the 12-month period ending the February prior to the beginning of the Fiscal Year budgeted as determined by the U.S. Department of Labor, Bureau of Labor Statistics, or other mutually agreeable source if such a CPI is no longer available. This factor will be applied to the Operating Budget until such time as a new Operating Budget is approved by the Authority. Any shortfall in revenues will be made up from available reserves dedicated by the Board for such a purpose, and if insufficient to cover the shortfall, any available reserve funds not designated by the Board for other purposes or otherwise legally restricted for other purposes by external parties. Reserves shall mean any available cash or investments.

(2) Non-Operating Budget. The Non-Operating Budget shall automatically be established at the required level necessary to meet annual debt service requirements including any revenue coverage covenants. Each Member shall contribute to the Authority such amounts which will yield during each Fiscal Year net revenues payable to the Authority sufficient for the Authority to satisfy all covenants in any indentures, loan agreements or other documents entered into by the Authority and to enter into such other agreements as are necessary for the Authority to secure financing to pay the acquisition price for any facilities authorized by the Authority.

(3) Capital Project Budget. The Capital Project Budget shall automatically be established at the required level necessary to implement capital projects previously approved by the Authority.

c. Payments of Amounts Due. The payments owed for contributions from each Member to the Authority shall be due, payable, and delivered by the Members to the Authority within forty-five (45) days after receipt of a billing therefor from the Authority. To the extent permitted by state law, unpaid and past due contributions shall bear interest at ten percent (10%) per annum, calculated daily, from the date due to the date payment is received by the Authority.

15. ASSESSMENTS FOR EXTRAORDINARY COSTS: In the event the Authority should experience an unanticipated need to pay for extraordinary costs (e.g., those costs that are unanticipated and not otherwise funded through the budget), including, but not limited to the costs of litigation or indemnification as provided in this Agreement, and to the extent that such costs cannot otherwise be reasonably funded through use of reserves on hand or through the other revenue sources authorized by this Agreement, the Board may allocate the additional costs to the Members, whether such extraordinary costs are actually incurred or estimated to be necessary. Unless otherwise specifically allocated to one or more Members by the unanimous vote of the Board, all allocations of extraordinary costs shall be shared equally by each Member. The Members agree that they will then contribute their proportionate share of the extraordinary costs within a reasonable period of time as determined by the Board, or as otherwise specified in the Bylaws.

16. STAFFING: The Board shall provide for staffing of the Authority in accordance with procedures established in the bylaws. Such staffing shall ensure the Authority is able to accomplish all requirements imposed by SGMA, this Agreement, and/or any other requirements imposed by law. Legal counsel shall be appointed by the Board and shall serve at the pleasure of the Board. Legal counsel may be an attorney that also performs work for one of the Members, provided appropriate waivers suitable to the Board, and counsel for all of the Members, are first obtained.

17. DISPUTE RESOLUTION: The Members desire to informally resolve all disputes related to this Agreement and/or SGMA, whenever possible, at the lowest possible level, and triggering of the dispute resolution procedures described herein shall only occur where the Members and/or the Board have reached impasse and are unable to resolve matters without invoking formal dispute resolution procedures. Should informal resolution of any dispute prove unsuccessful, the Parties agree to neutral facilitation/mediation of the dispute as a next step prior to filing a lawsuit or otherwise seeking judicial intervention. The appointed facilitator/mediator, who need not be a licensed attorney, shall be a person who is not a current or former employee or agent of any Member, and someone who has knowledge of the rules governing public agencies, and who has experience with the management of groundwater resources in Southern California. The facilitator shall be compensated by the Authority.

The facilitator shall be a third party neutral assigned by the Center for Collaborative Policy ("CCP") of Sacramento State University, or such other neutral as is unanimously decided upon by the Members involved in the dispute. In the event that the Members involved in the dispute are unable to agree upon the facilitator or mediator, then each Member involved in the dispute shall provide the name of one recommended facilitator or mediator to the Authority's legal counsel. The facilitator/mediator shall then be selected by the Authority's legal counsel, based upon whichever recommended facilitator/mediator is the most qualified facilitator/mediator for the type of dispute involved. The selected facilitator/mediator shall diligently seek to achieve a consensus based solution to the dispute. Upon the request of one of the Members involved in the dispute, the facilitator shall render a recommended resolution of the dispute after five facilitated negotiation sessions between the Members involved in the dispute where an acceptable resolution has not yet been reached. The facilitator/mediator's recommended resolution shall not be admissible in any judicial proceedings. Where facilitation/mediation as described herein is unable to successfully resolve the dispute, then a Member involved in the dispute, upon providing 60 days-notice to the other Members and the Authority, may initiate judicial proceedings in the Superior Court for Riverside County.

This Section shall not bar a Member or Member(s) from initiating legal action in another appropriate forum with jurisdiction over the matter as necessary to comply with an applicable statute of limitation, provided such legal action, where authorized, is stayed pending completion of the dispute resolution process described herein. Members involved in a dispute governed by this Section are encouraged to enter a tolling agreement, if legally authorized, in order to allow sufficient time for completion of the process required by this Section.

18. WITHDRAWAL:

a. Notice to Members: Any Member may withdraw from the Authority by delivery of written notice to withdraw to each of the Members at least two years prior to the date of withdrawal ("Withdrawal Notice Period"), unless the Members unanimously agree to allow the withdrawing Member to withdraw sooner than two years, in which case the date of withdrawal shall be the date unanimously agreed upon by the Board. The withdrawing Member shall continue to be a full Member during the pendency of the Withdrawal Notice Period and shall retain all rights and obligations during such period unless otherwise agreed to by unanimous vote of the Board.

b. Effect of Withdrawal: Should a Member choose to withdraw from the Authority in accordance with the terms of this Agreement, that Member retains any legal right it has under SGMA to serve as the GSA for the groundwater basin underlying its jurisdictional boundaries, provided such withdrawal will not cause the Authority (or its remaining Members) to default on financial obligations or to otherwise fail to comply with the legal obligations imposed by SGMA. The Authority and the non-withdrawing Members shall retain whatever legal rights they have under SGMA, and the withdrawal of the Member shall have no effect on the continuance of this Agreement among the remaining Members. The withdrawing Member shall not take any action after withdrawal that would be reasonably anticipated to frustrate the ability of the Authority to comply with SGMA. After providing written notice of withdrawal, the withdrawing Member shall act at all times in good faith in the best interests of the Authority until such time as the withdrawal process is complete.

c. Continuing Fiscal Obligations: Any Member that withdraws as provided herein shall remain proportionately liable during the Withdrawal Notice Period for its proportionate share of the budget. If the Members elect to incur extraordinary costs in accordance with Section 15, the withdrawing Member shall be proportionately liable during the Withdrawal Notice Period for the obligations or debts approved and incurred by the Authority for those extraordinary costs, unless the Members agree otherwise. Any Member that withdraws shall remain proportionately liable for any unfunded capital expenditures or debt service obligations incurred or approved by the Board prior to the date of written notice of withdrawal of such Member until such time as the obligation is fully satisfied.

d. Continuing Claims Obligations: Members will remain obligated to contribute their proportionate share (based upon the membership roll as of the date of the claim), including without limitation legal defense costs, for any occurrences incurred during the Member's membership, but not presented as a claim against the Authority until after the Member's withdrawal.

e. Divisions of Property Assets: The real and/or personal property assets contributed by the withdrawing Member or the value of the real and/or personal property assets at the date of withdrawal will be returned to the withdrawing Member to the extent such assets are not required for the Authority to meet its continuing obligations as a GSA under SGMA. If such real and/or personal property assets are needed to meet the continuing obligations of the Authority to comply with SGMA, then the remaining Members of the Authority and the withdrawing Member shall negotiate a purchase or lease of such assets for a price not to exceed the fair market value of those assets.

19. TERM AND TERMINATION: This Agreement shall become effective, and the Authority shall come into existence, on the Effective Date. The Agreement, and the Authority, shall thereafter continue in full force and effect until the governing bodies of the Members unanimously elect to terminate the Agreement. Upon unanimous election to terminate this Agreement, the Board shall continue to act as a board to wind up and settle the affairs of the Authority. The Board shall adequately provide for the known debts, liabilities and obligations of the Authority, and shall then distribute the assets of the Authority among the Members, as follows:

a. The assets contributed by each Member, or the value thereof as of the date of termination, shall be distributed to that Member.

b. The remaining assets shall then be distributed to each Member in equal proportions.

The distribution of assets shall be made in-kind to the extent possible by returning to each Member those assets contributed by such parties to the Authority; however, no party shall be required to accept transfer of an asset in kind.

Notwithstanding any other provision by the Board for payment of all known debts, liabilities and obligations of the Authority, each Member shall remain liable for any and all such debts, liabilities, and obligations in equal proportions, or in the proportion specified by unanimous action of the Board if alternative proportions are so specified for particular actions or activities that give rise to such debts, liabilities, and obligations.

Termination of this Agreement shall not occur, and the Members shall continue to fund the operations of the Authority as a GSA for the Sub-Basin, until the Authority determines by a unanimous vote of the Board that: (a) a GSA is no longer required for the Sub-Basin; or (b) one or more of the individual Members will undertake the legal obligations of a GSA previously performed by the Authority, and such termination of the Authority will not result in the Sub-Basin being placed in a probationary status by the SWRCB.

20. INDEMNIFICATION/CONTRIBUTION: Members, directors, officers, agents and employees of the Authority shall use ordinary care and reasonable diligence in the exercise of their powers, and in the performance of their duties pursuant to this Agreement. The Authority shall hold harmless, defend and indemnify the Members, the Authority Board, and the Members' directors, agents, officers and employees from and against any liability, claims, actions, costs, damages or losses of any kind, including death or injury to any person and/or damage to property (including property owned by any Member), arising out of the activities or omissions of the Authority, or its agents, officers and employees related to this Agreement or SGMA ("Claims").

a. To the extent authorized by California law, no Member shall be liable for the actions or omissions of any other Member or the Authority related to this Agreement.

b. The indemnification obligations described herein shall continue beyond the term of this Agreement as to any acts or omissions occurring during this Agreement or any extension of this Agreement.

c. To the extent that the Authority is unable or unwilling (because of comparative fault of Member(s), or other good faith legal basis) to hold harmless, defend and/or indemnify any Member to this Agreement as provided in this Section, such Member shall be entitled to contribution from the other Members in equal proportion to the extent one Member pays more than its equal share of such obligation. Provided, however, that where one or more Members is determined by a court (or in a settlement approved by a court) to be responsible for a greater proportion for the Claims, each Member will only be responsible for contribution to the other Member (or Members) up to the extent of the contributing Member's proportional responsibility.

21. INSURANCE: The Authority shall obtain insurance for the Board members and general liability insurance containing liability in such amounts as the Board shall determine will be necessary to adequately insure against the risks of liability (including compliance with the indemnification provisions in Section 20 above) that may be incurred by the Authority. The Members, their officers, directors and employees, shall be named as additional insureds.

22. CLAIMS: All claims against the Authority, including, but not limited to, claims by public officers and employees for fees, salaries, wages, mileage, or any other expenses, shall be filed within the time and in the manner specified in Chapter 2 (commencing with Section 910) of Part 3, Division 3.6 of Title I of the Government Code, which describes the appropriate content of a claim.

23. ENTIRE AGREEMENT REPRESENTED: This Agreement represents the entire agreement among the parties as to its subject matter and no prior oral or written understanding shall be of any force or effect. No part of this Agreement may be modified without the written consent of all of the parties.

24. HEADINGS: Section headings are provided for organizational purposes only and do not in any manner affect the scope, meaning or intent of the provisions under the headings.

25. NOTICES: Except as may be otherwise required by law, any notice to be given shall be written and shall be either personally delivered sent by facsimile transmission, emailed or sent by first class mail, postage prepaid and addressed as follows:

MEMBERS:

City of Corona
Attn: General Manager,
Department of Water and Power
Address: 755 Public Safety Way
Corona, CA 92880

Elsinore Valley Municipal Water District
Attn: General Manager
Address: 31315 Chaney Street
Lake Elsinore, CA 92530

Temescal Valley Water District
Attn: General Manager
Address: 22646 Temescal Canyon Rd
Corona, CA 92883

Notice delivered personally is deemed to be received upon delivery. Notice sent by first class mail shall be deemed received on the fourth day after the date of mailing. Any party may change the above address by giving written notice pursuant to this Section.

26. CONSTRUCTION: This Agreement reflects the contributions of all parties and accordingly the provisions of Civil Code § 1654 shall not apply to address and interpret any uncertainty.

27. NO THIRD PARTY BENEFICIARIES INTENDED: Unless specifically set forth, the parties to this Agreement do not intend to provide any other party with any benefit or enforceable legal or equitable right or remedy.

28. WAIVERS: The failure of any party to insist on strict compliance with any provision of this Agreement shall not be considered a waiver of any right to do so, whether for that breach or any subsequent breach.

29. CONFLICT WITH LAWS OR REGULATIONS/SEVERABILITY: This Agreement is subject to all applicable laws and regulations. If any provision of this Agreement is found by any court or other legal authority, or is agreed by the parties, to be in conflict with any code or regulation governing its subject, the conflicting provision shall be considered null and void. If the effect of nullifying any conflicting provision is such that a material benefit of the Agreement to any party is lost, the Agreement may be terminated at the option of the affected party. In all other cases the remainder of the Agreement shall continue in full force and effect.

30. FURTHER ASSURANCES AND OBLIGATION OF GOOD FAITH DEALING: Each party agrees to execute any additional documents and to perform any further acts which may be reasonably required to affect the purposes of this Agreement. Moreover,

consent or approval, where reasonably requested in furtherance of the purposes of this Agreement or compliance with SGMA, shall not be unreasonably withheld by a Member.

31. COUNTERPARTS: This Agreement may be signed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

32. AMENDMENT: This document may only be amended with a vote by all of its Members.

33. CUA ASSIGNMENT: To the extent that this Agreement is deemed to be a "material contract" under either of the CUA Management Agreements, the Members have no right to terminate this Agreement, either or without cause, based upon the existence or non-existence of either or both of the CUA Management Agreements. Therefore, if an applicable CUA Management Agreement expires or terminates for any reason, the Members shall remain fully obligated to perform under this Agreement contracting directly with the CUA or another third party contracted by the CUA for the maintenance, management and operation of the applicable utility systems.

CITY OF CORONA SIGNATURE PAGE
FOR
JOINT POWERS AGREEMENT BY AND AMONG THE CITY OF CORONA, ELSINORE VALLEY MUNICIPAL WATER DISTRICT AND TEMESCAL VALLEY WATER DISTRICT FOR THE FORMATION OF A JOINT POWERS AUTHORITY AND MANAGEMENT OF THE BEDFORD-COLDWATER SUB-BASIN OF THE ELSINORE BASIN

EACH OF THE UNDERSIGNED, having read and considered the above provisions, indicate their agreement by their authorized signatures.

CITY OF CORONA,
a California General Law City organized and existing under the laws of the State of California

By: _____
Dick Haley
Mayor

Attest:

_____
Lisa Mobley
City Clerk

Approved as to Form:

_____
Dean Derleth
City Attorney

Consent:

_____
Darrell Talbert
Executive Director
Corona Utility Authority

ELSINORE VALLEY MUNICIPAL WATER DISTRICT SIGNATURE PAGE FOR JOINT POWERS AGREEMENT BY AND AMONG THE CITY OF CORONA, ELSINORE VALLEY MUNICIPAL WATER DISTRICT AND TEMESCAL VALLEY WATER DISTRICT FOR THE FORMATION OF A JOINT POWERS AUTHORITY AND MANAGEMENT OF THE BEDFORD-COLDWATER SUB-BASIN OF THE ELSINORE BASIN

EACH OF THE UNDERSIGNED, having read and considered the above provisions, indicate their agreement by their authorized signatures.

ELSINORE VALLEY MUNICIPAL WATER DISTRICT, a Municipal Water District organized under Water Code §§ 71000

By:_____
Harvey R. Ryan
President, Board of Directors

ATTEST

Terese Quintanar
Secretary to the Board

APPROVED AS TO FORM

John E. Brown
General Counsel

TEMESCAL VALLEY WATER DISTRICT SIGNATURE PAGE
FOR
JOINT POWERS AGREEMENT BY AND AMONG THE CITY OF CORONA, ELSINORE VALLEY MUNICIPAL WATER DISTRICT AND TEMESCAL VALLEY WATER DISTRICT FOR THE FORMATION OF A JOINT POWERS AUTHORITY AND MANAGEMENT OF THE BEDFORD-COLDWATER SUB-BASIN OF THE ELSINORE BASIN

EACH OF THE UNDERSIGNED, having read and considered the above provisions, indicate their agreement by their authorized signatures.

TEMESCAL VALLEY WATER DISTRICT,
a California Water District organized under
California Water Code §§ 34000 et seq.

By: _____
C.W. Colladay
President, Board of Directors

Attest:

_____
Paul Rodriguez
Board Secretary

Approved as to Form:

_____
Dave Saunders
General Counsel

APPENDIX B

Bedford-Coldwater GSA Notice of Decision to become a Groundwater Sustainability Agency

April 20, 2017

Mark Nordberg, GSA Project Manager
Senior Engineering Geologist
California Department of Water Resources
901 P Street, Room 213A
P.O. Box 942836
Sacramento, CA 94236

Re: Notice of Election to Become a Groundwater Sustainability Agency for the Bedford-Coldwater Subbasin (Basin No. 8-.004.02)

Pursuant to California Water Code section 10723.8 of the Sustainable Groundwater Management Act (SGMA), the Bedford-Coldwater Joint Powers Authority (JPA) provides this notice of election to serve as the Groundwater Sustainability Agency (GSA) for the entire Bedford-Coldwater Subbasin (Basin No. 8-004.02) (the "Subbasin"). The JPA was formed by way of joint powers agreement among Elsinore Valley Municipal Water District, Temescal Valley Water District, and the City of Corona. The Board of Directors of the JPA approved a resolution forming the JPA on March 29, 2017.

Along with this letter and a copy of the joint powers agreement, we have also uploaded to the DWR SGMA Portal–GSA Formation Notification System a map and GIS shapefiles depicting the boundaries of the Subbasin from Bulletin 118 and the service area boundaries of the members of the JPA.

The GSA and its management area cover the entire 7,025-acre Subbasin. For planning purposes, minor portions of the Subbasin are located outside the service area boundaries of the member agencies of the JPA. The first of these areas comprises approximately 114 acres of steep, remote canyons within the Cleveland National Forest. To the JPA's knowledge, no pumping is currently occurring in the portion of the Subbasin within these canyons and it is likely that no pumping has historically or will ever occur there due to their inaccessibility and relative lack of groundwater.

A second small area consisting of approximately 44 acres outside of the JPA's boundaries is the eastern end of Dawson Canyon, which is located in the central, eastern side of the Subbasin. To the JPA's knowledge, there are only two de minimis, domestic pumpers in this area. The remote canyon has little potential for significant groundwater extraction. Notwithstanding, the GSA intends to ensure through the groundwater sustainability planning process that sustainability is reached within the SGMA statutory timeframe in the Dawson Canyon and all other areas of the Subbasin, including within the above-indicated U.S. Forest Service lands.

The JPA members have worked with the County of Riverside and the Riverside County Flood Control & Water Conservation District ("Flood Control") to obtain their support for the JPA to secure GSA status over the entire Subbasin. Support letters from the County of Riverside and Flood Control are attached. In the unlikely event that any pumping in the United States Forest Service or Dawson Canyon areas outside of the JPA's service area were to ever occur or exceed de minimis thresholds, the JPA will work with the County and Flood Control to regulate such pumping, as may be appropriate.

We have also uploaded to the DWR SGMA portal all of the other information needed to form a GSA, including copies of the JPA's Government Code section 6066 notice, the JPA resolution approving the formation of the GSA, and the list of interested parties.

Please do not hesitate to contact me with any questions you may have about this matter.

Sincerely,

Margie Armstrong
Interim Administrator
Bedford-Coldwater Joint Powers Authority

RESOLUTION NO. 2017-01

RESOLUTION OF INTENT OF THE BOARD OF DIRECTORS OF THE BEDFORD-COLDWATER GROUNDWATER SUSTAINABILITY AUTHORITY, A JOINT POWERS AUTHORITY, TO BECOME THE GROUNDWATER SUSTAINABILITY AGENCY FOR THE BEDFORD COLDWATER SUB-BASIN OF THE ELSINORE GROUNDWATER BASIN

WHEREAS, in September 2014. the Sustainable Groundwater Management Act ("SGMA") was signed into law, with an effective date of January 1, 2015, and codified at California Water Code, Section 10720 et seq; and

WHEREAS, the legislative intent of SGMA is to, among other goals, provide for sustainable management of alluvial groundwater basins and sub-basins defined by the California Department of Water Resources ("DWR"), to enhance local management of groundwater, to establish minimum standards for sustainable groundwater management, and to provide specified local agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater; and

WHEREAS, Water Code section 10723(a) authorizes a "local agency" with water supply, water management or local land use responsibilities, or a combination of local agencies with such responsibilities overlying a groundwater basin, to decide to become a Groundwater Sustainability Agency (GSA) under SGMA; and

WHEREAS, Elsinore Valley Municipal Water District ("EVMWD"), the City of Corona ("Corona") and Temescal Valley Water District ("TVWD") jointly requested the Elsinore Basin be split into two distinct groundwater areas; and

WHEREAS, on October 11, 2016, the California Water Commission approved the subject request and established two sub-basins within the Elsinore Basin; the southerly Elsinore Valley Sub-Basin (Bulletin 118 Basin No. #8-004.1) and the northerly Bedford Coldwater Sub-Basin (#8-004.2); and

WHEREAS, Bedford Coldwater Groundwater Sustainability Authority (Authority) is a "local agency" comprised of EVMWD, Corona, and TVWD (each a "Member") with "water management" responsibilities within the Bedford-Coldwater Sub Basin (DWR Bulletin 118, No. 8-004.2) (the "Sub-Basin") of the Elsinore Groundwater Basin (DWR Bulletin 118, No. 8-004); and

WHEREAS, sustainable groundwater management of groundwater basins designated by DWR as high and medium priority basins is required by SGMA; and

WHEREAS, the boundaries of the Authority overlie the Sub-Basin, which is not adjudicated and is designated by DWR as a high priority basin; and

WHEREAS, California Water Code Section 10723.8 requires that a local agency deciding to serve as a GSA notify DWR within 30 days of the local agency's decision to become a GSA authorized to undertake sustainable groundwater management within a basin; and

WHEREAS, California Water Code Section 10723.8 mandates that 90 days following the posting by DWR of the local agency's decision to become a GSA, that entity shall be presumed to be the exclusive GSA for the area within the basin the agency is managing as described in the notice, provided that no other GSA formation notice covering the same area has been submitted to DWR; and

WHEREAS, the Authority intends to manage all portions of the Sub-Basin subject to SGMA under a groundwater sustainability plan (GSP); and

WHEREAS, in accordance with Section 10723(b) of the California Water Code, and Section 6066 of the California Government Code, a notice of public hearing was published in two general circulation newspapers in Riverside County regarding the Authority's intent to consider becoming a GSA for the Sub-Basin.

NOW, THEREFORE, THE AUTHORITY BOARD OF DIRECTORS HEREBY FINDS, DETERMINES, RESOLVES, AND ORDERS AS FOLLOWS:

SECTION 1. The above recitals, and each of them, are true and correct, and are incorporated as terms of this resolution.

SECTION 2. The Authority Board of Directors hereby decides and determines that the Authority shall become the GSA for all of those portions of the Sub-Basin that are required to be managed under SGMA.

SECTION 3. Authority staff, or staff of one of the Authority Members on behalf of the Authority, shall submit to DWR, within thirty (30) days of the approval of this Resolution, all documentation and information required by Water Code section 10723.8 to support the Authority's formation of a GSA over the Sub-Basin.

SECTION 4. The approval of this Resolution and the actions described herein are exempt from the requirements of the California Environmental Quality Act (CEQA) since: (1) they are not a "project" for purposes of CEQA (CEQA Guidelines 14 Cal. Code Regs. §15378 (b)(5)) because the approval will not will not result in direct or indirect physical changes in the environment; and (2) it can be seen with certainty that there is no possibility that the approval in question may have a significant effect on the environment. (CEQA Guidelines, 14 Cal. Code Regs. §15061(b)(3).) Staff is directed to file and post within ten (10) business days a Notice of Exemption for this approval with the Clerk of the Board of Supervisors of Riverside County.

SECTION 5. The Board Secretary shall certify the adoption of this resolution.

PASSED, APPROVED AND ADOPTED this 29th day of March, 2017, by the following vote:

AYES:
NOES:
ABSENT:

Chairperson

ATTEST:

Secretary

THE PRESS-ENTERPRISE

1825 Chicago Ave, Suite 100
Riverside, CA 92507
951-684-1200
951-368-9018 FAX

PROOF OF PUBLICATION
(2010, 2015.5 C.C.P)

Publication(s): The Press-Enterprise

PROOF OF PUBLICATION OF

Ad Desc.: /

I am a citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an authorized representative of THE PRESS-ENTERPRISE, a newspaper in general circulation, printed and published daily in the County of Riverside, and which newspaper has been adjudicated a newspaper of general circulation by the Superior Court of the County of Riverside, State of California, under date of April 25, 1952, Case Number 54446, under date of March 29, 1957, Case Number 65673, under date of August 25, 1995, Case Number 267864, and under date of September 16, 2013, Case Number RIC 1309013; that the notice, of which the annexed is a printed copy, has been published in said newspaper in accordance with the instructions of the person(s) requesting publication, and not in any supplement thereof on the following dates, to wit:

03/15, 03/22/2017

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Date: March 22, 2017
At: Riverside, California

Legal Advertising Representative, The Press-Enterprise

TEMESCAL VALLEY WATER DISTRICT
22646 TEMESCAL CYN RD
ATTN: MEL MCCULLOUGH
CORONA, CA 92883

Ad Number: 0010914773-01

P.O. Number:

Ad Copy:

NOTICE OF PUBLIC HEARING TO CONSIDER THE ELECTION BY THE BEDFORDCOLDWATER GROUNDWATER SUSTAINABILITY AUTHORITY TO BECOME THE GROUNDWATER SUSTAINABILITY AGENCY FOR THE BEDFORD COLDWATER SUBBASIN OF THE ELSINORE BASIN

NOTICE IS HEREBY GIVEN pursuant to Section 10723(b) of the California Water Code and Section 6066 of the California Government Code that the Board of Directors ("Board") of the Bedford-Coldwater Groundwater Sustainability Authority will hold a public hearing to consider the proposed decision by Bedford-Coldwater Groundwater Sustainability Authority to become the Groundwater Sustainability Agency ("GSA") for the BedfordColdwater Subbasin (#8-004.02) of the Elsinore Basin (#8-004) on Wednesday, March 29, 2017 at 4 p.m., in the Boardroom of Temescal Valley Water District's headquarters, located at 22646 Temescal Canyon Road, Temescal Valley, California 92883.

The purpose of the public hearing will be to hear comments from the public regarding the Bedford-Coldwater Groundwater Sustainability Authority's proposed formation of a GSA within its boundaries in the Bedford-Coldwater Subbasin (#8-004.02).

At the end of the public hearing, the Board may adopt, revise or modify a Resolution of Intent to become the GSA and to submit notification to the California Department of Water Resources ("DWR"), which shall post the notice pursuant to Section 10723.8(b) of the California Water Code. The notification submitted to DWR will include a description of the proposed boundaries of the GSA and the Subbasin that the Bedford-Coldwater Groundwater Sustainability Authority intends to manage pursuant to the Sustainable Groundwater Management Act ("SGMA").

The draft Resolution of Intent is on file and available for inspection during regular business hours at the office of the Temescal Valley Water District at 22646 Temescal Canyon Road, Temescal Valley, California 92883.

To publish March 15, 2017 and March 22, 2017.

PROOF OF PUBLICATION

THIS SPACE RESERVED FOR CLERK / RECORDING STAMP

CITY OF CORONA

NOTICE OF PUBLIC HEARING TO CONSIDER THE ELECTION BY THE BEDFORD-COLDWATER GROUNDWATER SUSTAINABILITY AUTHORITY TO BECOME THE GROUNDWATER SUSTAINABILITY AGENCY FOR THE BEDFORD COLDWATER SUBBASIN OF THE ELSINORE BASIN

NOTICE IS HEREBY GIVEN pursuant to Section 10723(b) of the California Water Code and Section 6066 of the California Government Code that the Board of Directors ("Board") of the Bedford-Coldwater Groundwater Sustainability Authority will hold a public hearing to consider the proposed decision by Bedford-Coldwater Groundwater Sustainability Authority to become the Groundwater Sustainability Agency ("GSA") for the Bedford-Coldwater Subbasin (#8-004.02) of the Elsinore Basin (#8-004) on WEDNESDAY, MARCH 29, 2017 AT 4 P.M., in the Boardroom of Temescal Valley Water District's headquarters, located at 22646 Temescal Canyon Road, Temescal Valley, California 92883.

The purpose of the public hearing will be to hear comments from the public regarding the Bedford-Coldwater Groundwater Sustainability Authority's proposed formation of a GSA within its boundaries in the Bedford-Coldwater Subbasin (#8-004.02).

At the end of the public hearing, the Board may adopt, revise or modify a Resolution of Intent to become the GSA and to submit notification to the California Department of Water Resources ("DWR"), which shall post the notice pursuant to Section 10723.8(b) of the California Water Code. The notification submitted to DWR will include a description of the proposed boundaries of the GSA and the Subbasin that the Bedford-Coldwater Groundwater Sustainability Authority intends to manage pursuant to the Sustainable Groundwater Management Act ("SGMA").

The draft Resolution of Intent is on file and available for inspection during regular business hours at the office of the Temescal Valley Water District at 22646 Temescal Canyon Road, Temescal Valley, California 92883.

Published: March 15, 2017 and March 22, 2017.

JOB CC17-025

SENTINEL WEEKLY NEWS

"Adjudicated for City of Corona, Corona Judicial Dist., Riverside County, California"

SWN-2511 JOB CC17-025

MARCH 15, 22, 2017

Sentinel Weekly News

Adjudicated for the City of Corona, California

1307-C West 6th St., Suite 139

Corona, CA. 92882

Tel: (951) 737-9784 / Fax: (951) 737-9785

E-mail: SentinelWeekly@aol.com

PROOF OF PUBLICATION

(2010, 2015.5 C.C.P.)

STATE OF CALIFORNIA

COUNTY OF RIVERSIDE

I am a Citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an Authorized Representative of *SENTINEL WEEKLY NEWS* (formerly known as The Lake Mathews Sentinel), a Newspaper of General Circulation, printed and published weekly in the City of Corona, County of Riverside, and which Newspaper has been Adjudicated a Newspaper of General Circulation by the Superior Court of the County of Riverside, State of California, under the date of March 30, 1995, Case Number 262254; and under the date of December 7, 1999, Case Number 334071; and the Notice, of which the annexed is a printed copy, has been published in said Newspaper in accordance with the instructions of the Person(s) requesting publication, and not in any supplement thereof on the following dates to wit:

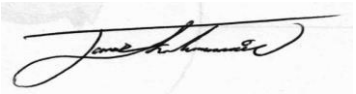
(1) ***March 22, 2017***

(2)

(3)

(4)

I certify (or declare) under penalty of perjury that the foregoing is true and correct.



/S/ _____

Authorized Representative

DATED: __ ***MARCH 22, 2017*** __

APPENDIX C

GSP Elements Guide

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.			**Introduction to Plan Contents**					
			This Article describes the required contents of Plans submitted to the Department for evaluation, including administrative information, a description of the basin setting, sustainable management criteria, description of the monitoring network, and projects and management actions.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
SubArticle 1.			**Administrative Information**					
§ 354.2.			**Introduction to Administrative Information**					
			This Subarticle describes information in the Plan relating to administrative and other general information about the Agency that has adopted the Plan and the area covered by the Plan.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.4.			**General Information**					
			Each Plan shall include the following general information:					
(a)			An executive summary written in plain language that provides an overview of the Plan and description of groundwater conditions in the basin.	17:25	ES			
(b)			A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public.	225:230	10			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10733.2 and 10733.4, Water Code.					
§ 354.6.			**Agency Information**					
			When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:					
(a)			The name and mailing address of the Agency.	29:31	1.3			
(b)			The organization and management structure of the Agency, identifying persons with management authority for implementation of the Plan.	29:30	1.3.1			
(c)			The name and contact information, including the phone number, mailing address and electronic mail address, of the plan manager.	29:30	1.3.1			
(d)			The legal authority of the Agency, with specific reference to citations setting forth the duties, powers, and responsibilities of the Agency, demonstrating that the Agency has the legal authority to implement the Plan.	30	1.3.2			
(e)			An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.	30:31	1.3.3			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.8, 10727.2, and 10733.2, Water Code.					

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.8.			**Description of Plan Area**					
			Each Plan shall include a description of the geographic areas covered, including the following information:					
(a)			One or more maps of the basin that depict the following, as applicable:					
	(1)		The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.	27, 35:47	2.1	Figure 1-1		
	(2)		Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.	35:36, 49	2.1.2	Figure 2-2		
	(3)		Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.	35:36, 48:49	2.1.2	Figure 2-1, 2-2		
	(4)		Existing land use designations and the identification of water use sector and water source type.	36, 38	2.1.3, 2.1.5	Figure 2-8, 2-9		
	(5)		The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.	36:37, 50:53	2.1.2	Figures 2-3,2-4, 2-5, 2-6		
(b)			A written description of the Plan area, including a summary of the jurisdictional areas and other features depicted on the map.	35:49	2.1	Figure 2-1, 2-2		
(c)			Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.	37:38	2.1.4			
(d)			A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.	37:38	2.1.4			
(e)			A description of conjunctive use programs in the basin.	37:38	2.1.4			

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(f)			A plain language description of the land use elements or topic categories of applicable general plans that includes the following:					
	(1)		A summary of general plans and other land use plans governing the basin.	38, 55:56	2.1.5	Figure 2-8, 2-9		
	(2)		A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects	38	2.1.5			
	(3)		A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.	38	2.1.5			
	(4)		A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans.	38	2.1.5			
	(5)		To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.	38	2.1.5			
(g)			A description of any of the additional Plan elements included in Water Code Section 10727.4 that the Agency determines to be appropriate.					none determined to be appropriate
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10720.3, 10727.2, 10727.4, 10733, and 10733.2, Water Code.					
§ 354.10.			**Notice and Communication**					
			Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:					
(a)			A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.	61:62, 157, 164:166, 168:169, 178, 288:300	3.10, 6.2.4, 6.3.4, 6.5.4, 6.6.4, 6.7.4, Appendix D			
(b)			A list of public meetings at which the Plan was discussed or considered by the Agency.	301:354	Appendix E			
(c)			Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.	355:389	Appendix F			

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(d)			A communication section of the Plan that includes the following:					
	(1)		An explanation of the Agency's decision-making process.	256:263	Appendix B			
	(2)		Identification of opportunities for public engagement and a discussion of how public input and response will be used.	288:300	Appendix D			
	(3)		A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.	288:300	Appendix D			
	(4)		The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.	288:300	Appendix D			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.8, 10728.4, and 10733.2, Water Code					
SubArticle 2.			**Basin Setting**					
§ 354.12.			**Introduction to Basin Setting**					
			This Subarticle describes the information about the physical setting and characteristics of the basin and current conditions of the basin that shall be part of each Plan, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions. Information provided pursuant to this Subarticle shall be prepared by or under the direction of a professional geologist or professional engineer.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.14.			**Hydrogeologic Conceptual Model**					
(a)			Each Plan shall include a descriptive hydrogeologic conceptual model of the basin based on technical studies and qualified maps that characterizes the physical components and interaction of the surface water and groundwater systems in the basin.	57:73	3	Figures 3-1:3-10		
(b)			The hydrogeologic conceptual model shall be summarized in a written description that includes the following:					
	(1)		The regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency.	58:59, 64:68	3.4, 3.5	Figures 3-1:3-5		
	(2)		Lateral basin boundaries, including major geologic features that significantly affect groundwater flow.	68	3.5, 3.6, 3.9	Figure 3-5		
	(3)		The definable bottom of the basin.	60:61, 69	3.7	Figure 3-6		

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(4)		Principal aquifers and aquitards, including the following information:					
		(A)	Formation names, if defined.	60, 68	3.6.1	Figure 3-5		
		(B)	Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.	58:61, 68, 390:506	3.4, 3.5, 3.6, 3.7, 3.8, 3.9, Appendix G	Figure 3-5		
		(C)	Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.	58:61, 68, 390:506	3.4, 3.5, 3.6, 3.7, 3.8, 3.9, Appendix G	Figure 3-5		
		(D)	General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs.	79:80	4.4, 4.5			
		(E)	Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply.	62:63	3.11			
	(5)		Identification of data gaps and uncertainty within the hydrogeologic conceptual model	63	3.12			
(c)			The hydrogeologic conceptual model shall be represented graphically by at least two scaled cross-sections that display the information required by this section and are sufficient to depict major stratigraphic and structural features in the basin.	61, 70:72	3.8	Figure 3-7:3-9		
(d)			Physical characteristics of the basin shall be represented on one or more maps that depict the following:					
	(1)		Topographic information derived from the U.S. Geological Survey or another reliable source.	64		Figure 3-1		
	(2)		Surficial geology derived from a qualified map including the locations of cross-sections required by this Section.	68		Figure 3-5		
	(3)		Soil characteristics as described by the appropriate Natural Resources Conservation Service soil survey or other applicable studies.	67		Figure 3-4		
	(4)		Delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.	73		Figure 3-10		
	(5)		Surface water bodies that are significant to the management of the basin.	65		Figure 3-2		
	(6)		The source and point of delivery for imported water supplies.	35:36, 54	2.1.2.1	Figure 2-7		
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10733, and 10733.2, Water Code.					

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.16.			**Groundwater Conditions**					
			Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:					
(a)			Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:					
	(1)		Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin.	96:97		Figure 4-7, Figure 4-8		
	(2)		Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers.	91:95		Figure 4-2, Figure 4-6		
(b)			A graph depicting estimates of the change in groundwater in storage, based on data, demonstrating the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type.	139		Figure 5-6		
(c)			Seawater intrusion conditions in the basin, including maps and cross-sections of the seawater intrusion front for each principal aquifer.	8.3	4.8			
(d)			Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.	79:83, 100:102	4.4, 4.5, 4.6, 4.7	Figure 4-11:4-13		
(e)			The extent, cumulative total, and annual rate of land subsidence, including maps depicting total subsidence, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	76:78, 98:99	4.3	Figure 4-9, 4-10		
(f)			Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	83:89, 103:108	4.9	Figures 4-14:4-19		
(g)			Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	83:89, 109:111	4.9	Figures 4-20:4-22		
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10727.4, and 10733.2, Water Code.					

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.18.			**Water Budget**					
(a)			Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.	112, 114:119, 138:139	5.1, 5.5	Figure 5-5, 5-6		
(b)			The water budget shall quantify the following, either through direct measurements or estimates based on data:					
	(1)		Total surface water entering and leaving a basin by water source type.	121:122, 138	5.6	Figure 5-5	Table 5-3	
	(2)		Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.	126:129, 139	5.7.1	Figure 5-6	Table 5-4	
	(3)		Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.	126, 129:130, 139	5.7.2	Figure 5-6	Table 5-4	
	(4)		The change in the annual volume of groundwater in storage between seasonal high conditions.	126, 130:131, 139, 513:520	5.8, Appendix J	Figure 5-6	Table 5-4	
	(5)		If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.					Not applicable
	(6)		The water year type associated with the annual supply, demand, and change in groundwater stored.	112:113, 134	5.2	Figure 5-1		
	(7)		An estimate of sustainable yield for the basin.	131:133	5.9		Table 5-5	
(c)			Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:					
	(1)		Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information.	124:126, 139	5.7	Figure 5-6	Table 5-4	

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(2)		Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:					
		(A)	A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information.	124:126, 138, 390:506, 513:520	5.7, Appendix G, Appendix J	Figure 5-5	Table 5-4	
		(B)	A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon.	124:126, 138, 390:506, 513:520	5.7, Appendix G, Appendix J	Figure 5-6	Table 5-4	
		(C)	A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type.	124:126, 131:134, 139	5.7, 5.9	Figure 5-6, 5-1	Table 5-4	
	(3)		Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:					
		(A)	Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.	117:119, 121:125, 140:141, 143	5.5.3, 5.6, 5.7	Figures 5-7, 5-8, 5-10		
		(B)	Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.	114:120, 124:125, 140:141, 143	5.5, 5.7	Figures 5-7, 5-8, 5-10	Table 5-2	

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
		(C)	Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate.	114:125, 140:141, 143, 390:506, 513:520	5.5, 5.6, 5.7, Appendix G, Appendix J	Figures 5-7, 5-8, 5-10		
(d)			The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:					
	(1)		Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use.	112:113, 139, 390:506, 513:520	5.2, Appendix G, Appendix J	Figure 5-6		
	(2)		Current water budget information for temperature, water year type, evapotranspiration, and land use.	112:114, 139, 390:506, 513:520	5.2,5.3, Appendix G, Appendix J	Figure 5-6		
	(3)		Projected water budget information for population, population growth, climate change, and sea level rise.	117:119, 140:141, 390:506, 513:520	5.5.3, Appendix G, Appendix J	Figure 5-7, 5-8		
(e)			Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions.	114:131, 390:506	5.5, 5.6, 5.7, 5.8, Appendix G			
(f)			The Department shall provide the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM) and the Integrated Water Flow Model (IWFM) for use by Agencies in developing the water budget. Each Agency may choose to use a different groundwater and surface water model, pursuant to Section 352.4.	112, 390:506	5.1, Appendix G			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10723.2, 10727.2, 10727.6, 10729, and 10733.2, Water Code.					

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.20.			**Management Areas**					
(a)			Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.	114, 135, 509:512	5.4, Appendix I	Figure 5-2		
(b)			A basin that includes one or more management areas shall describe the following in the Plan:					
	(1)		The reason for the creation of each management area.	114, 509:512	5.4, Appendix I			
	(2)		The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.	145:183	6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7			
	(3)		The level of monitoring and analysis appropriate for each management area.	189:200	7			
	(4)		An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.	144:183	6			
(c)			If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.	114, 135	5.4	Figure 5-2		
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10733.2 and 10733.4, Water Code.					
SubArticle 3.			**Sustainable Management Criteria**					
§ 354.22.			**Introduction to Sustainable Management Criteria**					
			This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.24.			**Sustainability Goal**					
			Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.	145	6.1.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10727, 10727.2, 10733.2, and 10733.8, Water Code.					
§ 354.26.			**Undesirable Results**					
(a)			Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.	145, 148, 156:157, 162:163, 167, 173	6.1.1, 6.2.1, 6.3.1, 6.5.1, 6.6.1, 6.7.1			

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(b)			The description of undesirable results shall include the following:					
	(1)		The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.	145:146, 149, 157, 163, 168, 173:178	6.1.2, 6.2.2, 6.3.2, 6.5.2, 6.6.2, 6.7.2			
	(2)		The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.	146:147, 149, 157, 164, 168, 178	6.1.3, 6.2.3, 6.3.3, 6.5.3, 6.6.3, 6.7.3			
	(3)		Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.	145:147, 150, 157, 164:166, 178	6.1, 6.2.4, 6.3.4, 6.5.4, 6.6.4, 6.7.4			
(c)			The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.	150, 157:159, 166, 169:172, 179	6.2.5, 6.3.5, 6.5.5, 6.6.5, 6.7.5			
(d)			An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.	162	6.4			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10723.2, 10727.2, 10733.2, and 10733.8, Water Code.					

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.28.			**Minimum Thresholds**					
(a)			Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.	152:156, 159:161, 164:166, 169:172, 179:181	6.2.6, 6.3.6, 6.5.4, 6.6.5, 6.7.6			
(b)			The description of minimum thresholds shall include the following:					
	(1)		The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.	150, 157:159, 166, 169:172, 179	6.2.5, 6.3.5, 6.5.5, 6.6.5, 6.7.5			
	(2)		The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.	152:156, 159:161, 172, 179:181	6.2.6, 6.3.6, 6.5.6, 6.6.6, 6.7.6			
	(3)		How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.	152:156, 159:161, 172, 179:181	6.2.6, 6.3.6, 6.5.6, 6.6.6, 6.7.6			
	(4)		How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.	152:156, 159:161, 172, 179:181	6.2.6, 6.3.6, 6.5.6, 6.6.6, 6.7.6			
	(5)		How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.	152:156, 159:161, 172, 179:181	6.2.6, 6.3.6, 6.5.6, 6.6.6, 6.7.6			
	(6)		How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.	152:156, 159:161, 172, 179:181	6.2.6, 6.3.6, 6.5.6, 6.6.6, 6.7.6			

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(c)			Minimum thresholds for each sustainability indicator shall be defined as follows:					
	(1)		Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:					
		(A)	The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin.	74:75, 92:95, 147:156, 184	4.1.3, 6.2	Figure 4-3:4-6, 6-1		
		(B)	Potential effects on other sustainability indicators.	160	6.3.6.1			
	(2)		Reduction of Groundwater Storage. The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.	156:161	6.3			
	(3)		Seawater Intrusion. The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following:					
		(A)	Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer.	162	6.4			
		(B)	A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.	162	6.4			
	(4)		Degraded Water Quality. The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.	162:166	6.5			

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(5)		Land Subsidence. The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following:					
		(A)	Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects.	166:172	6.6			
		(B)	Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.	99, 166:172	6.6	Figure 4-10		
	(6)		Depletions of Interconnected Surface Water. The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:					
		(A)	The location, quantity, and timing of depletions of interconnected surface water.	172:182, 185:188	6.7	Figures 6-2:6-5		
		(B)	A description of the groundwater and surface water model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.	179, 185:188	6.7.5	Figures 6-2:6-5		
(d)			An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.	156:161	6.3			
(e)			An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.	162	6.4			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10733, 10733.2, and 10733.8, Water Code.					

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.30.			**Measurable Objectives**					
(a)			Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.	155:156, 161, 166, 172, 182	6.2.7, 6.3.7, 6.5.5, 6.6.6, 6.7.7			
(b)			Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.	155:156, 161, 166, 172, 182	6.2.7, 6.3.7, 6.5.5, 6.6.6, 6.7.7			
(c)			Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.	155:156, 161, 166, 172, 182	6.2.7, 6.3.7, 6.5.5, 6.6.6, 6.7.7			
(d)			An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.	161, 182	6.3.7, 6.7.7			
(e)			Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.	145:147	6.1			
(f)			Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.	155:156, 161, 166, 172, 182	6.2.7, 6.3.7, 6.5.5, 6.6.6, 6.7.7			
(g)			An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.	155:156, 161, 166, 172, 182	6.2.7, 6.3.7, 6.5.5, 6.6.6, 6.7.7			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
SubArticle 4.			**Monitoring Networks**					
§ 354.32.			**Introduction to Monitoring Networks**					
			This Subarticle describes the monitoring network that shall be developed for each basin, including monitoring objectives, monitoring protocols, and data reporting requirements. The monitoring network shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.34.			**Monitoring Network**					
(a)			Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation.	189:195	7.1		Table 7-1	
(b)			Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:					
	(1)		Demonstrate progress toward achieving measurable objectives described in the Plan.	189:195	7.1		Table 7-1	
	(2)		Monitor impacts to the beneficial uses or users of groundwater.	189:195	7.1		Table 7-1	
	(3)		Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.	189:195	7.1		Table 7-1	
	(4)		Quantify annual changes in water budget components.	189:195	7.1		Table 7-1	

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(c)			Each monitoring network shall be designed to accomplish the following for each sustainability indicator:					
	(1)		Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods:					
		(A)	A sufficient density of monitoring wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.	191:192, 199, 203	7.1.1	Figure 7-1	Table 7-2	
		(B)	Static groundwater elevation measurements shall be collected at least two times per year, to represent seasonal low and seasonal high groundwater conditions.	191:192, 199, 203	7.1.1	Figure 7-1	Table 7-2	
	(2)		Reduction of Groundwater Storage. Provide an estimate of the change in annual groundwater in storage.	192:193	7.1.2			
	(3)		Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.	193	7.1.3			
	(4)		Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.	193:194, 199, 203	7.1.5	Figure 7-2	Table 7-2	
	(5)		Land Subsidence. Identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.	193	7.1.4			

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(6)		Depletions of Interconnected Surface Water. Monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. The monitoring network shall be able to characterize the following:					
		(A)	Flow conditions including surface water discharge, surface water head, and baseflow contribution.	194:195	7.1.6			
		(B)	Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.	194:195	7.1.6			
		(C)	Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.	194:195	7.1.6			
		(D)	Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.	194:195	7.1.6			
(d)			The monitoring network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area.	189:195, 202:203	7.1	Figure 7-1, 7-2		
(e)			A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.	189:195	7.1		Table 7-1	
(f)			The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:					
	(1)		Amount of current and projected groundwater use.	189:195	7.1			
	(2)		Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow.	189:195	7.1			
	(3)		Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.	189:195	7.1			
	(4)		Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response.	189:195	7.1			

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(g)			Each Plan shall describe the following information about the monitoring network:					
	(1)		Scientific rationale for the monitoring site selection process.	189:195	7.1			
	(2)		Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.	195:197	7.2			
	(3)		For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.	189:195	7.1			
(h)			The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.	189:195	7.1			
(i)			The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.	195:197	7.2			
(j)			An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.	189:195	7.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10727.4, 10728, 10733, 10733.2, and 10733.8, Water Code					
§ 354.36.			**Representative Monitoring**					
			Each Agency may designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin, as follows:					
(a)			Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined.	198	7.3			

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(b)			(b) Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following:					
	(1)		Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy.	198	7.3			
	(2)		Measurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy.	198	7.3			
(c)			The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area.	198	7.3			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2 and 10733.2, Water Code					
§ 354.38.			**Assessment and Improvement of Monitoring Network**					
(a)			Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.	200:201	7.5		Table 7-3	
(b)			Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.	200:201	7.5		Table 7-3	
(c)			If the monitoring network contains data gaps, the Plan shall include a description of the following:					
	(1)		The location and reason for data gaps in the monitoring network.	201			Table 7-3	
	(2)		Local issues and circumstances that limit or prevent monitoring.	200:201	7.5		Table 7-3	
(d)			Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.	200:201	7.5		Table 7-3	
(e)			Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:					
	(1)		Minimum threshold exceedances.	189:195	7.1			
	(2)		Highly variable spatial or temporal conditions.	189:195	7.1			
	(3)		Adverse impacts to beneficial uses and users of groundwater.	189:195	7.1			
	(4)		The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.	189:195	7.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10728.2, 10733, 10733.2, and 10733.8, Water Code					

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.40.			**Reporting Monitoring Data to the Department**					
			Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10728, 10728.2, 10733.2, and 10733.8, Water Code.					
SubArticle 5.			**Projects and Management Actions**					
§ 354.42.			**Introduction to Projects and Management Actions**					
			This Subarticle describes the criteria for projects and management actions to be included in a Plan to meet the sustainability goal for the basin in a manner that can be maintained over the planning and implementation horizon.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.44.			**Projects and Management Actions**					
(a)			Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.	204:218	8			
(b)			Each Plan shall include a description of the projects and management actions that include the following:					
	(1)		A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following:					
		(A)	A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	
		(B)	The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	
	(2)		If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.					Not applicable
	(3)		A summary of the permitting and regulatory process required for each project and management action.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	

Article 5.			Plan Contents for Bedford-Coldwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(4)		The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	
	(5)		An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	
	(6)		An explanation of how the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	
	(7)		A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	
	(8)		A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	
	(9)		A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	
(c)			Projects and management actions shall be supported by best available information and best available science.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	
(d)			An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.	204:218	8.1,8.2,8.3, 8.4,8.5,8.6, 8.7,8.8		Tables 8-1:8-8	
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					

APPENDIX D

BCGSA Stakeholder Outreach Plan

STAKEHOLDER OUTREACH PLAN

BEDFORD COLDWATER GROUNDWATER SUBBASIN (#8-004.02) of the ELSINORE BASIN (#8-004)

RIVERSIDE COUNTY, CALIFORNIA

SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA) PROGRAM

Prepared For:

BEDFORD COLDWATER GROUNDWATER SUSTAINABILITY AUTHORITY

Acting as a Groundwater Sustainability Agency

Prepared By:

Stantec Consulting Services, Inc.
300 North Lake Avenue, Suite 400
Pasadena, CA 91101

October 2018
Updated October 2021

TABLE OF CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS..... i

1.0 INTRODUCTION.....1

2.0 OBJECTIVES 1

3.0 STAKEHOLDER IDENTIFICATION 1

4.0 OUTREACH ACTIVITIES 3

4.1 Public Notices and Meetings 3

4.1.1 Public Meetings 4

4.1.2 Agency Meetings 4

4.2 GSA Website.....4

4.3 Direct Mailings/Email.....5

4.4 Outreach Implementation Timeline 5

5.0 EVALUATION.....7

5.1 Public Meeting Participation and Attendance.....7

5.2 Comment and Response Database 7

6.0 REFERENCES.....7

APPENDIX A - SUMMARY OF STATUTORY REQUIREMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

BCGSA	Bedford Coldwater Groundwater Sustainability Authority acting as a Groundwater Sustainability Agency
CASGEM	California Statewide Groundwater Elevation Monitoring
Corona	City of Corona
DAC	disadvantaged community
DWR	California Department of Water Resources
EVMWD	Elsinore Valley Municipal Water District
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
JPA	Joint Powers Authority
SGMA	Sustainable Groundwater Management Act
TVWD	Temescal Valley Water District

1.0 INTRODUCTION

The Sustainable Groundwater Management Act (SGMA), effective January 1, 2015, was enacted in California to regulate and sustainably manage groundwater basins throughout the state. SGMA provides a framework to guide local public agencies and newly created Groundwater Sustainability Agencies (GSAs) in the management of their underlying groundwater basins, especially those considered critically affected as defined by the Department of Water Resources (DWR).

The Bedford Coldwater Groundwater Sustainability Authority (BCGSA) was formed as a result of a Joint Powers Agreement to create a Joint Powers Authority (JPA). The JPA consists of the City of Corona (Corona), Elsinore Valley Municipal Water District (EVMWD), and Temescal Valley Water District (TVWD) acting as the Groundwater Sustainability Agency (GSA) for the Bedford Coldwater Groundwater Subbasin (Subbasin), a subbasin of the Elsinore Groundwater Basin. The BCGSA will be responsible for creating a Groundwater Sustainability Plan (GSP) to achieve long-term groundwater sustainability in the Subbasin. Under SGMA Regulations (California Water Code [Water Code] Section 10723.2), the BCGSA must consider all beneficial users and users of groundwater throughout the GSP development process. The BCGSA, comprised of three local agencies, will strive to achieve sustainable groundwater management in the region in the best interests of the stakeholders and local community.

This Stakeholder Outreach Plan (Outreach Plan) outlines the communication methods and strategies the BCGSA will employ to most effectively engage and involve stakeholders throughout GSP development and SGMA implementation per California Water Code.

2.0 OBJECTIVES

The purpose of this Outreach Plan is to involve stakeholders and understand their values throughout development of the GSP for the Subbasin. The objectives of the Outreach Plan are to:

- Identify and include interested stakeholders, including: affected governments, agencies, land use and environmental organizations, interested parties, and members of the public
- Provide multiple forums for stakeholder involvement
- Encourage stakeholder input throughout the GSP development process
- Receive and understand information about stakeholders' values and interests
- Incorporate comments and feedback received during GSP development
- Abide by SGMA Regulations and ensure broad public participation and transparency

3.0 STAKEHOLDER IDENTIFICATION

SGMA Regulations require GSAs to consider the interests of all beneficial users and users of groundwater (Water Code Section 10723.2), and establish and maintain a list of persons interesting in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents (Water Code Section 10723.4). Per Water Code Section 10723.8(a)(4), a list of interested parties was developed and provided to DWR during formation of the BCGSA. The BCGSA will continue to expand this list throughout the GSP development process. An initial list of stakeholders is presented in Table 1.

Table 1 – List of Stakeholders in the BCGSA Area

Category	Identified Stakeholders
Holders of overlying groundwater rights – Agricultural users	None identified
Holders of overlying groundwater rights – Domestic well owners	• Golf Club at Glen Ivy • Shea Homes, Inc. • Other small producers
Municipal well operators	• City of Corona Department of Water and Power • Elsinore Valley Municipal Water District • Temescal Valley Water District
Industrial well operators	• Coldwater Aggregates
Public water systems	• Western Municipal Water District • Eastern Municipal Water District • City of Corona Department of Water and Power • Elsinore Valley Municipal Water District • Temescal Valley Water District
Local land use planning agencies	• Riverside County, Planning Department • City of Corona
Regulatory Agencies	• Riverside County Flood Control and Water Conservation District • California Regional Water Quality Control Board – Santa Ana Region (8)
Environmental Groups	• The Nature Conservatory
Surface water users, if there is a hydrologic connection between surface and groundwater bodies	• Santa Ana Watershed Protection Agency • City of Corona Department of Water and Power • Elsinore Valley Municipal Water District • Temescal Valley Water District
The Federal Government	• United States Forest Service • United States Fish and Wildlife Service
California State Agencies	• California Department of Water Resources • California Department of Fish and Wildlife Groundwater Program
California Native American Tribes	• Soboba Band of Luiseño Indians • Rincon Band of Luiseño Indians • Agua Caliente Band of Cahuilla Indians • Temecula Band of Luiseño Indians
Disadvantaged communities (DAC), including, but not limited to, those served by private domestic wells or small community water systems	None identified
Entities listed in Water Code Section 10927 that are monitoring and reporting groundwater elevations in all or a part of a groundwater basin managed by the groundwater sustainability agency	Elsinore Valley Municipal Water District is the entity responsible for the California Statewide Groundwater Elevation Monitoring (CASGEM) program

3.1 Tribal Lands in the Basin

There are no tribal entities with land within the Basin. The list of stakeholders includes four California Native American tribes in the region, though not with land in the Basin, in order to continue the long history of coordination with tribal entities between the GSA agencies. The tribes have been contacted for stakeholder meetings as well as for consultation during the California Environmental Quality Act (CEQA) process for two new monitoring wells. The tribes have indicated no specific interest in the Basin, however the BCGSA will continue to consult with the tribes throughout GSP implementation and CEQA permitting.

3.2 Private Well Owners

The BCGSA believes there are very few active private wells, none of which are used for potable water supply in the Basin. While the BCGSA is aware of a small number of private wells, a systematic well inventory identifying all active private wells has not been completed to date. The GSP includes a project to address this data gap with a survey and inventory of active private wells throughout the Basin (Project 2, Section 8.7). This project was designed to locate and characterize the construction and use of existing private wells so that they can be included in sustainable management of the Basin.

4.0 OUTREACH ACTIVITIES

The BCGSA will implement the following outreach activities to maximize stakeholder involvement during development and implementation of the GSP. A summary of SGMA stakeholder outreach requirements and Water Code sections (Dobbin, 2015) are included in Table A.1 of Appendix A.

4.1 Public Notices and Meetings

SGMA establishes public notice requirements for GSAs to ensure that the general public and other stakeholders, are aware of actions by their local GSA. Table 2 outlines the three sections of the Water Code that require public notice, including before establishing a GSA, before adopting or amending a GSP, and before imposing or increasing a fee.

Table 2 – SGMA Requirements for Public Notice

Public Notice Requirement	Water Code Section
“Before deciding to become a groundwater sustainability agency, and after publication of notice pursuant to Section 6066 of the Government Code, the local agency or agencies shall hold a public hearing in the county or counties overlying the basin.”	10723(b)
“A groundwater sustainability agency may adopt or amend a groundwater sustainability plan after a public hearing, held at least 90 days after providing notice to a city or county within the area of the proposed plan or amendment.”	10728.4
“Prior to imposing or increasing a fee, a groundwater sustainability agency shall hold at least one public meeting, at which oral or written presentations may be made as part of the meeting.”	10730(b)(1)

The BCGSA will satisfy these requirements by publishing notices in local news outlets for Riverside County (*The Press-Enterprise)* and the City of Corona (*Sentinel Weekly News)*, as well as posting on the BCGSA website.

In accordance with Water Code Section 10723(b), the following notices were provided to the public during formation of the BCGSA:

- On March 15, 2017 and March 22, 2017, a notice of public hearing was published in *The Press-Enterprise* and *Sentinel Weekly News* to inform the public of the intent to hold a public hearing to consider the proposed decision by Bedford-Coldwater Groundwater Sustainability Authority to become the GSA for the Bedford-Coldwater Subbasin of the Elsinore Basin.

- On March 29, 2017, the Bedford-Coldwater Groundwater Sustainability Authority held a public hearing in the Boardroom of the Temescal Valley Water District's headquarters to hear comments from the public regarding the Bedford-Coldwater Groundwater Sustainability Authority's proposal to form a GSA within the Bedford-Coldwater Subbasin.

4.1.1 Public Meetings

To promote broad public participation and stakeholder involvement (Water Code Section 10727.8(a)), the BCGSA will conduct at least two public meetings during development of the GSP. Each meeting will be open to stakeholders and will include agency representatives. These meetings will be an opportunity for stakeholders to ask questions and provide input on sections of the GSP.

Public meetings will be held in the Boardroom of the Temescal Valley Water District's headquarters, located at 22646 Temescal Canyon Road, Temescal Valley, California 92883. More information including date and time of upcoming meetings will be provided on the BCGSA website. Throughout stakeholder outreach, the BCGSA will evaluate if additional accommodations will be necessary (e.g., evening meetings, translation for hearing impaired or non-English speaking individuals, etc.) in order to include as many stakeholders as possible.

As of this 2021 update, two public meetings have been held: November 7, 2019 in the Temescal Valley Water District boardroom, and July 15, 2021 online via Zoom. Since the start of the COVID-19 pandemic, to encourage participation and ensure the safety of all participants, all public and JPA Board meetings have been conducted through online formats.

Stakeholders will continue to be encouraged to participate in meetings and engage with BCGSA members following adoption of the GSP through email updates and website postings. Public meetings will be held as needed prior to significant updates made to the GSP throughout GSP implementation. Meeting information will be made available on the BCGSA website.

4.1.2 JPA Board Meetings

Representatives of each agency comprising the BCGSA will be present during quarterly Board meetings with the JPA. The dates, times, and location of these meetings will be posted on the BCGSA website. Time is designated during these meetings for the BCGSA to provide the JPA with updates on the progress of GSP development and SGMA implementation. There will be opportunity for the public to pose questions and comments at the start of each meeting. This public comment period will continue throughout GSP implementation.

4.2 GSA Website

The BCGSA will develop a website to facilitate the sharing of information about GSP development and SGMA implementation with stakeholders. Information will include maps, a calendar of upcoming meetings

and important dates, meeting summaries, groundwater information, relevant documents, mailing list signup, and other SGMA/GSA related information. The BCGSA website is located at: www.bedfordcoldwatergsa.com

The website will be updated regularly. There will be a designated page where users are encouraged to request more information, ask questions, or be added to the list of stakeholders. Links to the BCGSA website will be provided on the homepages of member agency websites.

Prior to initiating the development of a GSP, SGMA Regulations require that GSAs make a written statement describing the manner in which interested parties may participate in the development and implementation of the GSP available to the public and to DWR (Water Code Section 10727.8(a)). A section of the BCGSA website will allow the public to access this statement, the Outreach Plan, and any other written requirements.

4.3 Direct Mailings/Email

The BCGSA will maintain and continue to update a list of stakeholders. The list will be updated as persons request information though the website and from attendance at public meetings. Information distributed to those on the list who are interested in receiving BCGSA updates may include, plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents (Water Code Section 10723.4).

4.4 Outreach Implementation Timeline

Stakeholder engagement opportunities will be tracked and available on the BCGSA website throughout the GSP development process. Figure 1 shows the required stakeholder engagement opportunities throughout the four phases of GSP development as described by DWR (DWR, 2018). Forms of stakeholder engagement may include public meetings, information distributed to the BCGSA list of stakeholders, or DWR open public comment periods online via the SGMA Portal found at https://sgma.water.ca.gov/portal/#intro.

Phase 1 (years 2015 to 2017) is the GSA Formation and Coordination phase and includes one stakeholder input requirement. This requirement was completed by holding a public hearing to form the GSA from the Bedford Coldwater Groundwater Sustainability Authority.

Phase 2 (year 2017 to 2022) is the GSP Preparation and Submission part of the GSP development process. During this phase, stakeholders will be provided with opportunities to provide input on sections of the GSP by attending public meetings or reaching out on the BCGSA website.

Phase 3, occurring at any point after completion of Phase 2, consists of GSP review and evaluation. Once the GSP is submitted, any person may provide comments to DWR regarding a proposed or adopted GSP via the SGMA Portal found on DWR's website.

Phase 4 (year 2022+) is the Implementation and Reporting phase following adoption of the GSP. Active stakeholder involvement and public meetings are encouraged by DWR during this phase.

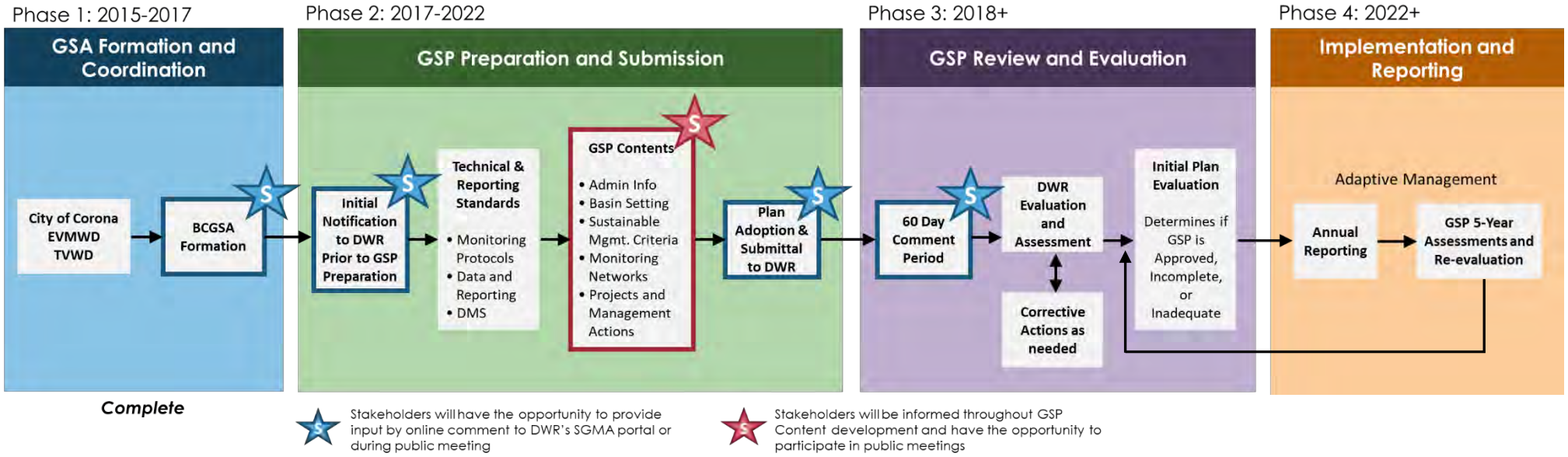


Figure 1 – Stakeholder Input Timeline (adapted from DWR, 2018)

5.0 EVALUATION

GSAs are encouraged to continually evaluate the effectiveness and monitor the progress of stakeholder engagement. The BCGSA will monitor the effectiveness of the Outreach Plan throughout GSP development and implementation by actively revising and updating the Outreach Plan to reflect any changing needs of stakeholders. The stakeholders list will be updated as needed to ensure all interested groups and beneficial users are included.

5.1 Public Meeting Participation and Attendance

Recording attendance and participation at public meetings is one method the BCGSA will use to implement the Outreach Plan and identify any adjustments that may be required. A record of attendance will be taken at each public meeting, and written feedback request forms will be available to each attendee. The forms will allow a clear pathway for the BCGSA to receive direct feedback on how to improve engagements with the public, if necessary, and to ensure individual interests are documented and considered.

5.2 Comment and Response Database

The BCGSA will maintain a database in order to ensure that comments voiced during public meetings and throughout stakeholder engagement are addressed. The database will track comments (and other information including name, date, and venue), assign responsibility for response preparation, and track distribution of responses. A copy of the information contained in the database will be included in the GSP as required by GSP Regulations Section 354.10.

6.0 REFERENCES

California Department of Water Resources (DWR), 2018. “Guidance Document for Groundwater Sustainability Plan, Stakeholder Communication and Engagement.” Sustainable Groundwater Management Program. January.

Dobbin, Kristin, et al., 2015. “Collaborating for Success: Stakeholder Engagement for Sustainable Groundwater Management Act Implementation.” Community Water Center. July.

Water Code Sections can be found online at California Legislative Information. <https://leginfo.legislature.ca.gov/faces/home.xhtml>

APPENDIX A

Summary of Statutory Requirements

Table A.1 – Summary of Statutory Requirements for Stakeholder Engagement in SGMA

Timeframe	Requirement	California Water Code Section
During GSA Formation	"Before electing to be a groundwater sustainability agency… the local agency or agencies shall hold a public hearing"	10723 (b)
	"A list of interested parties [shall be] developed [along with] an explanation of how their interests will be considered"	10723.8(a)(4)
During GSP Development and Implementation	"A groundwater sustainability agency may adopt or amend a groundwater sustainability plan after a public hearing"	10728.4
	"Prior to imposing or increasing a fee, a groundwater sustainability agency shall hold at least one public meeting"	10730(b)(1)
	"The groundwater sustainability agency shall establish and maintain a list of persons interested in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents"	10723.4
	"Any federally recognized Indian Tribe… may voluntarily agree to participate in the preparation or administration of a groundwater sustainability plan or groundwater management plan… A participating Tribe shall be eligible to participate fully in planning, financing, and management under this part"	10720.3(c)
	"Prior to initiating the development of a groundwater sustainability plan, the groundwater sustainability agency shall make available to the public and the department a written statement describing the manner in which interested parties may participate in the development and implementation of the groundwater sustainability plan"	10727.8(a)
Throughout SGMA Implementation	"The groundwater sustainability agency shall consider the interests of all beneficial uses and users of groundwater"	10723.2
	"The groundwater sustainability agency shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin"	10727.8(a)

APPENDIX E

Public Meeting Summaries

BEDFORD COLDWATER
Groundwater Sustainability Authority

Board Members:
Paul Rodriguez, TVWD
Jacque Casillas, City of Corona
Phil Williams, EVMWD

MEETING SUMMARY
Public Meeting
Bedford Coldwater Groundwater Sustainability Authority
6:30 PM, November 7, 2019
22646 Temescal Valley Road, Temescal Valley, CA 92883

Attendees
Craig Kessler, SoCal Golf Association
Kevin Fitzgerald, SoCal Golf Association
Rachel Gray, Eastern Municipal Water District
Kristian Aifelor, City of Corona Department of Water and Power
Sonny Gowan, ECS/Glen Ivy
Arean Park, KOK/Tom's Farms
Mike Buckantz, Associates Environmental
Jim St. Martin, Chandler's Sand and Gravel
Trevor Wood, Chandler's Sand and Gravel
Pakiza Chatha, California Department of Water Resources
Ray Alvarez, Glen Ivy Hot Springs
Brandon Barnett, KWC Engineers
Charley Land, California Department of Fish and Wildlife
Ian Achimore, Santa Ana Watershed Project Authority
Jacque Casillas, City of Corona
Phil Williams, Elsinore Valley Municipal Water District
Margie Armstrong, Elsinore Valley Municipal Water District
Tom Moody, City of Corona
Jeff Pape, Temescal Valley Water District
Victor Harris, Stantec
Kelly Shugart, Stantec

Agenda
1. Welcome and Introductions
2. Introduction to the Sustainable Groundwater Management Act (SGMA)
3. Bedford Coldwater Groundwater Sustainability Authority
4. Open Discussion
5. Next Steps

Victor Harris presented on the above topics followed by an open discussion. Comments from stakeholders were mostly addressed by Victor Harris, Tom Moody, and Jeff Pape are summarized below.

General comments from Jeff Pape, TVWD:
- It will be helpful for the BCGSA to know details about stakeholders' wells in the Subbasin: Has anyone had to lower pumps? Any water quality issues?
- We are interested in obtaining the earliest well data available for warm water and cold water wells.

General comments from Tom Moody, City of Corona

- The BCGSA is interested in gaining information about the geology where wells have been drilled in order to better understand the hydrogeology and the water entering those wells.
- We want to understand where recharge is occurring in the Subbasin and that we have recharge occurring in the correct location for future modelling efforts.
- We are interested in the native safe yield at each of the wells in the Subbasin so the BCGSA can know how much can be pumped safely without damaging the aquifer.

Stakeholder Comment: Will future development go into recharge in the Subbasin?
Response: The BCGSA will need to do a water study, but yes, it's possible.

Stakeholder Comment: Does water withdrawn in the basin stay in the basin or is it transported out?
Response: Most of the water stays in or very near the basin, but not 100% of it. Any exports out of the Subbasin is another aspect we need to understand. TVWD imports 100% of its potable water, about 3,000 acre-feet.

Stakeholder Comment: Is any of the water used for recharge?
Response: Recycled water is percolated into the ground.

Stakeholder Comment: What should we worry about for future projects?
Response: We will try to plan for known development as part of the Master Plan, for example, recycled water is required for landscape irrigation. If something deviates from the Master Plan, we will need to work it out with the developer.

Stakeholder Comment: For future projects, will developments need to be equipped with a reservoir or way to capture rainwater?
Response: It's possible; we want to minimize runoff and maybe look into xeriscaping. Future developments could be required to do stormwater management. Knowing how much runoff we are saving could go into offsetting extractions.

Stakeholder Comment: There is a creek passing through my client's land and they are experiencing erosion. Would it be possible to use [BCGSA] budget to create a reservoir to hold water on that land?
Response: If it promotes general sustainability, it could be a possibility.

Stakeholder Comment: Will you develop regulations for new and existing developments?
Response: There could be guidance setup for minimizing runoff, for example. The BCGSA will continue to review and update the GSP regularly. As regulations change, we will need to see how our plan fits and update, as needed.

Stakeholder Comment: Can you speak more to fees?
Response: Extraction fees are a possible authority, but it is more about compliance. It would be an enforcement amount. Fees could potentially used as funding for new projects or enforcement.

Stakeholder Comment: Is the GSA's authority a one-size fits all or will you look at each user individually concerning compliance with policies? Not everything would fit for the spa, for example, like landscaping policies.
Response: Policies will need to be practical and equitable for everyone.

Stakeholder Comment: How do you plan on gathering data?

Response: We will be asking users for any data they have. Lots of wells are de minimus, less than 2 acre-feet per year, or hard rock wells and are exempt. We are in contact with most of the larger producers and hope to have good relationships with everyone in the basin. We really want to know the geology and to understand the basin.

Stakeholder Comment: Are you reaching out to other stakeholders?

Response: We have contacted all we are aware of in the basin. Do you have suggestions on how to reach others? We will be reaching out during a data gathering period and will publish our list of stakeholders. We will be careful of confidentiality, especially with the mining operations. We need to understand the basin without hurting business. We will be asking everyone for their information.

DWR Comment: How can stakeholders stay engaged?

Response: Attend meetings which are posted on the BCGSA website. A listserv is a good way to keep people engaged and send notifications automatically. We will also add the presentation slides to the website.

BEDFORD COLDWATER
Groundwater Sustainability Authority

Bedford Coldwater Subbasin Groundwater Sustainability Plan

Public Meeting - Thursday, November 7, 2019

Presenter: Victor Harris, PG, CEG, CHG

1

Agenda

1. Welcome and Introductions
2. Introduction to the Sustainable Groundwater Management Act (SGMA)
3. Bedford Coldwater Groundwater Sustainability Authority
4. Open Discussion
5. Next Steps

2

Meeting Objectives

- Help keep you informed about the Sustainable Groundwater Management Act
- Understand your needs and priorities
- Open lines of communication
- Build common goals for the Bedford Coldwater Subbasin

3

Introduction to the Sustainable Groundwater Management Act

4

The Sustainable Groundwater Management Act (SGMA)

- Sustainable Groundwater Management Act (SGMA) was passed by the California legislature in 2014
  - Created a framework for sustainable groundwater management in California
- **Sustainable Groundwater Management** = *"Management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results."*



"…groundwater management in California is best accomplished locally."
- Governor Jerry Brown, September 2014

BEDFORD COLDWATER Groundwater Sustainability Authority

5

SGMA

- Requires the formation of Groundwater Sustainability Agencies (GSAs) – generally agencies overlying the groundwater basin
- GSAs are responsible for preparing Groundwater Sustainability Plans (GSPs) and be submitted by:
  - January 2020 for critically over drafted basins
  - January 2022 for remaining high and medium priority basins
- Creates a single sustainability goal for the basin or subbasin
  - Achieved within 20 years of GSP implementation
  - Maintained without causing undesirable results

BEDFORD COLDWATER Groundwater Sustainability Authority

6

SGMA

Two main goals to promote basin health:

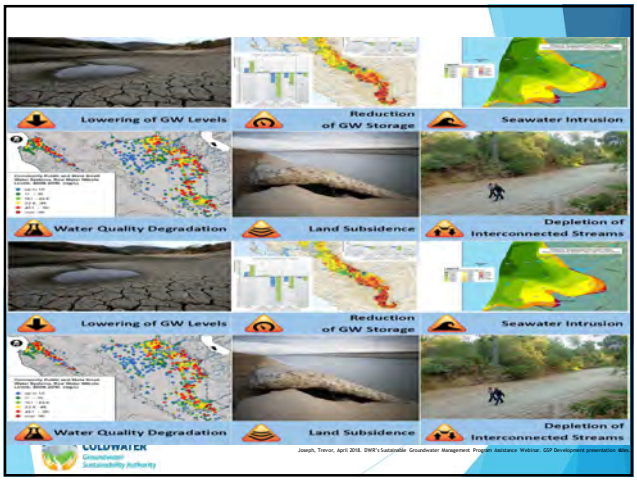
1. Stop overdraft by "balancing the water budget"
2. Achieve sustainable yield and avoid six undesirable results





BEDFORD COLDWATER Groundwater Sustainability Authority

7



Joseph, Trevor, April 2018. DWR's Sustainable Groundwater Management Program Assistance Webinar. GSP Development presentation.

8

Basin Prioritization

- Four groundwater basin categories: High, medium, low, and very low
- Based on components in California Water Code Section 10933(b)
  - Population overlying basin or subbasin
  - Number of wells that draw from the basin
  - Irrigated acreage overlying the basin
  - Reliance on groundwater for primary source of water



BEDFORD COLDWATER Groundwater Sustainability Authority

9

Groundwater Sustainability Agencies

- SGMA Required Groundwater Sustainability Agencies (GSAs) be formed
- Expanded the role of DWR to support local implementation of sustainable groundwater management by GSAs
- Allows for intervention by the State Water Resources Control Board (SWRCB) at points throughout the process of achieving sustainable groundwater management



BEDFORD COLDWATER Groundwater Sustainability Authority

10

Powers and Authority of a GSA

- Adopt rules, regulations, ordinances and resolutions to achieve groundwater sustainability
- Conduct investigations for the purpose of:
  - Determining the need for groundwater management
  - Preparing and adopting a GSP and implementing rules and regulations
  - Proposing and updating fees
  - Monitor compliance and enforcement
  - Inspection of property or facilities to ascertain compliance
- Require registration of a groundwater extraction facility
- Require measurement and recording of groundwater extraction (costs borne by owner or operator)
- Require groundwater extraction facilities to file an annual report

BEDFORD COLDWATER Groundwater Sustainability Authority

11

Powers and Authority of a GSA (continued)

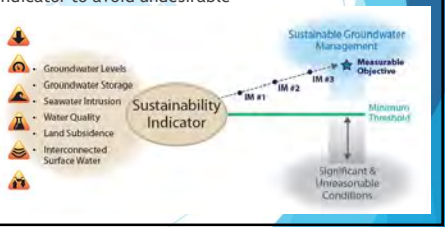
- Acquire land, water rights, rights-of-way, structures, or other property
- Appropriate and acquire surface or groundwater (or rights thereof)
- Transport, reclaim, purify, desalinate or treat wastewater or polluted water
- Additional authorities
  - Regulate or limit groundwater extractions
  - Limit construction of new wells, or reactivation of older wells
  - Authorize transfers and carryover of groundwater extraction allocations

BEDFORD COLDWATER Groundwater Sustainability Authority

12

Groundwater Sustainability Plan

- ***GSP development must be a transparent and open process encouraging stakeholder and public input***
- Establish minimum thresholds for each sustainability indicator to avoid undesirable results



BEDFORD COLDWATER Groundwater Sustainability Authority

13

Bedford Coldwater Groundwater Sustainability Authority

BEDFORD COLDWATER Groundwater Sustainability Authority

14

Bedford Coldwater Groundwater Sustainability Authority

- Joint Powers Authority (JPA) formed by three local agencies in February 2017 for management of the Subbasin
  - City of Corona
  - Elsinore Valley Municipal Water District
  - Temescal Valley Water District
- JPA signed a resolution in March 2017 to become the GSA for the Subbasin
- Governed by a representative Board member from each agency

City of Corona



Jacque Casillas, Director

EVMWD



Phil Williams, Vice-Chairman

TVWD



Paul Rodriguez, Chairman

BEDFORD COLDWATER Groundwater Sustainability Authority

15



BEDFORD COLDWATER Groundwater Sustainability Authority

Bedford Coldwater GSA
Basin and Agency Boundaries

16

Bedford Coldwater Subbasin Prioritization

- Bedford Coldwater Subbasin classified as a *very low priority* subbasin
- Groundwater use <9,500 acre-feet per year and no documented impacts to the subbasin



DWR SGMA Basin Prioritization Tool

17

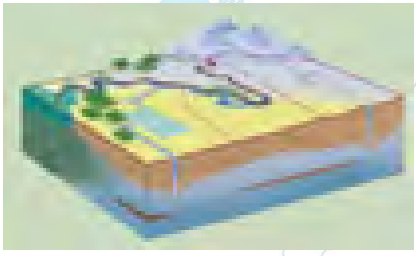
2017 Prop 1 SGWP Grant

- BCGSA was awarded funding by the Department of Water Resources (DWR) of the State of California through the Proposition 1 Sustainable Groundwater Planning (SGWP) Grant
- SGWP Grant provides funding to assist in financing the planning and/or selected project activities that will improve sustainable groundwater management
- BCGSA submits quarterly progress reports to DWR under the conditions of the grant

18

GSP Development

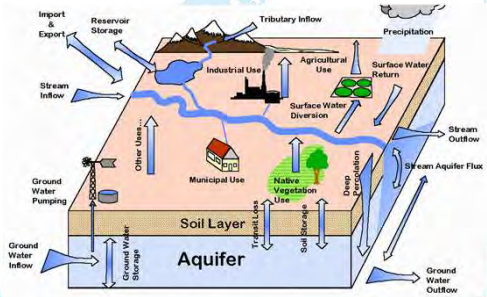
The First Step is a Conceptual Model



19

GSP Development

A Water Budget is Key to the Conceptual Model



20

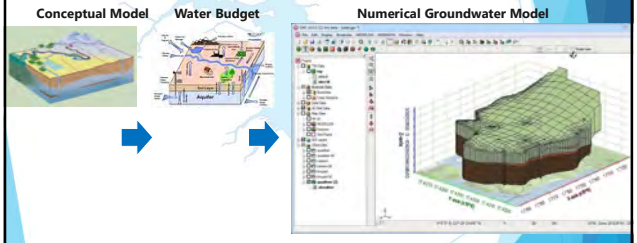
Geologic Map of the Bedford Coldwater Subbasin



21

GSP Development

From Conceptual Model to Groundwater Flow Model



BEDFORD COLDWATER Groundwater Sustainability Authority

22

Potential Projects for BCGSA

- Drill new, or locate suitable existing wells for groundwater monitoring
- Surface water instrumentation and monitoring
- Baseline groundwater quality sampling





BEDFORD COLDWATER Groundwater Sustainability Authority

23

GSP Development Timeline

July 2019
- Begin Draft GSP development

July 2020
- Draft GSP available for public review

December 2020
- Final Draft GSP submitted to DWR

BEDFORD COLDWATER Groundwater Sustainability Authority

24

Open Discussion

- Who are the private groundwater users in the Subbasin?
  - Rough estimate of volume used
  - Use of groundwater
  - Groundwater quality
  - Concerns?
- Who has concerns about the current groundwater conditions or elements of the GSP?
- What specific subject matter should be discussed in the GSP?

25

Next Steps

- How can you stay involved?
  - Visit our website: www.BedfordColdwaterGSA.com
  - Attend BCGSA Board meetings
  - Provide current contact information for BCGSA updates
  - Contact Victor Harris at 626-840-3592, victor@hhwaterresources.com
- Please complete our survey before you leave

Thank you for your interest and participation in the Bedford Coldwater Subbasin!

26

BEDFORD COLDWATER
Groundwater Sustainability Authority

BCGSA Stakeholder Survey

Meeting Date: November 7, 2019

Organization or Business Name: Chandler's Sand & Gravel

Stakeholder Name: Jim St. Martin

Email: JSTMARTIN@CHANDLERSCORP.COM **Phone:** 949.933.3905

Question:	Response:
1. Are you familiar with SGMA regulations?	No
2. Are you currently engaged in activity or discussions regarding groundwater management in this region?	No
3. Do you own or manage/operate land in this region?	Yes
4. Do you manage water resources? If yes, what is your role?	Management
5. What is your primary interest in land or water resources management?	Still Learning
6. Do you have concerns about groundwater management? If yes, what are they?	
7. Do you have recommendations regarding groundwater management? If yes, what are they?	
8. Private groundwater users: Primary use? Rough estimate of volume used? General groundwater quality?	
9. Who else would you recommend we contact who may have interest in water resources in the Bedford Coldwater Sub-basin?	
10. Please note any other comments or concerns regarding development of the Groundwater Sustainability Plan for the Bedford Coldwater Sub-basin.	

How helpful was this meeting in understanding SGMA and water resources in the Bedford Coldwater Sub-basin?

Please circle response: 1 Not helpful 2 3 Neutral 4 5 Very helpful

Please provide suggestions for improvement of stakeholder outreach:

PROP 1 WATER BOND 2014

BEDFORD COLDWATER
Groundwater Sustainability Authority

BCGSA Stakeholder Survey

Meeting Date: November 7, 2019

Organization or Business Name: Chandley's Sand & Gravel

Stakeholder Name: Trevor Wood

Email: Twood@chandlerscorp.com **Phone:** 36 308-8312

Question:	Response:
1. Are you familiar with SGMA regulations?	yes
2. Are you currently engaged in activity or discussions regarding groundwater management in this region?	Yes
3. Do you own or manage/operate land in this region?	Yes
4. Do you manage water resources? If yes, what is your role?	Yes - Plant Manager Maitri Road Recycling
5. What is your primary interest in land or water resources management?	effects on business
6. Do you have concerns about groundwater management? If yes, what are they?	
7. Do you have recommendations regarding groundwater management? If yes, what are they?	—
8. Private groundwater users: Primary use? Rough estimate of volume used? General groundwater quality?	
9. Who else would you recommend we contact who may have interest in water resources in the Bedford Coldwater Sub-basin?	
10. Please note any other comments or concerns regarding development of the Groundwater Sustainability Plan for the Bedford Coldwater Sub-basin.	

How helpful was this meeting in understanding SGMA and water resources in the Bedford Coldwater Sub-basin?

Please circle response: 1 Not helpful 2 3 Neutral (4) 5 Very helpful

Please provide suggestions for improvement of stakeholder outreach:

still learning

PROP 1 WATER BOND 2014

BEDFORD COLDWATER
Groundwater Sustainability Authority

BCGSA Stakeholder Survey

Meeting Date: November 7, 2019

Organization or Business Name: Santa Ana Watershed Project Authority

Stakeholder Name: Ian Achimore

Email: iachimore@sawpa.org **Phone:** _____

Question:	Response:
1. Are you familiar with SGMA regulations?	yes
2. Are you currently engaged in activity or discussions regarding groundwater management in this region?	yes
3. Do you own or manage/operate land in this region?	no
4. Do you manage water resources? If yes, what is your role?	From a salt management perspective
5. What is your primary interest in land or water resources management?	Wata quality, TDS
6. Do you have concerns about groundwater management? If yes, what are they?	
7. Do you have recommendations regarding groundwater management? If yes, what are they?	
8. Private groundwater users: Primary use? Rough estimate of volume used? General groundwater quality?	
9. Who else would you recommend we contact who may have interest in water resources in the Bedford Coldwater Sub-basin?	
10. Please note any other comments or concerns regarding development of the Groundwater Sustainability Plan for the Bedford Coldwater Sub-basin.	

How helpful was this meeting in understanding SGMA and water resources in the Bedford Coldwater Sub-basin?

Please circle response: 1 Not helpful 2 3 Neutral 4 (5) Very helpful

Please provide suggestions for improvement of stakeholder outreach:

PROP 1 WATER BOND 2014

BEDFORD COLDWATER
Groundwater Sustainability Authority

Board Members:
Paul Rodriguez, TVWD
Jacque Casillas, City of Corona
Phil Williams, EVMWD

MEETING SUMMARY
Public Meeting to Review the Bedford Coldwater Basin Draft Groundwater Sustainability Plan (GSP)
Bedford Coldwater Groundwater Sustainability Authority
6:00 PM, July 15, 2021
Online Zoom Meeting

Attendees
Rachel Gray, Eastern Municipal Water District
Kristian Alfelor, City of Corona Department of Water and Power
Sonny Gowan, ECS/Glen Ivy
Jim St. Martin, Chandler's Sand and Gravel
Mike Weil, California Department of Water Resources
Brent Miles, Glen Ivy Hot Springs
Phil Williams, Elsinore Valley Municipal Water District
Margie Armstrong, Elsinore Valley Municipal Water District
Ganesh Krishnamurthy, Elsinore Valley Municipal Water District
Parag Kalaria, Elsinore Valley Municipal Water District
Paul Rodriguez, Temescal Valley Water District
Melissa Estrada-Maravilla, City of Corona
Jesus Gastelum, Elsinore Valley Municipal Water District
Sodavy Ou, West Yost Associates
Jerry Sincich, Temescal Valley Municipal Advisory Council (MAC)
Craig Deleo, Temescal Driving Range
Eric Werner, Werner Corporation
Tom Moody, City of Corona
Jeff Pape, Temescal Valley Water District
Chad Taylor, Todd Groundwater
Maureen Reilly, Todd Groundwater
Terese Quintanar, Elsinore Valley Municipal Water District
Victor Harris, H & H Water Resources
Kelly Shugart, Stantec

Agenda
1. Groundwater Sustainability Plan (GSP) Background
2. Introduction to the Bedford Coldwater Basin
3. SGMA Requirements
4. Recommended Actions and Projects
5. Schedule and Timeline
6. Questions, Comments, and Open Discussion

The second Stakeholders Meeting of the Bedford-Coldwater Groundwater Sustainability Authority was held via teleconference. Participants joined by accessing Zoom web meeting. The meeting began at 6:00 p.m. and was recorded.

Mr. Victor Harris made introductions of those attending and explained methods for participants to indicate the desire to speak or ask questions. Mr. Harris explained that the purpose of the meeting was to present a summary of the recently completed Bedford Coldwater Groundwater Sustainability Plan (GSP), and invite questions or comments from basin stakeholders. He presented and explained a PowerPoint presentation and welcomed questions and comments at the completion of the presentation. The PowerPoint is attached to this summary for reference.

After the PowerPoint presentation, the following questions were posed by stakeholders:

Stakeholder Question: Are there any new regulations that would prohibit private well owners from replacing or installing new wells?

> **Response:** The BCGSA and GSP has not introduced new regulations regarding well installations and will adopt the Riverside County well guidance. Well regulations can be found on the Riverside County website.

Stakeholder Question: Are you willing to discuss the GSP with local citizens groups in the Temescal Valley?

> **Response:** Yes.

Because of the relatively few questions or concerns voiced by attendees, Mr. Harris invited additional comments or questions during the public review period (ending September 6, 2021) via email or telephone contact (contact information was provided in the presentation). He also requested responses to a questionnaire distributed immediately after the meeting via email to invitees.

The meeting ended at approximately 7:00 pm.

BEDFORD COLDWATER
Groundwater Sustainability Authority

Bedford Coldwater Subbasin Groundwater Sustainability Plan

Public Meeting – Thursday, July 15, 2021

Presenter: Victor Harris, PG, CEG, CHG
BCGSA Administrator

PROP 1
GOVERNOR EDMUND G. BROWN, JR.
WATER BOND 2014
RELIABILITY | RESTORATION | RESILIENCE

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

Meeting Information

- **For Online Participation:**
  - Go to: www.zoom.us
  - Select Join a Meeting
  - Enter Meeting ID: 884 5768 5551
  - Meeting Password: 92530
- **For Call-in Only:**
  - Call: (669) 900-9128
  - Enter Meeting ID: 884 5768 5551
  - Meeting Password: 92530

BEDFORD COLDWATER
Groundwater Sustainability Authority

Agenda

1. Groundwater Sustainability Plan (GSP) Background
2. Introduction to the Bedford Coldwater Basin
3. SGMA Requirements
4. Recommended Actions and Projects
5. Schedule and Timeline
6. Questions, Comments, and Open Discussion

BEDFORD COLDWATER
Groundwater Sustainability Authority

Acknowledgements

- Bedford-Coldwater Groundwater Sustainability Authority (BCGSA) Board and Staff
- California Department of Water Resources (DWR) Funding



Jacque Casillas, Director



Paul Rodriguez, Chairman



Phil Williams, Vice-Chairman

PROP 1
GOVERNOR EDMUND G. BROWN, JR.
WATER BOND 2014
RELIABILITY | RESTORATION | RESILIENCE

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

CORONA
THE CIRCLE CITY
Established May 4, 1886
To Cherish Our Past - To Plan Our Future

TEMESCAL VALLEY WATER DISTRICT

EVMWD
Elsinore Valley Municipal Water District

BEDFORD COLDWATER
Groundwater Sustainability Authority

First Stakeholder Meeting Questions and Input

- November 7, 2019, Temescal Valley Water District
  - Introduction to Sustainable Groundwater Management Act (SGMA), BGSA, and GSP development



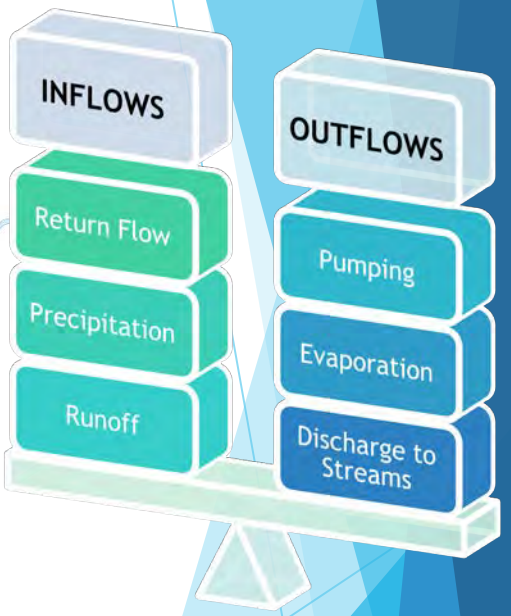
Issues Discussed:

- Protection of water quality
- Future projects
- New regulations
- Fees
- How to stay engaged

BEDFORD COLDWATER
Groundwater Sustainability Authority

SGMA Background

- Sustainable Groundwater Management Act (SGMA) was passed by the California legislature in 2014
  - Stop overdraft and achieve sustainable yield
- Requires the formation of Groundwater Sustainability Agencies (GSAs) overlying the groundwater basin
- GSAs are responsible for preparing Groundwater Sustainability Plans (GSPs)





"…groundwater management in California is best accomplished locally."

– Governor Jerry Brown, September 2014

BEDFORD COLDWATER
Groundwater Sustainability Authority

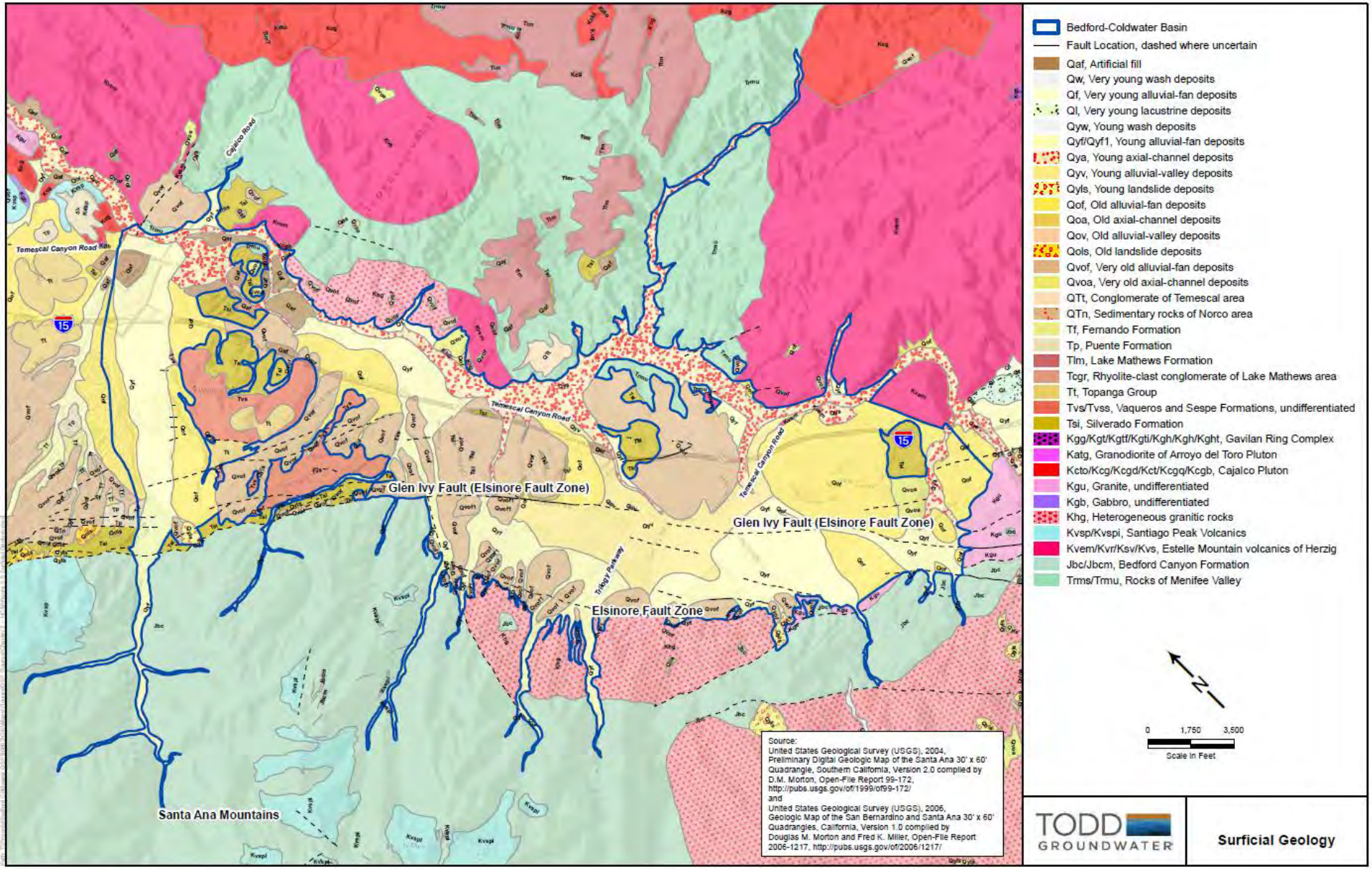


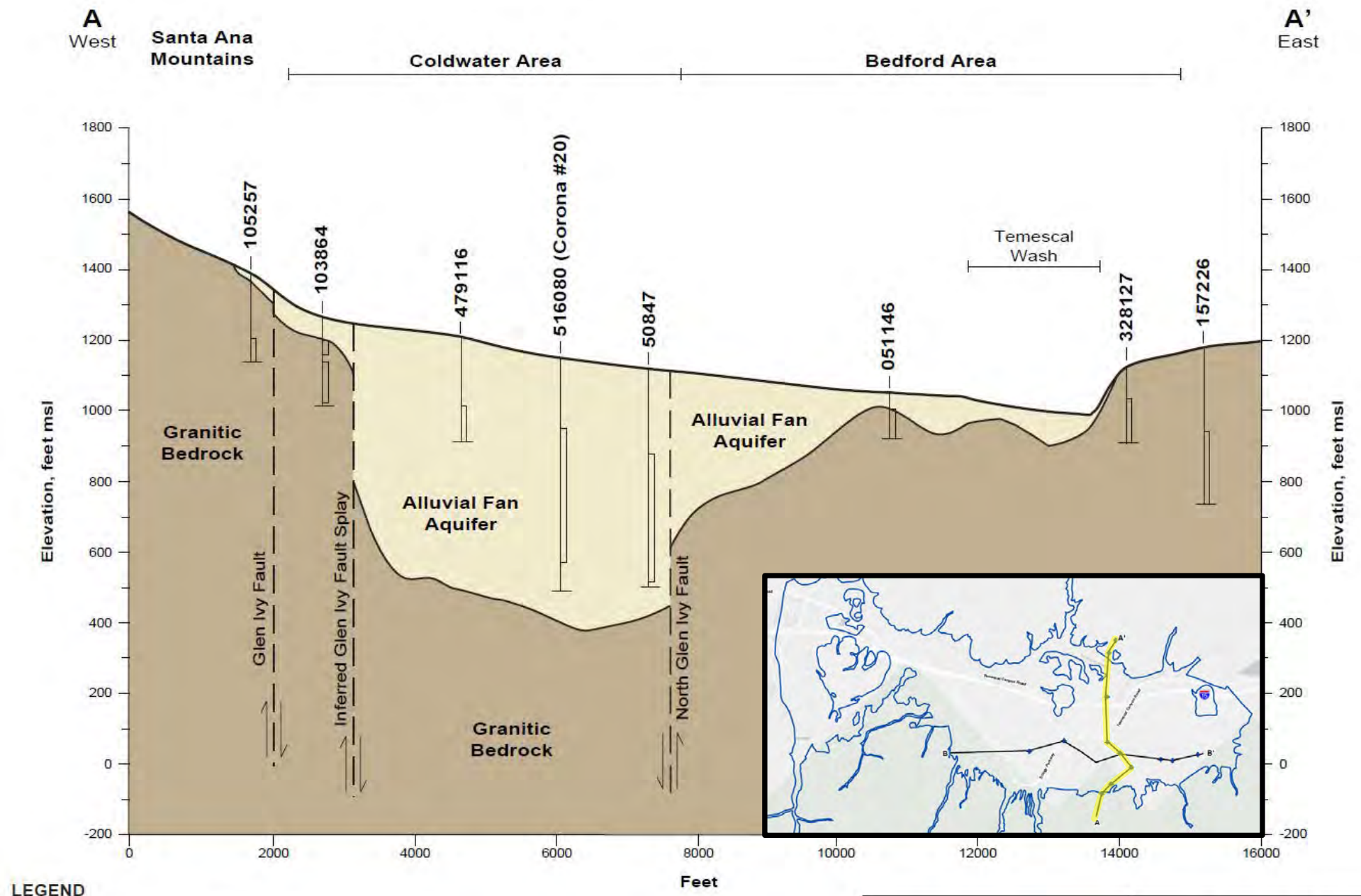
Bedford-Coldwater Subbasin

- Coldwater Management Area
- Bedford Management Area

BEDFORD COLDWATER
Groundwater Sustainability Authority

Geology of the Basin





LEGEND

50847 ← DWR Well Number

← Well Screen

← Bottom of Well

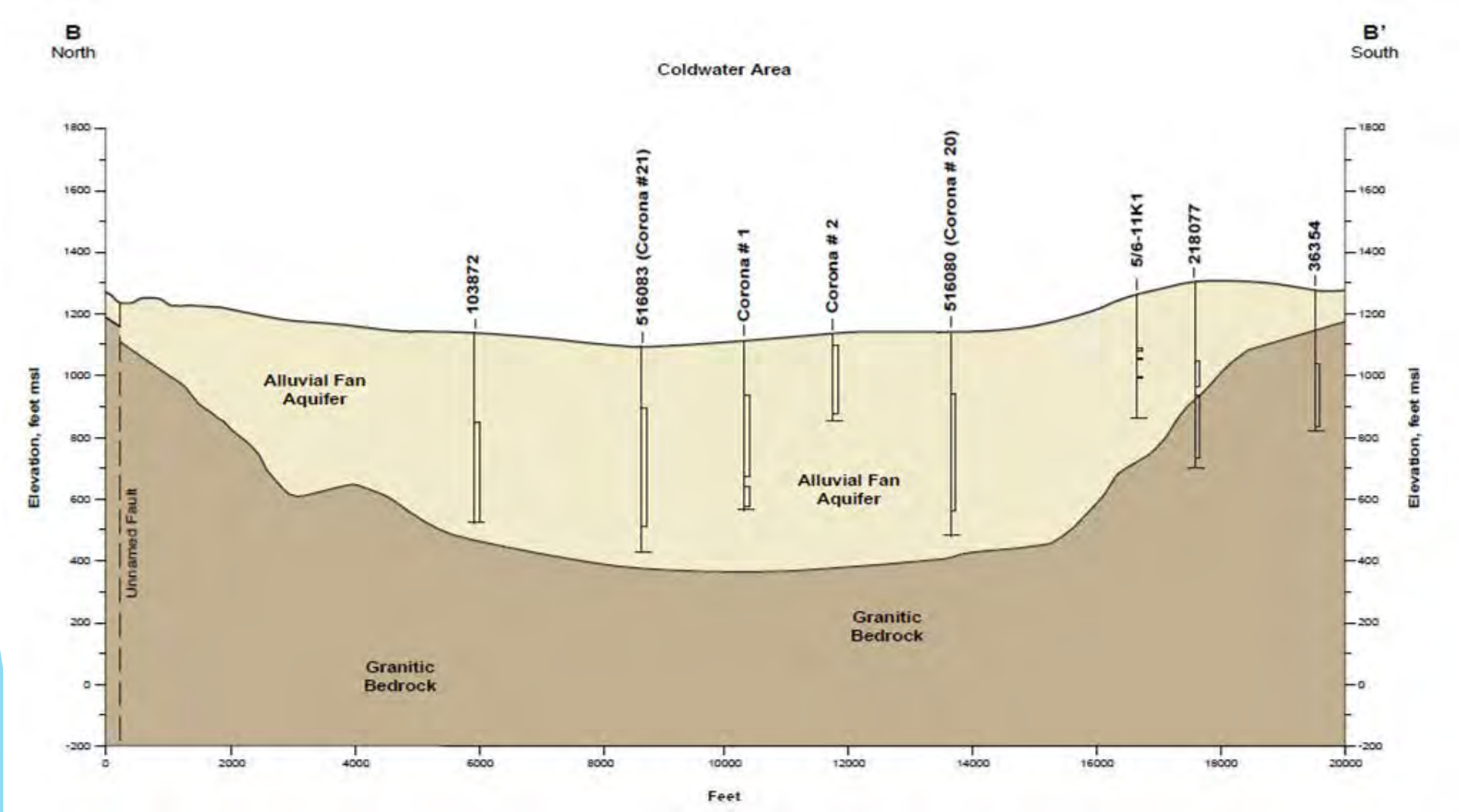
Alluvial Fan Aquifer

Granitic Bedrock

5X Vertical Exaggeration

TODD GROUNDWATER

Cross Section A to A'



LEGEND

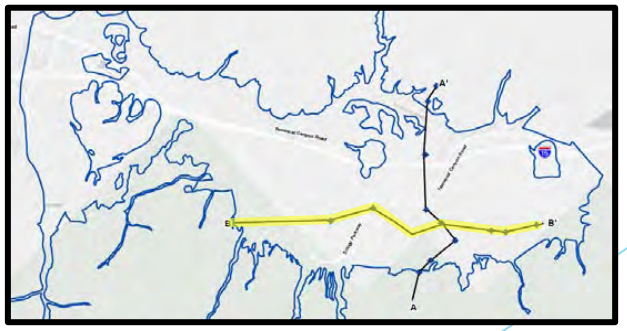
36354 ← DWR Well Number

← Well Screen

← Bottom of Well

Alluvial Fan Aquifer

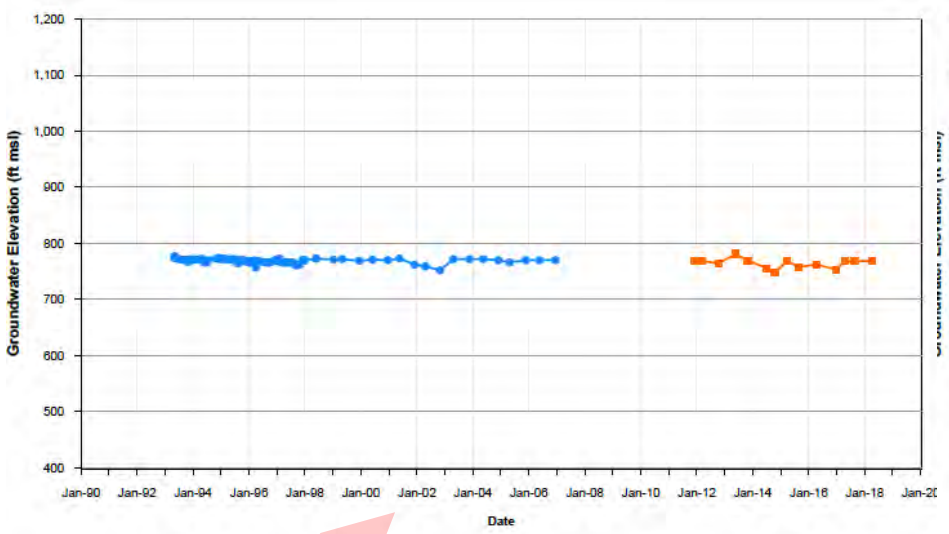
Granitic Bedrock

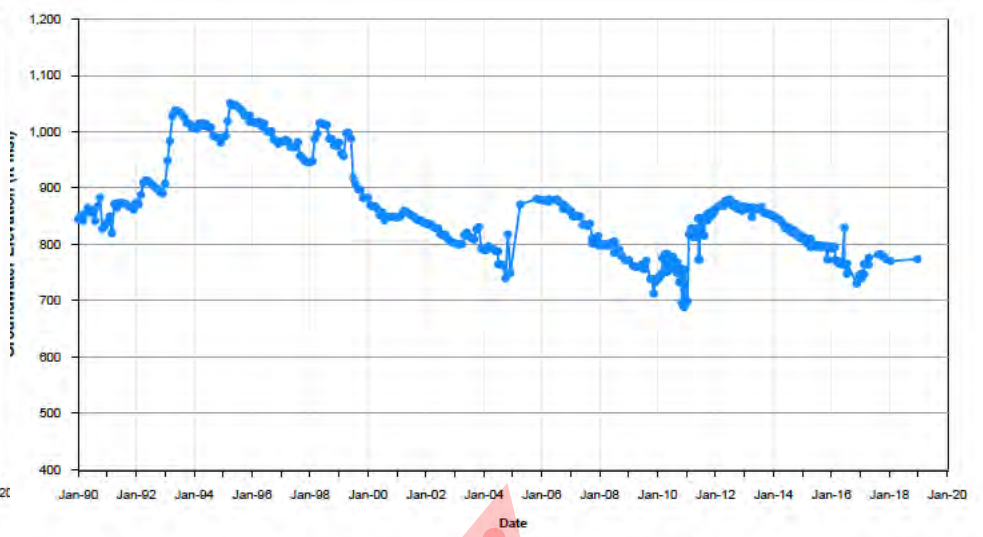


February 2020

TODD GROUNDWATER

Cross Section B to B'





Groundwater Level History



SGMA Terminology

- **Sustainability Criteria** = Quantitative ways the GSA can define, measure, and track sustainable management
  - **Undesirable results** = Significant and unreasonable conditions for any of the six sustainability indicators
  - **Minimum Threshold (MT)** = Numeric value used to define undesirable results for each sustainability indicator
  - **Management Action** = Initiated when MTs are approached or exceeded

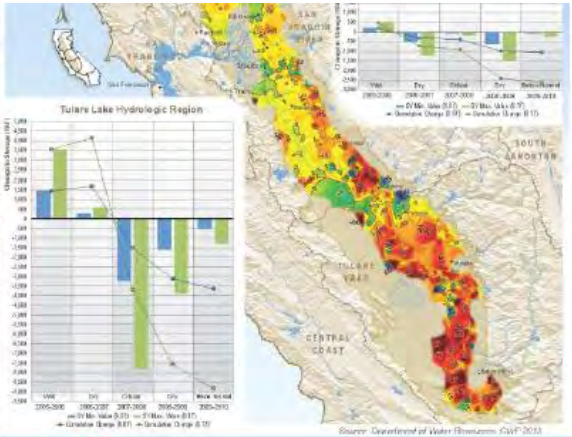


BEDFORD COLDWATER
Groundwater Sustainability Authority

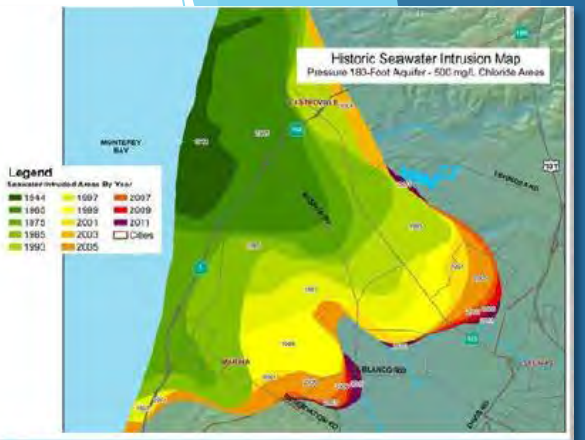
Six Undesirable Results



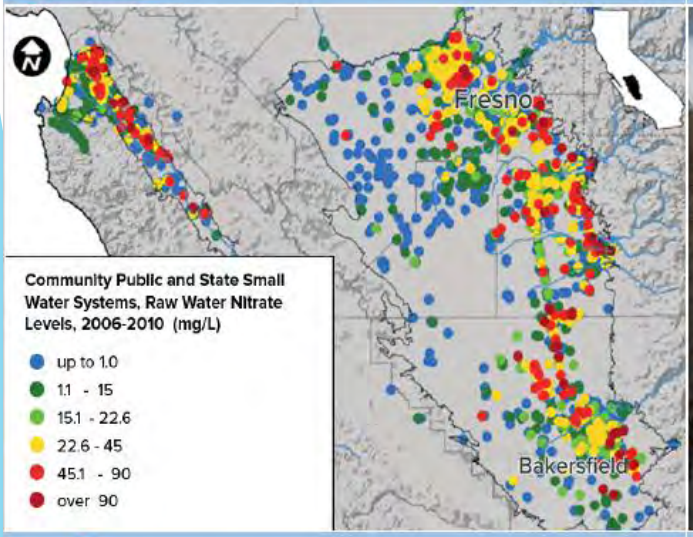
Lowering of GW Levels



Reduction of GW Storage



Seawater Intrusion



Water Quality Degradation



Land Subsidence



Depletion of Interconnected Streams

Joseph, Trevor, April 2018. DWR's Sustainable Groundwater Management Program Assistance Webinar. GSP Development presentation slides.

Consequences of Undesirable Results

- Increased pumping costs
- Entrained air in discharge/accelerated corrosion
- Loss of production
- Loss of groundwater-dependent habitat
- Subsidence
- Loss of groundwater in storage
- Loss of emergency supply

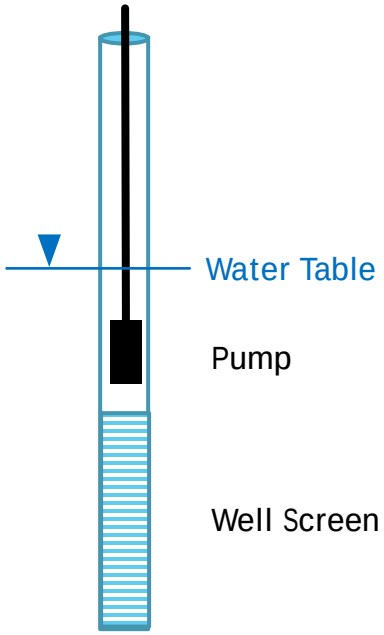
BEDFORD COLDWATER
Groundwater Sustainability Authority

Sustainability Goal for the Bedford-Coldwater Basin

- Provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses;
- Provide reliable storage for water supply resilience during droughts and shortages;
- Protect groundwater quality;
- Support beneficial uses of interconnected surface waters; and
- Support integrated and cooperative water resource management.

BEDFORD COLDWATER
Groundwater Sustainability Authority

Minimum Thresholds for Sustainability



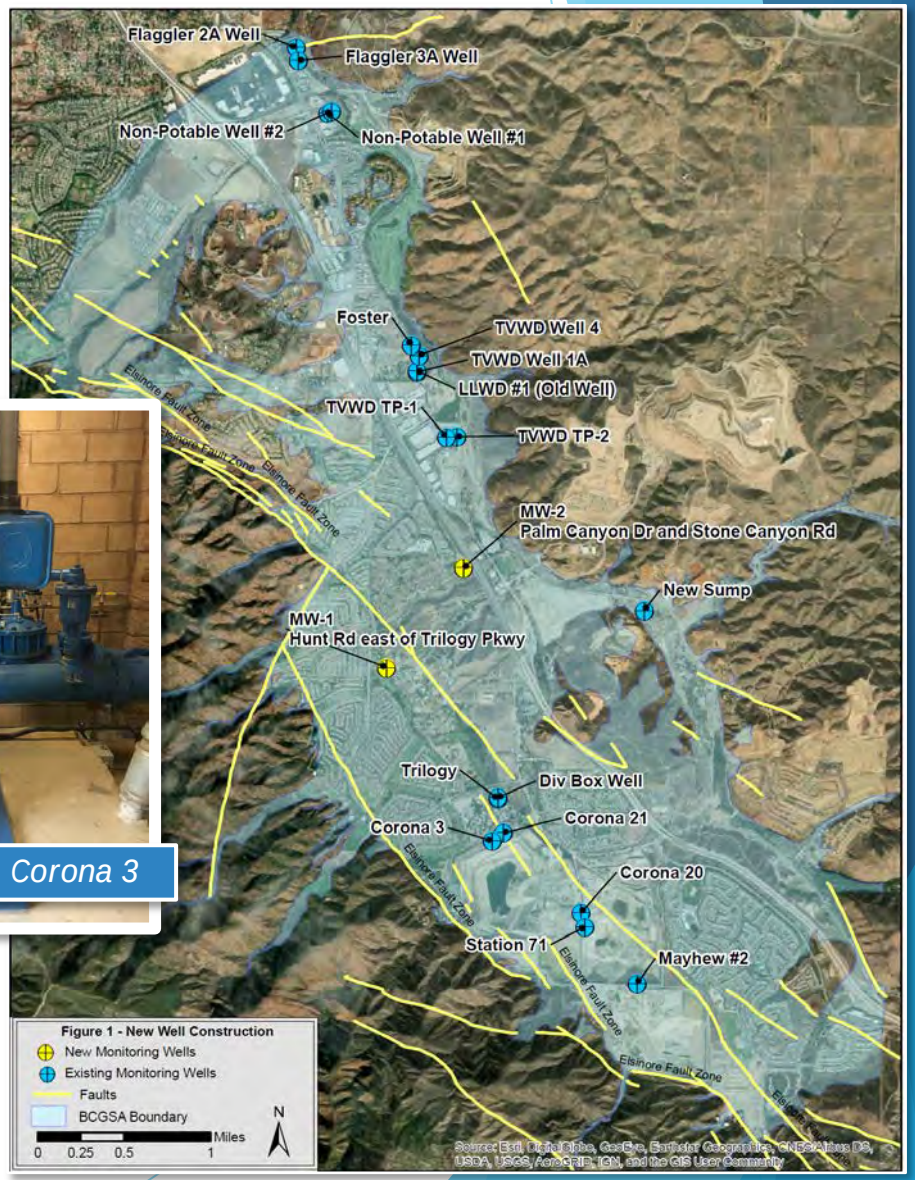
Sustainability Criteria	Minimum Threshold
Lowering of GW Levels	Maintain water levels at or above current pump intakes or screens (2 exceedances occur in 2 consecutive years in >2/3 or more wells in each management area)
Reduction of GW in Storage	Based on water levels
Land Subsidence	0.2 feet in any 5-year period
Degradation of GW Quality	5-year average TDS<1,000 mg/l, Nitrates<10 mg/l
Depletion of Interconnected Streams	Depth to water in wells near groundwater-supported vegetation is more than 35 ft for more than 1 year

Monitoring Network







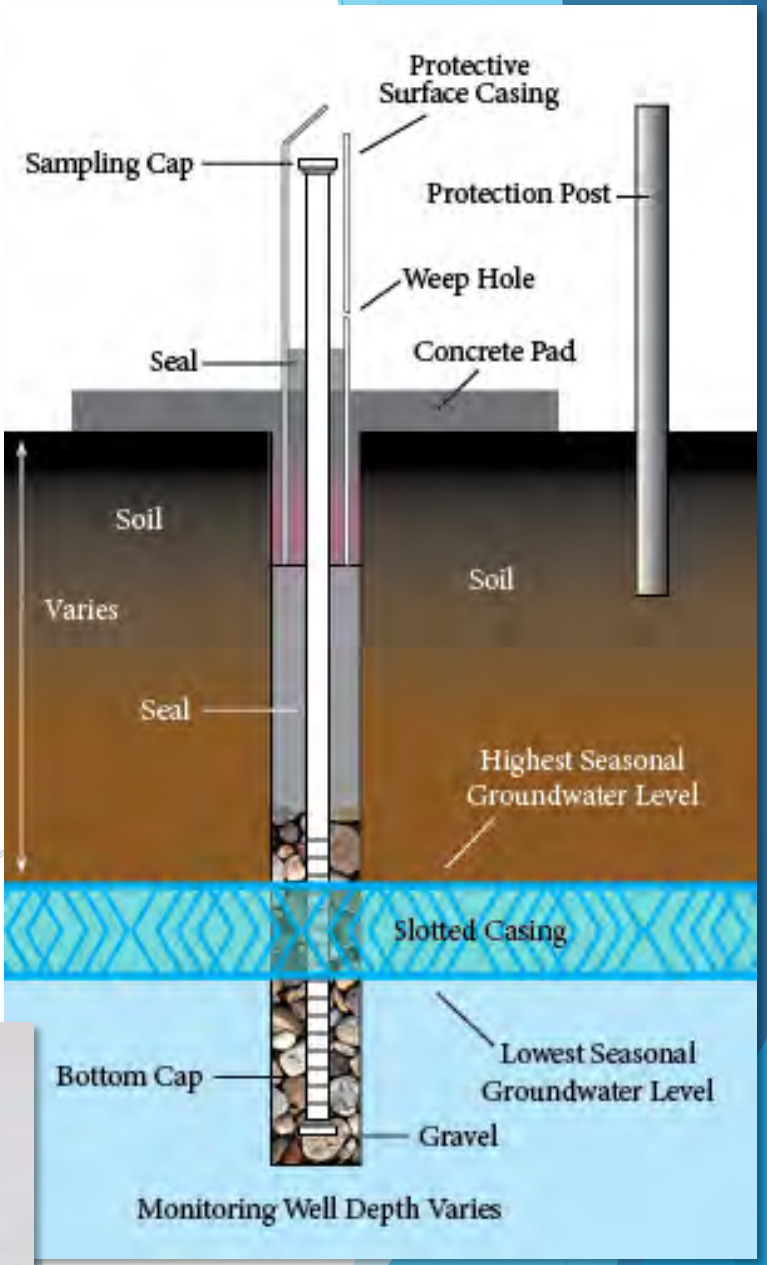


BEDFORD COLDWATER
Groundwater Sustainability Authority

Monitoring Well Construction and Transducer Installation







BEDFORD COLDWATER
Groundwater Sustainability Authority

Management Action 1

- Provide for Collection, Compilation, and Storage of Information Required for Annual Reports and Submit Annual Reports



Contents

- ✓ Executive Summary
- ✓ Groundwater Contour Maps
- ✓ Hydrographs
- ✓ Extraction Amounts
- ✓ Amount of Imported Supply
- ✓ Change in Groundwater in Storage
- ✓ Progress in Plan Implementation

BEDFORD COLDWATER
Groundwater Sustainability Authority

Management Action 2

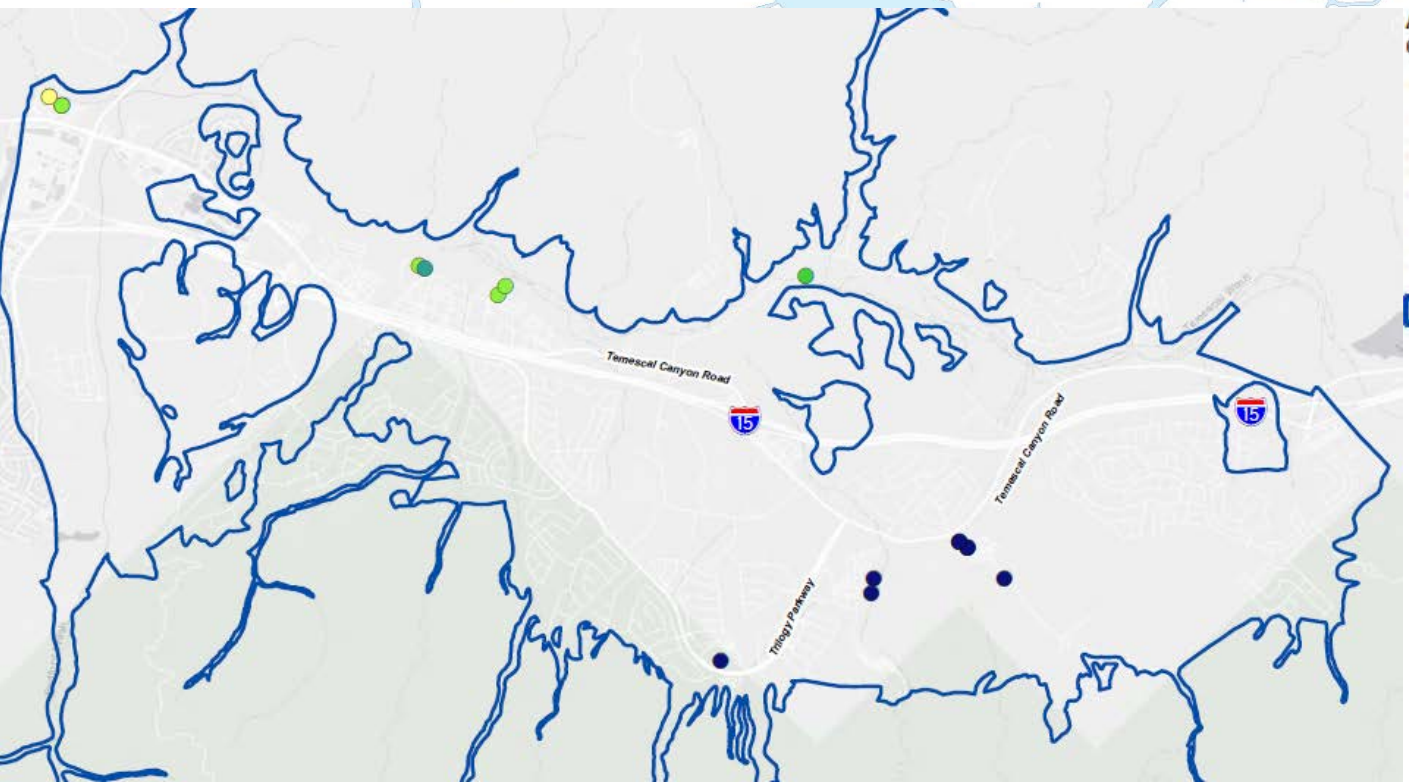
- Routinely Record Groundwater Levels and Take Action if Necessary



BEDFORD COLDWATER
Groundwater Sustainability Authority

Management Action 3

- Monitor Selected Groundwater Quality Constituents and Coordinate with the Regional Water Quality Control Board



Average Recent Total Dissolved Solids (TDS) Concentration

- Less than 500 mg/L
- 500 to 600 mg/L
- 600 to 700 mg/L
- 700 to 800 mg/L
- 800 to 900 mg/L
- 900 to 1,000 mg/L
- Bedford-Coldwater Basin

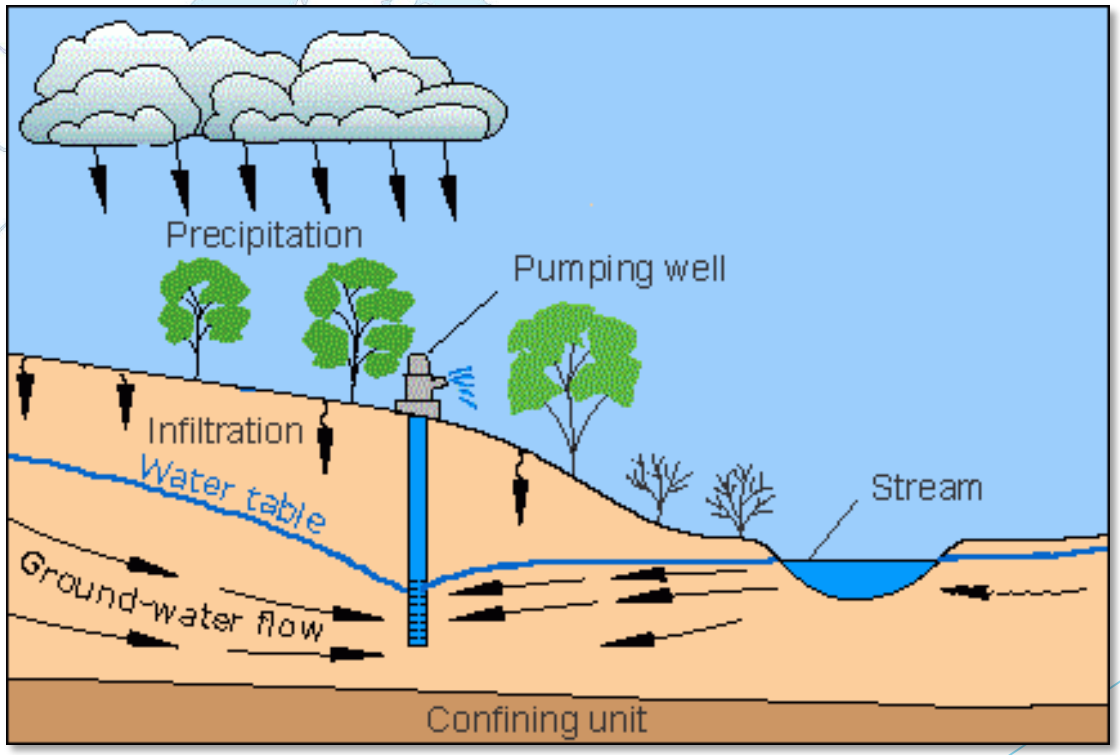
N

0 1,750 3,500

Scale in Feet

Management Action 4

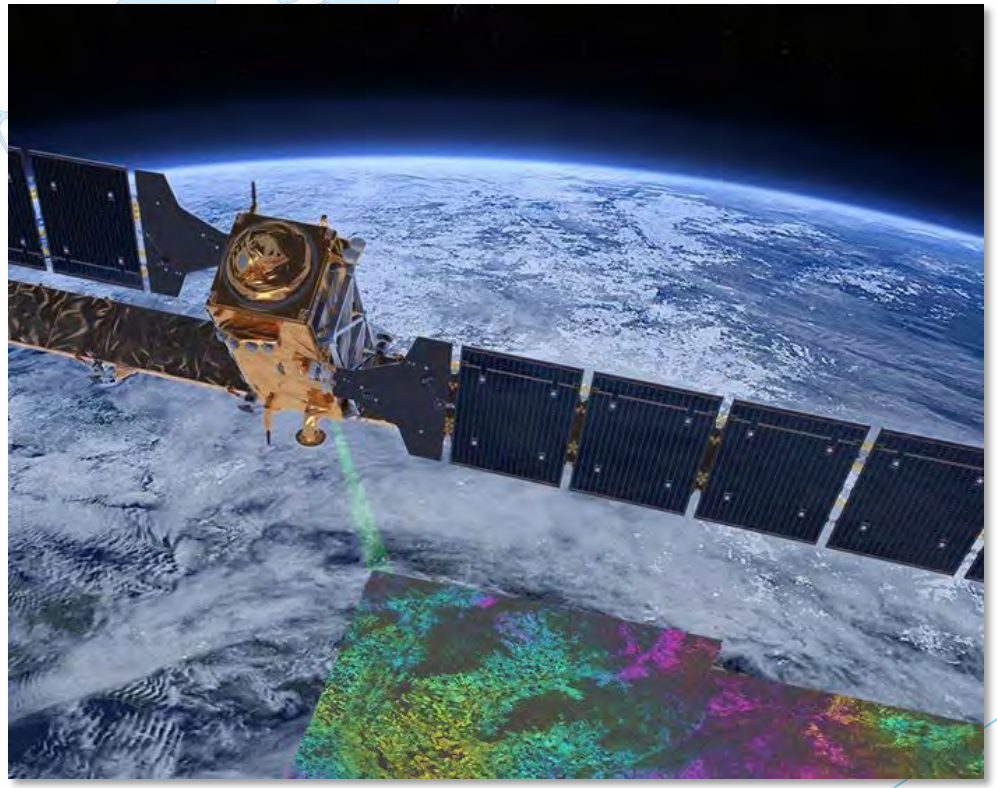
- Track Trends in Groundwater Levels Near Temescal Wash and Take Action as Necessary



BEDFORD COLDWATER
Groundwater Sustainability Authority

Management Action 5

- Review InSAR* Data on the DWR Dataviewer During 5-Year Updates



*** Interferometric Synthetic Aperture Radar**

BEDFORD COLDWATER
Groundwater Sustainability Authority

Project 1

- Investigate Groundwater / Surface Water Interaction at Temescal Wash



BEDFORD COLDWATER
Groundwater Sustainability Authority

Project 2

- Initiate a Survey of Active Private Wells



BEDFORD COLDWATER
Groundwater Sustainability Authority

Project 3

- Evaluation of Interaction of Aggregate Pits and Groundwater Flow



BEDFORD COLDWATER
Groundwater Sustainability Authority

Benefits of the GSP

- Ensures long-term sustainability of the Basin
- Evaluates and prepares for climate change
- Protects groundwater-dependent ecosystems
- Protects all groundwater users in the Basin
- Provides for transparent and open Basin management
- Provides for continuing stakeholder input



BEDFORD COLDWATER
Groundwater Sustainability Authority

GSP Implementation Schedule

	2022				2023				2024				2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Select GSP Administrator	✓																			
Action 1 – Provide for Collection, Compilation, and Storage of Information Required For Annual Reports and Submit Annual Reports	✓				✓				✓				✓				✓			
Action 2 – Routinely Record Groundwater Levels and Take Action if Necessary	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
Action 3 – Monitor Selected Groundwater Quality Constituents and Coordinate with the Regional Water Quality Control Board	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
Action 4 – Track Trends in Groundwater Levels near Temescal Wash and Take Action as Necessary	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
Action 5 – Review InSAR data on the SGMA Dataviewer During Annual and 5-year Updates	✓				✓				✓				✓				✓			
Project 1 – Investigate Groundwater/Surface Water Interaction at Temescal Wash		→	→	→	→	→	→													
Project 2 – Initiate a Survey of Private Wells			→	→																
Project 3 – Evaluation of the Effects of Aggregate Pits on Groundwater Flow and Quality				→	→	→	→	→	→	→										
Prepare 5-Year Evaluation																				✓

BEDFORD COLDWATER
Groundwater Sustainability Authority

Survey

Please submit your survey to
victor@hhwaterresources.com

Meeting Date: July 15, 2021

Organization or Business Name: _____

Stakeholder Name: _____

Email:_____ **Phone: _____**

Question:	Response:
1. Has this presentation increased your knowledge about the Groundwater Sustainability Plan (GSP)?	
2. Do you own or operate a water well in the vicinity of the basin? Do you plan to in the future?	
3. Is the timeline for GSP implementation clear?	
4. Do you have any concerns or suggestions about implementing the GSP in the Bedford-Coldwater Subbasin?	
5. Please note any other comments or questions regarding implementation of the GSP in the Bedford-Coldwater Subbasin or the GSP document itself. *(Reminder: written comments are due on the Draft GSP by September 6, 2021. Please email this survey and any addtional comments to victor@hhwaterresources.com).*	

How helpful was this meeting in understanding development of the draft GSP for the Bedford-Coldwater Subbasin?

Please circle response: **1** **2** **3** **4** **5**
Not helpful **Neutral** **Very helpful**

Please provide suggestions for improvement of stakeholder outreach:

Open Discussion

- How can you stay involved?
  - Visit our website: www.BedfordColdwaterGSA.com
  - Attend BCGSA Board meetings
  - Provide current contact information for BCGSA updates
  - Contact Victor Harris at 626-840-3592 or: victor@hhwaterresources.com

Thank you for your interest and participation in the Bedford Coldwater Subbasin GSP!

BEDFORD COLDWATER
Groundwater Sustainability Authority

BEDFORD COLDWATER
Groundwater Sustainability Authority

Bedford Coldwater Subbasin Groundwater Sustainability Plan

Public Meeting – Thursday, July 15, 2021

Presenter: Victor Harris, PG, CEG, CHG
BCGSA Administrator

1

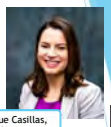
Agenda

1. Groundwater Sustainability Plan (GSP) Background
2. Introduction to the Bedford Coldwater Basin
3. SGMA Requirements
4. Recommended Actions and Projects
5. Schedule and Timeline
6. Questions, Comments, and Open Discussion

2

Acknowledgements

- Bedford-Coldwater Groundwater Sustainability Authority (BCGSA) Board and Staff
- California Department of Water Resources (DWR) Funding


Jacque Casillas, Director


Paul Rodriguez, Chairman


Phil Williams, Vice-Chairman

3

First Stakeholder Meeting Questions and Input

- November 7, 2019, Temescal Valley Water District
  - Introduction to Sustainable Groundwater Management Act (SGMA), BGSA, and GSP development



Issues Discussed:

- Protection of water quality
- Future projects
- New regulations
- Fees
- How to stay engaged

4

SGMA Background

- Sustainable Groundwater Management Act (SGMA) was passed by the California legislature in 2014
  - Stop overdraft and achieve sustainable yield
- Requires the formation of Groundwater Sustainability Agencies (GSAs) overlying the groundwater basin
- GSAs are responsible for preparing Groundwater Sustainability Plans (GSPs)





"...groundwater management in California is best accomplished locally."
Governor Jerry Brown, September 2014

BEDFORD COLDWATER Groundwater Sustainability Authority

5



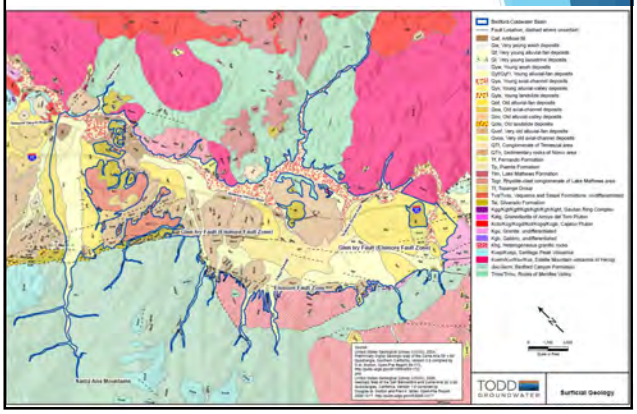
Bedford-Coldwater Subbasin

- Coldwater Management Area
- Bedford Management Area

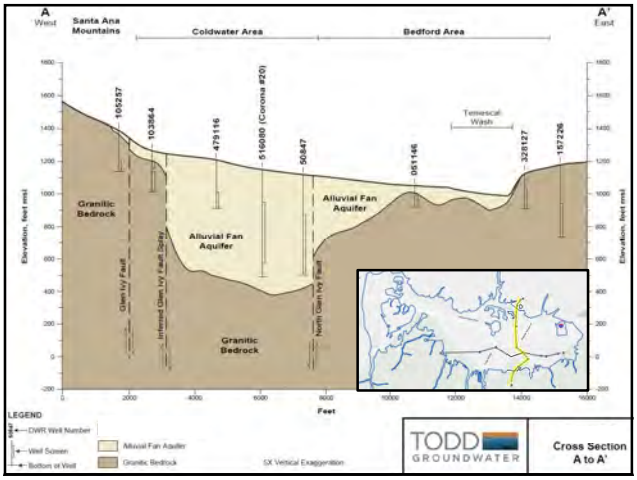
BEDFORD COLDWATER Groundwater Sustainability Authority

6

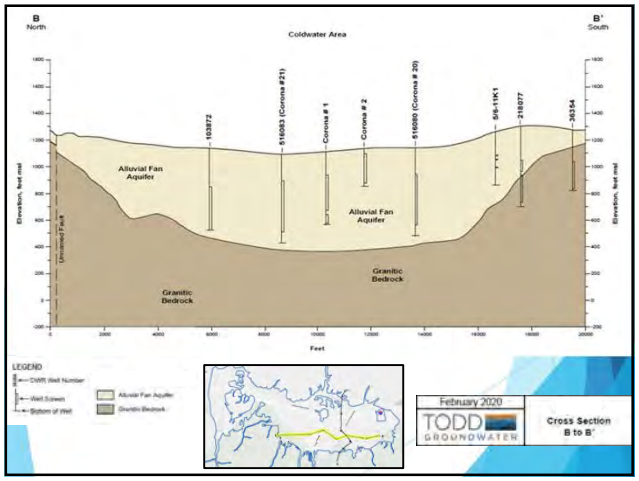
Geology of the Basin



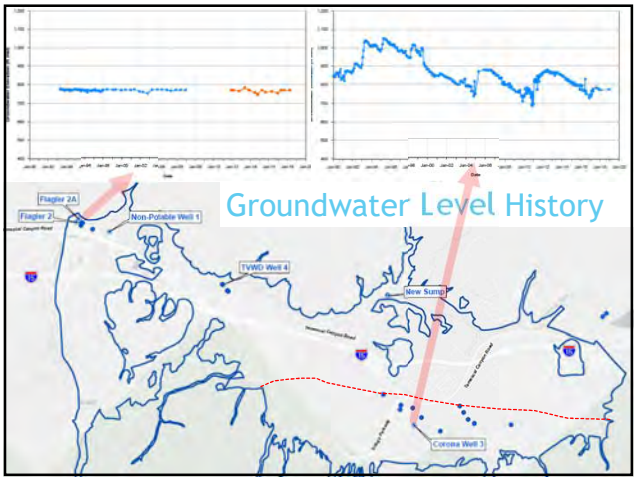
7



8



9



10

SGMA Terminology

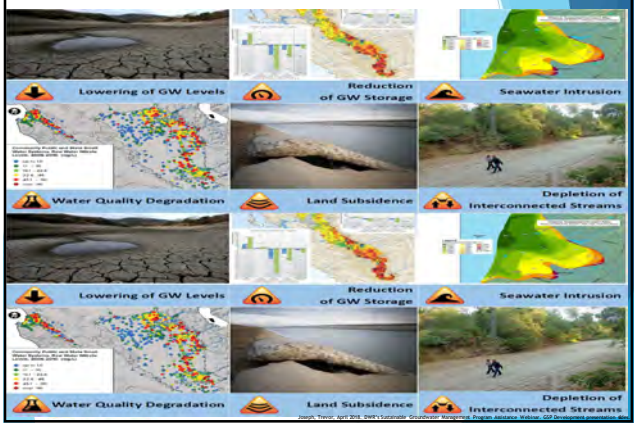
- **Sustainability Criteria** = Quantitative ways the GSA can define, measure, and track sustainable management
  - **Undesirable results** = Significant and unreasonable conditions for any of the six sustainability indicators
  - **Minimum Threshold (MT)** = Numeric value used to define undesirable results for each sustainability indicator
  - **Management Action** = Initiated when MTs are approached or exceeded

Lowering GW Levels
Reduction of Storage
Seawater Intrusion
Degraded Quality
Land Subsidence
Surface Water Depletion

BEDFORD COLDWATER Groundwater Sustainability Authority

11

Six Undesirable Results



12

Consequences of Undesirable Results

- Increased pumping costs
- Entrained air in discharge/accelerated corrosion
- Loss of production
- Loss of groundwater-dependent habitat
- Subsidence
- Loss of groundwater in storage
- Loss of emergency supply

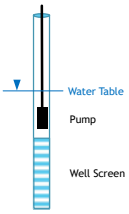
13

Sustainability Goal for the Bedford-Coldwater Basin

- Provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses;
- Provide reliable storage for water supply resilience during droughts and shortages;
- Protect groundwater quality;
- Support beneficial uses of interconnected surface waters; and
- Support integrated and cooperative water resource management.

14

Minimum Thresholds for Sustainability



Sustainability Criteria	Minimum Threshold
Lowering of GW Levels	Maintain water levels at or above current pump intakes or screens (2 exceedances occur in 2 consecutive years in >2/3 or more wells in each management area)
Reduction of GW in Storage	Based on water levels
Land Subsidence	0.2 feet in any 5-year period
Degradation of GW Quality	5-year average TDS<1,000 mg/l, Nitrates<10 mg/l
Depletion of Interconnected Streams	Depth to water in wells near groundwater-supported vegetation is more than 35 ft for more than 1 year

15

Monitoring Network

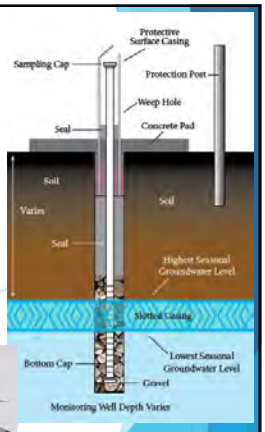


16

Monitoring Well Construction and Transducer Installation







BEDFORD COLDWATER Groundwater Sustainability Authority

17

Management Action 1

- Provide for Collection, Compilation, and Storage of Information Required for Annual Reports and Submit Annual Reports



Contents

- ✓ Executive Summary
- ✓ Groundwater Contour Maps
- ✓ Hydrographs
- ✓ Extraction Amounts
- ✓ Amount of Imported Supply
- ✓ Change in Groundwater in Storage
- ✓ Progress in Plan Implementation

BEDFORD COLDWATER Groundwater Sustainability Authority

18

Management Action 2

- Routinely Record Groundwater Levels and Take Action if Necessary



BEDFORD COLDWATER Groundwater Sustainability Authority

19

Management Action 3

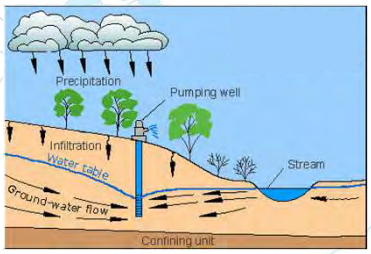
- Monitor Selected Groundwater Quality Constituents and Coordinate with the Regional Water Quality Control Board



20

Management Action 4

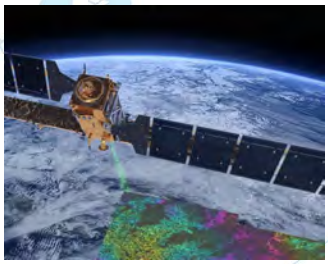
- Track Trends in Groundwater Levels Near Temescal Wash and Take Action as Necessary



21

Management Action 5

- Review InSAR* Data on the DWR Dataviewer During 5-Year Updates



* Interferometric Synthetic Aperture Radar

22

Project 1

- Investigate Groundwater/ Surface Water Interaction at Temescal Wash



23

Project 2

- Initiate a Survey of Active Private Wells



24

Project 3

- Evaluation of Interaction of Aggregate Pits and Groundwater Flow



25

Benefits of the GSP

- Ensures long-term sustainability of the Basin
- Evaluates and prepares for climate change
- Protects groundwater-dependent ecosystems
- Protects all groundwater users in the Basin
- Provides for transparent and open Basin management
- Provides for continuing stakeholder input



26

GSP Implementation Schedule

	2022				2023				2024				2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Select GSP Administrator	✓																			
Action 1 – Provide for Collection, Compilation, and Storage of Information Required For Annual Reports and Submit Annual Reports	✓				✓				✓				✓				✓			
Action 2 – Routinely Record Groundwater Levels and Take Action if Necessary	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
Action 3 – Monitor Selected Groundwater Quality Constituents and Coordinate with the Regional Water Quality Control Board	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
Action 4 – Track Trends in Groundwater Levels near Temescal Wash and Take Action as Necessary	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
Action 5 – Review InSAR data on the SGMA Dataviewer During Annual and 5-year Updates	✓				✓				✓				✓				✓			
Project 1 – Investigate Groundwater/Surface Water Interaction at Temescal Wash		→	→	→	→	→	→													
Project 2 – Initiate a Survey of Private Wells			→	→																
Project 3 – Evaluation of the Effects of Aggregate Pits on Groundwater Flow and Quality				→	→	→	→	→	→	→	→									
Prepare 5-Year Evaluation																				✓

27

Open Discussion

- How can you stay involved?
  - Visit our website: www.BedfordColdwaterGSA.com
  - Attend BCGSA Board meetings
  - Provide current contact information for BCGSA updates
  - Contact Victor Harris at 626-840-3592,or: victor@hhwaterresources.com

Thank you for your interest and participation in the Bedford Coldwater Subbasin GSP!

28

BEDFORD COLDWATER
Groundwater Sustainability Authority

BCGSA Stakeholder Survey

Meeting Date: July 15, 2021

Organization or Business Name: _____

Stakeholder Name: _____

Email:_____ **Phone:** _____

Question:	**Response:**
1. Has this presentation increased your knowledge about the Groundwater Sustainability Plan (GSP)?	
2. Do you own or operate a water well in the vicinity of the basin? Do you plan to in the future?	
3. Is the timeline for GSP implementation clear?	
4. Do you have any concerns or suggestions about implementing the GSP in the Bedford-Coldwater Subbasin?	
5. Please note any other comments or questions regarding implementation of the GSP in the Bedford-Coldwater Subbasin or the GSP document itself. *(**Reminder:** written comments are due on the Draft GSP by September 6, 2021. Please email this survey and any addtional comments to **victor@hhwaterresources.com**).*	

How helpful was this meeting in understanding development of the draft GSP for the Bedford-Coldwater Subbasin?

Please circle response: 1 2 3 4 5

Not helpful Neutral Very helpful

Please provide suggestions for improvement of stakeholder outreach:

PROP 1 GOVERNOR EDMUND G. BROWN, JR. WATER BOND 2014

DEPARTMENT OF WATER RESOURCES · STATE OF CALIFORNIA ·

APPENDIX F

Draft GSP Comments and Responses











September 6, 2021

Bedford Coldwater Groundwater Sustainability Authority
c/o Temescal Valley Water District
22646 Temescal Valley Road
Temescal Valley, CA 92883

Submitted via email: victor@hhwaterresources.com

Re: Public Comment Letter for the Bedford-Coldwater Basin Draft GSP

Dear Victor Harris,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Bedford-Coldwater Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Draft Bedford-Coldwater Basin GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,



Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund



J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists



Samantha Arthur
Working Lands Program Director
Audubon California



Danielle V. Dolan
Water Program Director
Local Government Commission



E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy



Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Bedford-Coldwater Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**, due to lack of clarity around tribal lands in the basin. The GSP states that there are no tribal lands in the basin, but includes four tribes in the list of stakeholders presented in Appendix D, Table 1.

The GSP indicates that there are no DACs in the basin (Section 2.1.2). The GSP includes a map of the density of domestic wells in the basin (Figure 2-4). The GSP should be further improved by including a map of individual domestic well locations and by indicating the population dependent on groundwater for their source of drinking water.

The missing elements regarding tribes and domestic wells are required for the GSA to fully understand the specific interests and water demands of these beneficial users, to support the development of water budgets using the best available information, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS

- Describe the occurrence of tribal lands in the basin. If tribes have interests in the basin, describe them in detail.
- Include a map of individual domestic well locations and a table of well data showing screen depths. Indicate the population dependent on groundwater for their source of drinking water.

Interconnected Surface Waters

The identification of Interconnected Surface Water (ISW) is **insufficient**.

The GSP describes the use of aerial photos to analyze stream reaches during the dry season. However, this analysis is insufficient to determine interconnected reaches. The GSP states: “the reach of Temescal Wash that passes through the Bedford-Coldwater Basin does not appear to

gain flow from groundwater seepage into the channel, at least during the dry season. Water levels in wells near the creek further suggest that the water table is usually below the creek bed elevation." Both of these sentences appear to discount the time periods when the stream reaches *may* be interconnected. The regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

Therefore, potential ISWs are not being identified, described, nor managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the basin, with reaches clearly labeled. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.
- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs.
- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the basin's GDEs.

The GSP uses TNC's GDE Pulse Tool to describe trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI), and provided a map of change in NDMI (Figure 4-16) plotted on NC dataset polygons. Additionally, the GSP provides general discussion of riparian vegetation and depth to groundwater. However, the depth to groundwater data was not directly used to verify the NC dataset polygons.

In particular, we found that some mapped features in the NC dataset were improperly disregarded based on the following:

- GDEs were disregarded based on the presence or proximity of surface water. However, partial reliance on surface water does not necessarily prove that the plants and animals do not access groundwater. Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis. Additionally, adverse impacts can occur to GDEs due to pumping that further separates groundwater from surface water.

- Mapped features in the NC dataset were disregarded if Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) data downloaded from GDE Pulse did not correlate with groundwater. This is an incorrect method, since a lack of a relationship does not preclude that groundwater is providing some of the ecosystem's water needs. If the ecosystem is tapping into shallow groundwater then the ecosystem should be categorized as a GDE. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

RECOMMENDATIONS

- Develop and describe a systematic approach for analyzing the basin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained or removed from the NC dataset (and the removal reason if polygons are not considered potential GDEs). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Please provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the basin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Bedford-Coldwater basin). The GSP provides a habitat map of the federally listed bird species gnatcatcher, but this is the only species referenced under the GDE discussion. The GSP mentions the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP), but provides few details.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATION
• State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Stakeholder Outreach Plan included in the GSP (Appendix D). We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public meetings, stakeholder email list, and updates to the GSP website.
- Domestic well owners are specifically mentioned in the Stakeholder Engagement Plan as holders of overlying groundwater rights, however no information is provided other than stating that their participation is invited in the GSP development process.
- The Stakeholder Outreach Plan does not include a plan for continual opportunities for engagement through the implementation phase of the GSP for tribes and environmental stakeholders.

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATIONS

- Include a more detailed and robust Stakeholder Outreach Plan that describes active and targeted outreach to engage domestic well owners, environmental stakeholders, and tribal stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.
- Describe the occurrence of tribal lands in the basin. The GSP states that there are no tribal lands in the basin, but includes four tribes in the list of stakeholders presented in Table 1. If tribes have interests in the basin, describe them in detail.
- Describe efforts to consult and engage with tribes within the basin. Refer to the DWR guidance entitled *Engagement with Tribal Governments* for specifics on how to consult with tribes.[4]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

Disadvantaged Communities and Drinking Water Users

The GSP has aligned the minimum thresholds for contaminants of concern to maximum contaminant levels (MCLs), but has done so by averaging monitored concentrations over a 5-year period and over the entire basin. The TDS water quality minimum threshold basin-wide is defined as 5-year average concentrations not exceeding the 1,000 mg/L Secondary MCL for TDS. The nitrate water quality minimum threshold basin-wide is defined as 5-year average concentrations not exceeding the 10 mg/L drinking water MCL for nitrate as nitrogen. The monitored concentrations are totaled from each well and then divided by the total number of wells to achieve a single value representing average conditions over the entire Basin.

[4] DWR Guidance Document for Engagement with Tribal Governments https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

The GSP acknowledges that the method of averaging concentrations (p. 6-25) "is slightly different than the suggested methods to determine sustainability, [but] the GSA desired a single quantitative value to guide management." Despite this explanation, we still disagree with averaging monitored concentrations over time and space. This is not an adequate methodology since concentrations averaged over 5-years and over the entire basin can not detect impacts to beneficial users of groundwater.

The GSP discounts domestic wells in the setting of SMC, based on the rationale that there are very few private wells in the basin, known private wells are for non-potable use, and responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner. Therefore, potential impacts on all beneficial users of groundwater in the basin have not been considered when defining undesirable results and establishing minimum thresholds.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users within the basin. Further describe the impact of passing the minimum threshold for drinking water users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Set minimum thresholds for degraded water quality that are compared to individually monitored concentrations, not those that are averaged over time or space.
- Describe direct and indirect impacts on drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider domestic water users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[8]
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for TDS and nitrate on drinking water users.
- Provide distinct maps for PFOS, PFOA and sulfate contamination plumes as required in SGMA regulations[9].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP uses 2014-2016 groundwater elevations as minimum thresholds for the depletion of interconnected surface water SMC (using groundwater elevations as proxy). We are concerned that this will not avoid undesirable results to environmental beneficial users. The true impacts to ecosystems under this scenario are not fully discussed in the GSP. If minimum thresholds are set to historic low groundwater levels and the subbasin is allowed to operate just above or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some

[8] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[9] "Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes." [23 CCR §354.16(d)]

drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

The GSP states (p. 6-37) that "undesirable results did occur in the Bedford-Coldwater Basin during the recent drought, because vegetation die-back occurred along about 3.9 miles of the channel, or about 57 percent of the total length of Temescal Wash in the Basin." The basin's ecosystems could be further damaged or even destroyed if groundwater conditions are maintained just above those levels in the long-term, since the subbasin would be permitted to sustain extreme dry conditions over multiple seasons and years.

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. GDEs are discussed only in relation to the depletions of interconnected surface water SMC (using groundwater elevations as proxy for depletions of interconnected surface waters), but not directly for the chronic lowering of groundwater SMC.
- When defining undesirable results for chronic lowering of groundwater levels and depletions of interconnected surface waters, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by groundwater conditions in the subbasin. Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[10] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[11] can be determined.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[12] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the GSP did not consider the 2070 extremely wet and extremely dry climate scenarios in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios

[10] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[11] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[12] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (precipitation, evaporation, and surface water flow) of the projected water budget. Additionally, the sustainable yield is calculated based on the projected pumping for future projections that include climate change. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and domestic well owners.

RECOMMENDATIONS

- Integrate extreme wet and dry scenarios into the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**. Without adequate monitoring and identification of data gaps, beneficial users of groundwater including GDEs, surface water users, and drinking water users will remain unprotected by the GSP. The Plan therefore fails to meet SGMA's requirements for the monitoring network[13]. We recommend the following steps to ensure that the monitoring network is protective of all beneficial users of groundwater.

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of GDEs and domestic wells to clearly identify potentially impacted areas. Ensure that existing and proposed representative monitoring sites adequately cover portions of the basin with GDEs and domestic wells.
- Provide a detailed plan for the investigation of shallow groundwater/surface water interaction at Temescal Wash as discussed in Section 8.6, instead of leaving this for a future project. Reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs.

[13] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. The GSP mentions biological surveys in Section 8.6, but no details are given.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to lack of identification of benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, surface water users, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for all beneficial users.

RECOMMENDATIONS

Because GDEs, aquatic habitats, surface water users, and drinking water users were not sufficiently identified in the GSP, please consider including the following related to potential project and management actions in the GSP:

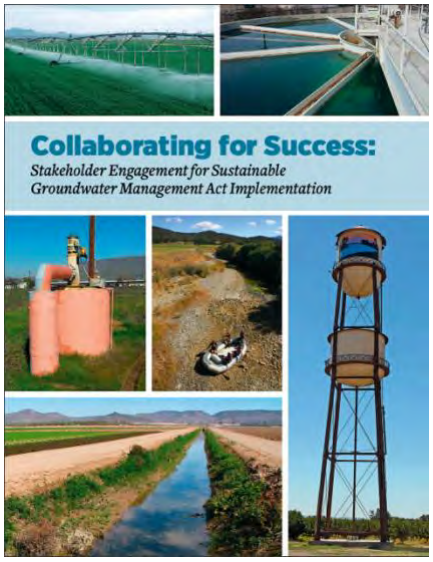
- Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[14].
- For domestic well owners, include discussion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[14] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

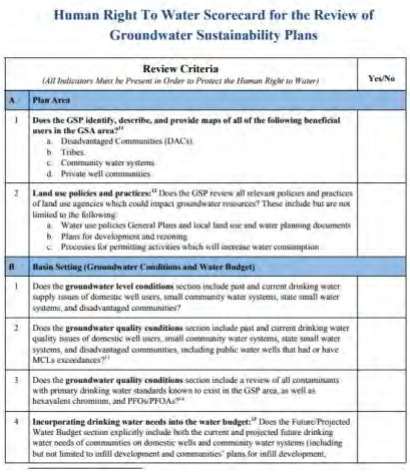
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

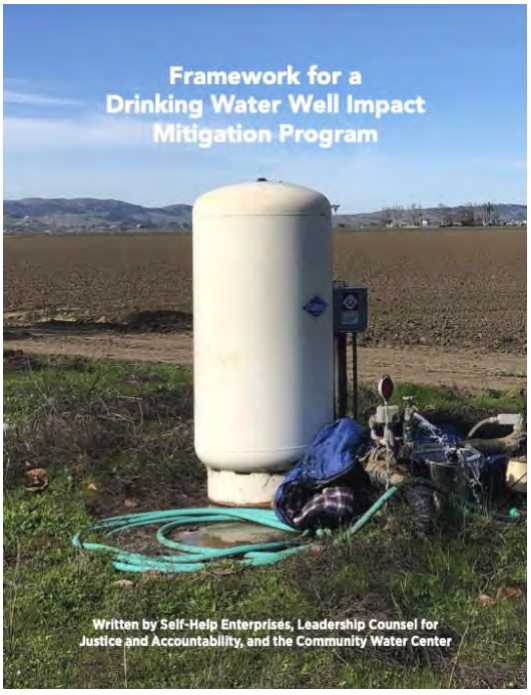


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[43] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems. d. Private well communities.	
2	**Land use policies and practices:**[44] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning. c. Processes for permitting activities which will increase water consumption.	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[45]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[46]	
4	**Incorporating drinking water needs into the water budget:**[47] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

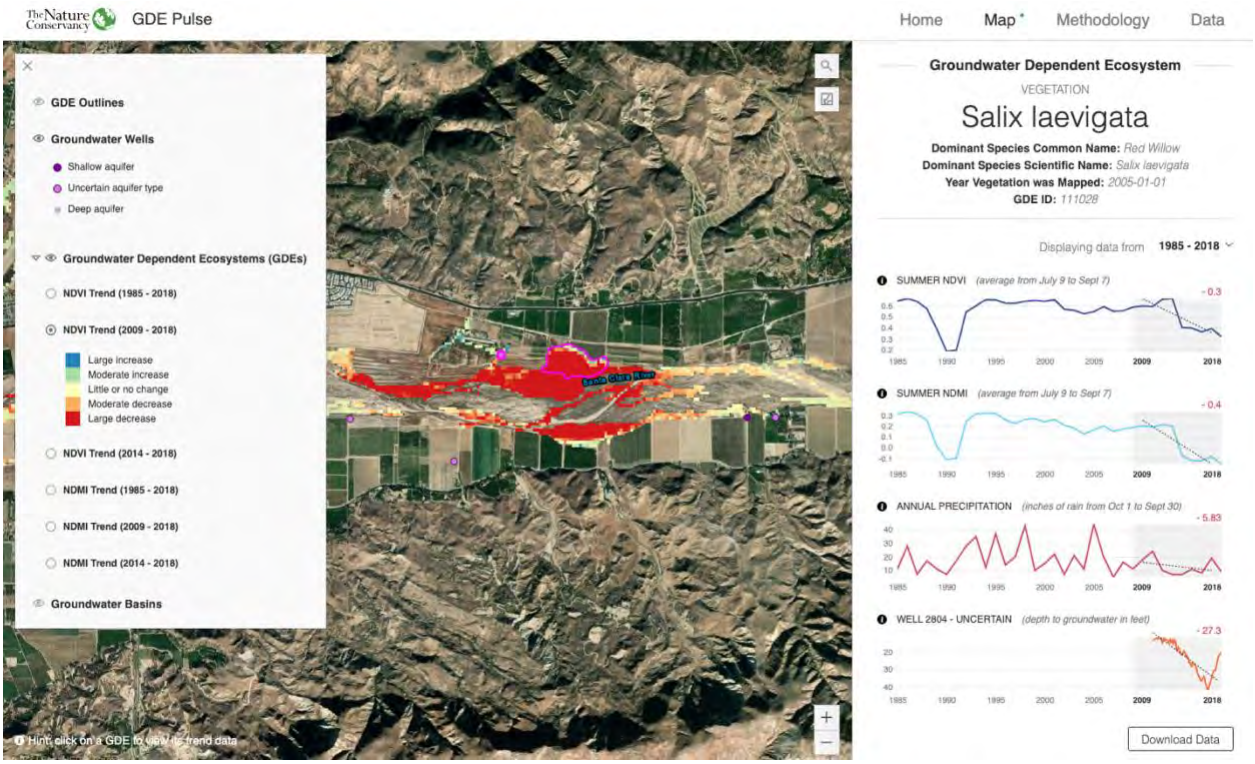
How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

---

[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

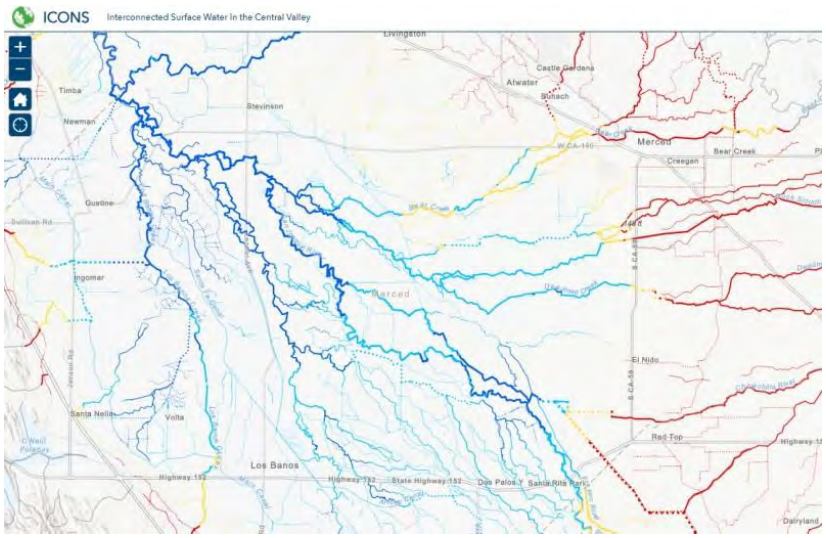
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Bedford-Coldwater Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Bedford-Coldwater Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Anas platyrhynchos	Mallard			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Butorides virescens	Green Heron			
Egretta thula	Snowy Egret			
Himantopus mexicanus	Black-necked Stilt			
Megaceryle alcyon	Belted Kingfisher			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Podilymbus podiceps	Pied-billed Grebe			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
CRUSTACEANS				
Crangonyx spp.	Crangonyx spp.			
Hyalella spp.	Hyalella spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Alotanypus spp.	Alotanypus spp.			
Argia spp.	Argia spp.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Coenagrionidae fam.	Coenagrionidae fam.			
Cricotopus bicinctus				Not on any status lists
Cricotopus trifascia				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Eukiefferiella spp.	Eukiefferiella spp.			
Hetaerina spp.	Hetaerina spp.			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Labrundinia spp.	Labrundinia spp.			
Libellulidae fam.	Libellulidae fam.			
Limnophyes spp.	Limnophyes spp.			
Micrasema spp.	Micrasema spp.			
Microtendipes spp.	Microtendipes spp.			
Nectopsyche spp.	Nectopsyche spp.			
Ochrotrichia spp.	Ochrotrichia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratendipes spp.	Paratendipes spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			

Procladius spp.	Procladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Tanytarsus spp.	Tanytarsus spp.			
Thienemannimyia spp.	Thienemannimyia spp.			
Tinodes spp.	Tinodes spp.			
Tipulidae fam.	Tipulidae fam.			
Tribelos spp.	Tribelos spp.			
Tricorythodes spp.	Tricorythodes spp.			
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Lymnaea spp.	Lymnaea spp.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Planorbidae fam.	Planorbidae fam.			
PLANTS				
Baccharis salicina				Not on any status lists
Cyperus erythrorhizos	Red-root Flatsedge			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists
Phacelia distans	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Pluchea sericea	Arrow-weed			
Rorippa palustris palustris	Bog Yellowcress			
Rumex salicifolius salicifolius	Willow Dock			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Veronica anagallis-aquatica	NA			

Attachment D

July 2019



IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

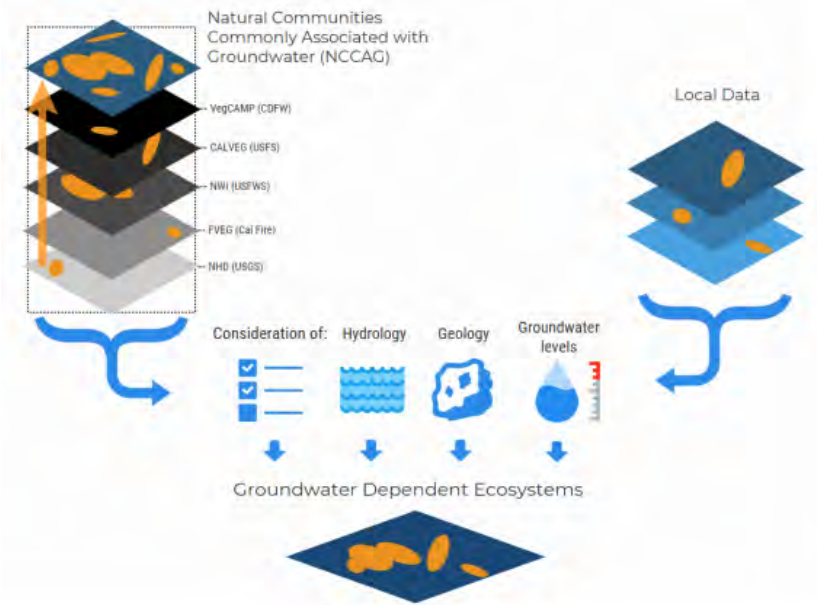


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

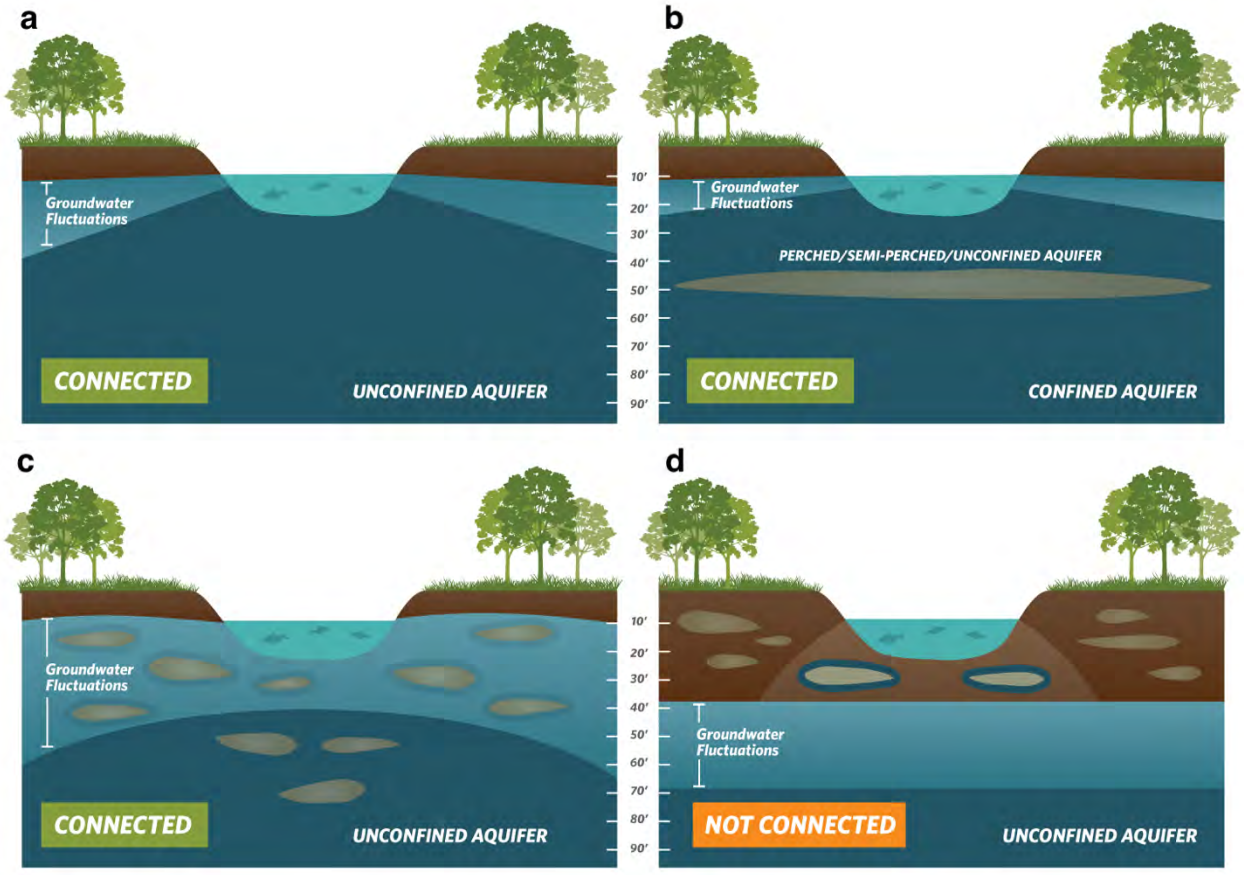


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. (b) Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. Bottom: (c) Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. (d) Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

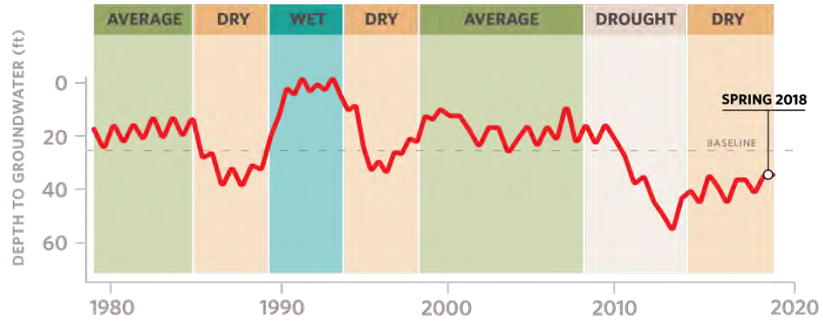


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

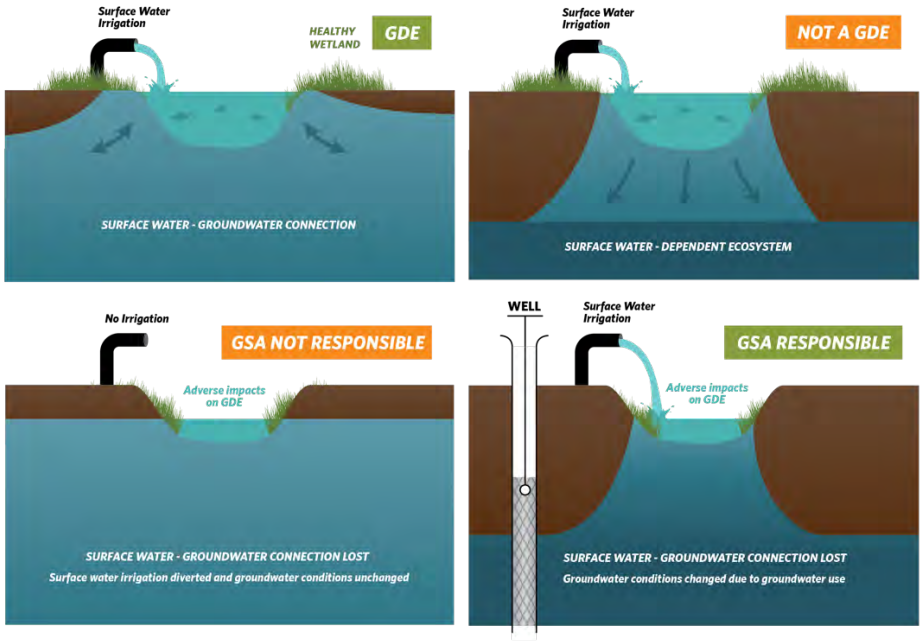


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. (Right) Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. Bottom: (Left) An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. (Right) Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

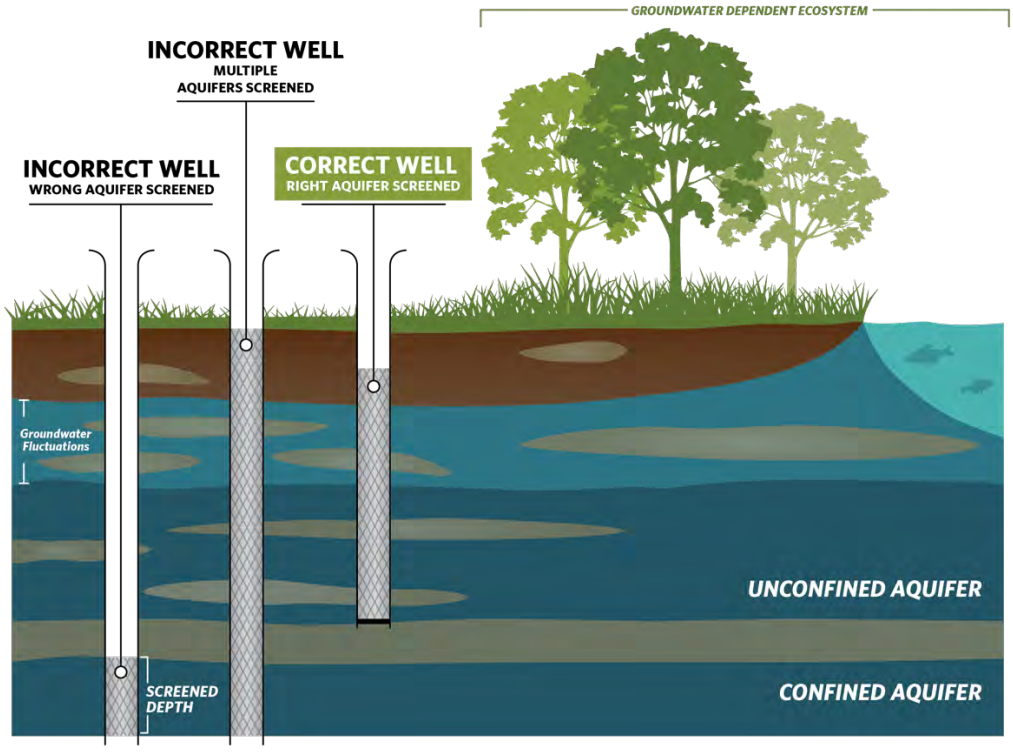


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

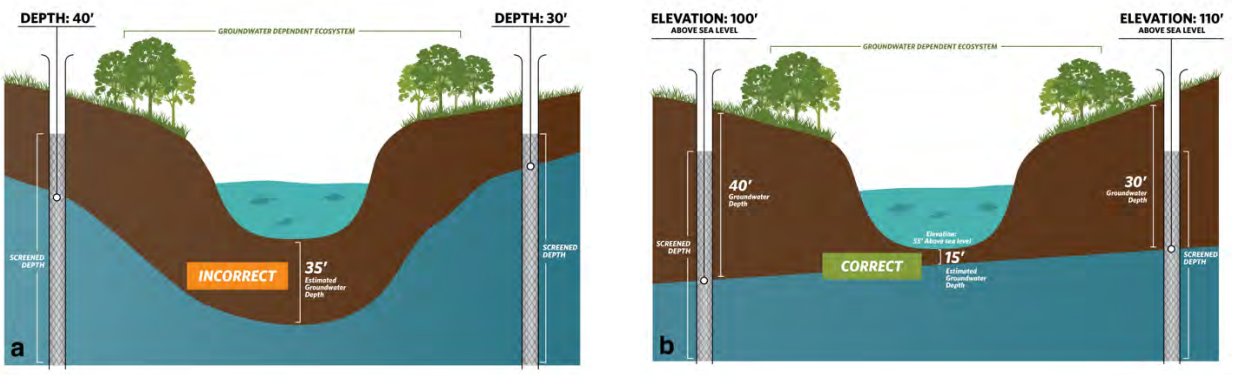


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. (b) Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

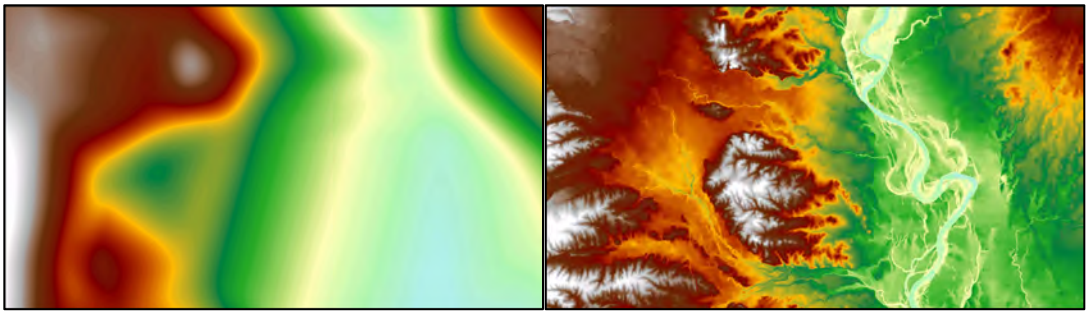


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. (Right) Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network. Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Board Members:
Paul Rodriguez, TVWD
Jacque Casillas, City of Corona
Phil Williams, EVMWD

November 1, 2021

To: Ngoro Atume – Clean Water Action/Clean Water Fund
Dr. J. Pablo Ortiz-Partida – Union of Concerned Scientists
Samantha Arthur – Audubon California
Danielle V. Dolan – Local Government Commission
E.J. Remson – The Nature Conservancy (TNC)
Melissa M. Rohde – The Nature Conservancy
Via email

RE: Public Comment Letter for the Bedford-Coldwater Basin Draft GSP Dated September 6, 2021

The Bedford-Coldwater Groundwater Sustainability Agency (BCGSA) appreciates your thorough review of our Groundwater Sustainability Plan (GSP). Throughout the process, the BCGSA has encouraged and welcomed public input, including the comment letter you submitted September 6, 2021. We have reviewed your comments and are editing the Bedford-Coldwater GSP in response to them. In addition, detailed responses to your comments are provided below. Your September 6 comment letter is attached for reference.

1. Comment: "Beneficial uses and users are not sufficiently considered in GSP development"

Beneficial uses and users have been considered throughout the GSP. We are adding text to Chapter 2 of the GSP to more completely document groundwater users in the Basin.

A. Comment: "Human Right to Water considerations are not sufficiently incorporated."

Disadvantaged Communities, Drinking Water Users, and Tribes

There are no disadvantaged communities (DACS) or tribal lands in the Basin, and the BCGSA believes there are very few active private wells, none of which are used for potable water supply in the Basin. We have clarified and added text in the Executive Summary and Chapters 2, 5 and 6 in response to your comment.

DACs

No DACs or severely disadvantaged communities (SDACs) have been identified in the Basin.

Tribal Lands

The comment takes issue with the statement that there are no tribal lands in the Basin when tribal entities were included in the list of stakeholders. The list of interested parties was developed to encourage public participation from any and all local and regional agencies, entities, and individuals. The list included tribes with land in the region even though they do not have land within the Basin. The BCGSA agencies have a long history of coordination with the regional tribal entities, and they always inform these entities of upcoming planning and/or infrastructure projects. The regional tribal entities take an interest in planning and infrastructure projects within the Basin and surrounding areas because there are important cultural resource sites within these areas. The BCGSA agencies

and regional tribal entities coordinate to assess infrastructure project sites prior to groundbreaking to identify and protect potential cultural resources.

Comment: "The identification of…drinking water users …is not sufficient"
While the BCGSA is aware of a small number of private wells in the Basin, a systematic well inventory identifying all active private wells has not been completed to date. This has been identified as a data gap in the GSP, as described in Section 6.2.7.1. The GSP also includes a project to address this data gap with a survey and inventory of active private wells throughout the Basin (Project 2, Section 8.7). This project was designed to locate and characterize the construction and use of existing private wells so that they can be included in sustainable management of the Basin. The BCGSA solicited information from private well owners during public meetings and through email and postal outreach but received little response.

Comment: "The identification of Interconnected Surface Water (ISW) is insufficient"
The comment claims that brief periods of interconnection can be ecologically significant, and we have not proven that those do not occur.

- If connection is due to surface flow creating losing stream conditions, then the gaged inflows document when surface flow is available that might establish connection. However:
    - Surface inflow from the Lee Lake Management Area in the Elsinore Subbasin is not affected by groundwater management in the Bedford-Coldwater Basin.
    - Any habitat value from those periods results from surface inflow, not groundwater discharge.
- Groundwater discharge is not flashy, the way stream flow is. Thus, although air photos represent only moments in time, they are more likely to detect groundwater discharge than surface flow events.
- Revisiting the Google Earth air photos including wet and dry seasons, we see groundwater emerging into a dry channel starting around the golf course in 2002 to 2004, 2012, and 2018. Throughflow (probably continuous from the Lee Lake Management Area in the Elsinore Subbasin) appeared to happen in 2005 to 2006, November 2009, and June 2012. However:
    - Perennial pools could easily be hidden from view by tree canopy. In the absence of perennial pools, the years with groundwater discharge-supported water in channel are probably too infrequent to support fish. Perennial pools can be important refugia for fish and other aquatic species. A channel survey for pools is needed.
    - The years with throughflow or groundwater discharge to a dry channel were years with significant wastewater discharges from Eastern Municipal Water District and/or Elsinore Valley Municipal Water District (verified by wastewater discharges before 2012 and gaged flow at Lee Lake after 2012). The possible open water in February 2018 upstream of Cajalco Road was the only event in a year without Lee Lake outflow.

The comment from the reviewers does not give examples of aquatic species and life history stages for which brief periods of groundwater-supported flow every few years are "essential".

We discussed the possible existence of aquatic species in the Bedford-Coldwater portion of the Temescal Wash with the Natural Resources Manager of the Riverside County Resource Conservation District and none were identified.

The conclusion "Therefore, potential ISWs are not being identified, described nor managed in the GSP" is an exaggeration. "Potential ISW" is a TNC term, not a Sustainable Groundwater Management Act (SGMA) term. There is extensive description and analysis of surface flow, riparian vegetation, and wetlands in the GSP. The GSP is managing groundwater dependent ecosystems (GDEs) by not allowing depth to water near Temescal Wash to drop more than 35 feet below the ground surface, which is much more restrictive than the water level minimum threshold.

The GSA recognizes that there is limited data on groundwater/surface water interaction and have identified this as a data gap. As noted in Section 8 of the GSP, a management action is described to monitor water levels in the vicinity of Temescal Wash, and a specific project is proposed to gather more information on potential groundwater/surface water interaction (including dedicated monitoring wells) along Temescal Wash.

Comment: "The identification of Groundwater Dependent Ecosystems is insufficient, due to a lack of comprehensive, systematic analysis of the basin's GDWs."

- The comment incorrectly states that some GDEs were disregarded based on the proximity or presence of surface water. This is an incorrect representation of the GSP, which stated that at "wetland" polygons where depth to groundwater is clearly too large to have groundwater discharge, any "wetland" vegetation is likely seasonally supported by rainfall and local ponding of runoff.
- The comment states that the lack of correlation between groundwater levels and normalized difference vegetation index (NDVI) changes is not evidence that NDVI is unrelated to groundwater levels. This fails to explain how an uncorrelated variable can be a causal factor in NDVI.
- The last bullet of "Recommendations" requests a "complete inventory" of fauna and flora in the Basin. The GSP discusses thirteen animal species by name and the five most abundant woody riparian vegetation species by name. All of the species discussed in the MSHCP and USARHCP that historically or presently occur along Temescal Wash were reviewed for potential groundwater dependence. A longer list of species associated with riparian or wetland areas—particularly ones not a focus in the HCPs—would not change the analysis results.
- The last bullet of "Recommendations" incorrectly states that "The GSP mentions the Western Riverside County Multispecies Habitat Conservation Plan but provides few details." In fact, Sections 4.9.4 and 4.9.4.1 each include a full paragraph describing the Multiple Species Habitat Conservation Plan (MSHCP) content that relates to Temescal Wash and the Basin. Also, Section 6.7.2.3 includes a full paragraph describing all species mentioned in the MSHCP whose habitat areas overlap the Basin. Furthermore, the comment neglected to note that the GSP also reviewed and discussed the Upper Santa Ana River Habitat

Conservation Plan (HCP), the Temescal Creek Native Fish Restoration Project, interviews with Resource Conservation District (RCD) staff (two additional long paragraphs in (Section 6.7.2.3), and review of U.S. Fish and Wildlife Service (USFWS) critical habitat maps (Section 4.9.4.1). In summary, the comment grossly mischaracterizes the evaluation of plant and animal species as inadequate when in fact, the consideration of relevant species was ample and the analysis went far beyond simply listing species, which by itself is of little value.

B. Comment: "Public trust resources are not sufficiently considered."

The GSA encouraged stakeholder engagement throughout the GSP process. Outreach efforts included website updates, individual phone calls, email, and postal mail. Domestic well owners were invited to participate but none indicated concern about the development of the GSP. As noted above there are no tribes in the Basin, although tribes in the region were invited to public meetings and consulted for the monitoring well construction project. We are updating our outreach plan to include continuing engagement during GSP implementation.

C. Comment: "Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users are not sufficiently analyzed."

DACs and drinking water users

Aside from the production wells of the BCGSA agencies, there is only one small community water system in the Basin, the Glen Ivy Hot Springs. The Glen Ivy well is regulated as a small community water system and is included in the sustainable management criteria. This well is also included as a monitoring well in the GSP and water levels and quality in the well will continue to be assessed as part of GSP implementation. As indicated in prior responses, there are no DACs or SDACs in the Basin and there are no known private domestic potable wells in the Basin. Project 2 (Section 8.7) will identify all active private wells in the Basin so that they can be included in sustainable management.

Distinct maps for perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and sulfate contamination are unavailable due to lack of available data and not required by SGMA.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The comment letter characterizes the sustainable management criteria (SMC) for interconnected surface water as observed groundwater elevations from the 2014-2016 drought. This is incorrect. The SMC is not defined in terms of historical groundwater elevations during 2014-2016. The minimum threshold (MT) for ISW is very clearly stated in Section 6.7.6:

> "The Minimum Threshold for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in wells near areas supporting phreatophytic riparian trees is greater than 35 feet for a period exceeding one year."

It should be noted that this MT is much more restrictive than the MT for chronic declines in groundwater levels (see GSP Table 6.1).

2. Comment: "Climate change is not sufficiently considered."

The comment states that "the GSP did not consider the 2070 extremely wet and extremely dry climate scenarios in the projected water budget." The comment appears to be referring to two alternative sets of monthly climate multipliers provided in the files of climate change factors downloadable from the SGMA Data Portal. Those sets of factors are labeled Drier/Extreme-Warming (DEW) and Wetter/Moderate-Warming (WMW). There is no requirement to use anything but the expected factors. In fact, the California Department of Water Resources (DWR) document "Guidance for Climate Change Data Use during Groundwater Sustainability Plan Development" does not even mention the alternative data sets. Rather, Section 4.5 of the guidance document states that uncertainty in climate change predictions is represented by inter-annual variability in the 50-year future simulations. It also states that the evaluation of sustainability will be based on the "central tendency" of the climate change factors, which is represented by the primary climate factor data set. The DEW and WMW data sets are for optional research purposes. Therefore, the climate change analysis in the GSP is adequate.

Our interpretation is that DWR is requesting two water budgets only (2030 and 2070) and that "uncertainty" is represented by the interannual variability represented by the 50 years of analysis. In other words, the climate change scenario is itself an expression of uncertainty relative to the future baseline scenario. Also, projects are evaluated on the "central tendency", which is based on the expected climate change factors (the ones used in the GSP climate change analysis). There is no requirement for additional analysis of alternative climate change factor sets such as those identified in the comment.

3. Comment: "Data gaps are not sufficiently identified and the GSP does not have a plan to eliminate them."

Data gaps in the monitoring network have been identified and projects and management actions to address those data gaps are included in the GSP. The existing Project 1 (Section 8.6) has been more clearly defined to include the siting and installation of shallow monitoring wells to eliminate the data gap for interconnected surface water, as described in response 4 below.

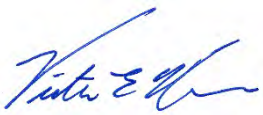
4. Comment: "Projects and Management Actions do not sufficiently consider potential impacts or benefits to beneficial uses and users."

Please see previous responses regarding the identification of beneficial users and uses, including the project already in the GSP to locate all private (including domestic) wells (Project 2, Section 8.7).

Regarding interconnected surface water and GDEs, Project 1 (Section 8.6) was clarified and expanded to add more detail in a phased approach involving well siting and permitting review, followed by construction of shallow monitoring wells along Temescal Wash where possible. A survey for perennial pools along the entire length of Temescal Wash in the Basin will also be conducted. The new wells along Temescal Wash will greatly increase the knowledge of groundwater conditions near the wash, and appropriate reduction in pumping to protect GDEs, if required (Management Action 4).

Once again, thank you for your detailed review of the Bedford-Coldwater GSP. We hope these responses to your comments are helpful.

Sincerely,



Victor Harris
BCGSA Administrator

Attachment: "Public Comment Letter for the Bedford-Coldwater Basin Draft GSP" dated September 6, 2021

APPENDIX G

Bedford-Coldwater GSP Numerical Groundwater Model Documentation Report

BEDFORD COLDWATER
Groundwater Sustainability Authority

BEDFORD-COLDWATER BASIN GROUNDWATER SUSTAINABILITY PLAN

GROUNDWATER MODEL DOCUMENTATION REPORT

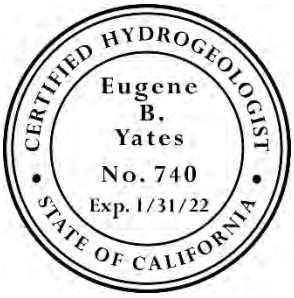
November 2021

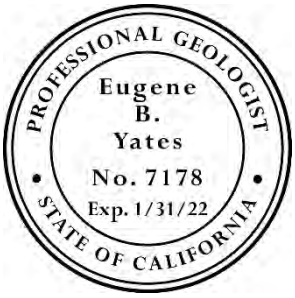
TODD GROUNDWATER

2490 Mariner Square Loop, Suite 215
Alameda, CA 94501
510.747.6920
www.toddgroundwater.com

SIGNATURE PAGE

Katherine White, PE
Senior Hydrologist
Todd Groundwater, Alameda, CA





Michael P. Maley, PG, CHg, CEG, PE
Principal Hydrogeologist
Todd Groundwater, Alameda, CA



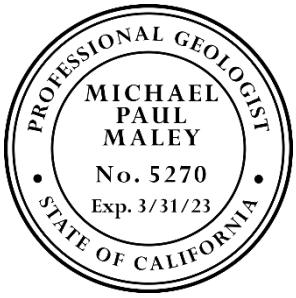


Table of Contents

1. Introduction 1
   1.1. Scope and Objective 1
   1.2. Summary of Previous Models 1
2. Basin Geology and Structure 2
   2.1. Bedford Coldwater Basin 2
      2.1.1. Physiography 2
      2.1.2. Hydrology 2
      2.1.3. Management Areas 2
   2.2. Regional Geology 3
      2.2.1. Geologic Units 3
      2.2.2. Faults 4
      2.2.3. Pull-Apart Basin 4
      2.2.4. Definable Basin Bottom 5
   2.3. Groundwater conditions 5
      2.3.1. Aquifer 5
      2.3.2. Recharge and Discharge Areas 5
      2.3.3. Primary Groundwater Uses 6
3. Rainfall-Runoff-Recharge Model 7
   3.1. Approach 7
   3.2. Land Use and Recharge Zones 8
   3.3. Rainfall 9
   3.4. Interception 9
   3.5. Runoff and Infiltration 9
   3.6. Root Zone Depth and Moisture Content 10
   3.7. Evapotranspiration 11
   3.8. Irrigation 11
   3.9. Deep Percolation from Root Zone to Shallow Groundwater 12
   3.10. Movement of Shallow Groundwater to Deep Recharge and Stream Base Flow 12
   3.11. Evapotranspiration by Riparian Vegetation 13
   3.12. Groundwater Inflow 13
   3.13. Calibration of Rainfall-Runoff-Recharge Model 14
4. Numerical Groundwater Model Development 15
   4.1. General Approach 15
   4.2. Model Setup 15
      4.2.1. Model Code Selection 15
      4.2.2. Base Period 16
      4.2.3. Model Domain and Grid 16
      4.2.4. Model Layers 17
      4.2.5. Faults 18
      4.2.6. Aquifer Conditions 18
   4.3. Boundary Conditions 19
      4.3.1. Surface Recharge 19
      4.3.2. Streams 19
      4.3.3. Mountain Front Recharge 20
      4.3.4. Evapotranspiration 21
      4.3.5. Groundwater Pumping 22

4.3.6. Recycled Water Recharge Ponds 22
4.3.7. Quarries 22
4.3.8. Subsurface Flow with Adjacent Groundwater Basins 23
4.4. Aquifer Properties 24
4.4.1. Aquifer Characteristics 24
4.4.2. Zone Approach 25
4.4.3. Hydraulic Conductivity 25
4.4.4. Vertical Conductance 25
4.4.5. Specific Yield and Specific Storage 26
4.5. Initial Condition 26
5. Historical Model Results 27
5.1. Calibration Methodology 27
5.1.1. Approach 27
5.1.2. Calibration Methodology 27
5.1.3. Primary and Alternative Calibration 28
5.2. Statistical Calibration 29
5.2.1. Primary Calibration Results 29
5.2.2. Alternative Calibration Results 30
5.2.3. Comparison to Previous Model Calibration for Coldwater MA 31
5.3. Groundwater Level Trends 32
5.3.1. Bedford MA Hydrographs 32
5.3.2. Coldwater MA Hydrographs 32
5.4. Evaluation Of Groundwater Flow 34
5.5. Model-Based Hydrologic Budget 35
6. Simulation of Future Conditions 37
6.1. Baseline Scenario 37
6.1.1. Baseline Assumptions 37
6.1.2. Baseline Water Budget Results 38
6.1.3. Baseline Groundwater Flow Evaluation 39
6.2. Growth and Climate Change Scenario 39
6.2.1. Growth and Climate Change Assumptions 39
6.2.2. Growth and Climate Change Scenario Water Budget Results 40
6.2.3. Future Growth and Climate Change Groundwater Map 41
7. SGMA Requirements 43
7.1. Model Data Gaps 43
7.2. Model Accuracy 44
7.3. Limitations to Calibration 44
8. References Cited 46

List of Tables (all tables follow text except where noted)

Table 1 Bedford-Coldwater Basin Land Use (acres) (in Text)
Table 2 Average Annual Groundwater Pumping
Table 3 Aquifer Properties
Table 4 Summary of Primary Calibration for The Bedford-Coldwater Model (in Text)
Table 5 Statistical Calibration by Well

Table 6 Summary of Alternative Calibration for The Bedford-Coldwater Model (in Text)
Table 7 Bedford-Coldwater GW Basin Water Balance (in acre-feet per year) - Historical
Table 8 Bedford MA Water Balance (in acre-feet per year) - Historical
Table 9 Coldwater MA Water Balance (in acre-feet per year) - Historical
Table 10 Change in Groundwater in Storage (in acre-feet per year) - Historical
Table 11 Bedford-Coldwater GW Basin Balance (in acre-feet per year) - Projected Future Baseline
Table 12 Bedford MA Water Balance (in acre-feet per year) - Projected Future Baseline
Table 13 Coldwater MA Water Balance (in acre-feet per year) - Projected Future Baseline
Table 14 Change in Groundwater in Storage (in acre-feet per year) - Projected Future Baseline
Table 15 Bedford-Coldwater GW Basin Water Balance (in acre-feet per year) - Projected Future Growth with Climate
Table 16 Bedford MA Water Balance (in acre-feet per year) - Projected Future Growth with Climate Change
Table 17 Coldwater MA Water Balance (in acre-feet per year) - Projected Future Growth with Climate Change
Table 18 Change in Groundwater in Storage (in acre-feet per year) - Projected Future Growth with Climate Change

List of Figures (all figures follow text)

Figure 1. Location and Topography of Bedford-Coldwater Basin
Figure 2 Local Watersheds that Drain into the Bedford-Coldwater Basin
Figure 3 Schematic Plan View Showing Faulting Associated with Pull-Apart Basins
Figure 4 1990 and 2018 Land Use for Recharge Polygons
Figure 5 Average Annual Rainfall
Figure 6 Relationship of Rainfall to Infiltration
Figure 7 Rainfall to Runoff Calibration
Figure 8 Location of MODFLOW Model Domain
Figure 9 Location of Management Areas
Figure 10 Topographic Elevation of the Top of Model Layer 1
Figure 11 Bottom Elevation Distribution for Model Layer 1
Figure 12 Bottom Elevation Distribution for Model Layer 2
Figure 13 Bottom Elevation Distribution for Model Layer 3
Figure 14 Schematic NW-SE Cross Section to Illustrate Relative Model Layer Thicknesses
Figure 15 Schematic NE-SW Cross Section to Illustrate Relative Model Layer Thicknesses
Figure 16 Location of Faults Included in MODFLOW model
Figure 17 Location of Streams
Figure 18 Distribution of General Head Boundary Used for Mountain Front Recharge
Figure 19 Distribution of Evapotranspiration (ET) Zones
Figure 20 Location of Pumping Wells with Measured Pumping Rates
Figure 21 Locations of Estimated Pumping for Historical Agriculture
Figure 22 Annual Groundwater Pumping Volumes in Basin

Figure 23 Location of Primary Quarry Areas and Wastewater Facilities
Figure 24 Boundary Conditions Applied for Recharge Ponds, Quarries and Subsurface Flow
Figure 25 Distribution of Aquifer Property Zones for Layers 1, 2 and 3
Figure 26 Initial Groundwater Conditions for Layer 2
Figure 27 Location of Monitoring Wells in MODFLOW Model in Bedford MA
Figure 28 Location of Monitoring Wells in MODFLOW Model in Coldwater MA
Figure 29 Scatter Plot Comparing Simulated to Measured Groundwater Levels
Figure 30 Calibration Hydrographs Bedford MA North Temescal Wash Area
Figure 31 Calibration Hydrographs Bedford MA North Temescal Wash Area
Figure 32 Calibration Hydrographs Bedford MA Mid Temescal Wash Area
Figure 33 Calibration Hydrographs Coldwater MA Coldwater Quarry Area
Figure 34 Calibration Hydrographs Coldwater MA Mayhew Quarry Area
Figure 35 Calibration Hydrographs Coldwater MA Other Quarry Area
Figure 36 Calibration Hydrographs Coldwater MA North of Quarry Area
Figure 37 Layer 1 Groundwater Elevations End of Simulation September 2018
Figure 38 Layer 1 Groundwater Elevations Near Highest Levels March 1995
Figure 39 Layer 1 Groundwater Elevations Near Lowest Levels October 2010
Figure 40 Simulated Change in Groundwater in Storage for Historical Simulation
Figure 41 Simulated Groundwater Storage Change for Future Baseline Scenario
Figure 42 Layer 1 Groundwater Elevations Future Baseline Scenario September 2068
Figure 43 2068 Land Use for Recharge Polygons for Future Growth Scenario
Figure 44 Simulated Groundwater Storage Change for Growth-Climate Change Scenario
Figure 45 Layer 1 Groundwater Elevations Future Growth Scenario September 2068

1. INTRODUCTION

The groundwater model was developed to support the Groundwater Sustainability Plan (GSP) for the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin (DWR Groundwater Basin 8-004.02) and is prepared in accordance with Sustainable Groundwater Management Act (SGMA). For convenience, DWR Basin 8-004.02 will be referred to as the Bedford-Coldwater Subbasin (Basin) in this memo.

1.1. SCOPE AND OBJECTIVE

SGMA effectively requires that groundwater modeling be used to demonstrate that a GSP will achieve sustainable basin operation. Various numerical model that has been developed, periodically updated, and used for various scenarios since the 1990s. The objective of this model was to simulate the surface water and groundwater model for the entire Basin that updates key parameters the Basin boundary, discretization, geologic layering, aquifer parameter distribution. The assessment and final model focuses on applicability to SGMA GSP regulations including consistency with DWR Best Management Practices for surface water and groundwater modeling (DWR, 2016). This comprehensive groundwater model serves as a quantitative tool for computing Basin-wide and management area specific water budgets as required by the SGMA GSP regulations.

1.2. SUMMARY OF PREVIOUS MODELS

The Basin Model (Bedford-Coldwater Model) incorporates the hydrologic, geologic and groundwater data to develop a numerical groundwater model to evaluate local water budgets and assess sustainability criteria. An earlier groundwater model was developed for use on the Coldwater Basin Recharge Feasibility Study (MWH, 2004). The Bedford-Coldwater Model builds on earlier data from the 2004 MWH model, and expands the previous model in order to cover the rest of the Basin. This report documents the setup and calibration of the model, including the steps used to process to incorporate this data into the groundwater model.

2. BASIN GEOLOGY AND STRUCTURE

The following summarizes the hydrogeologic conceptual model (HCM) and groundwater conditions from the GSP (see Sections 3 and 4). The HCM and groundwater conditions create a foundation of the technical aspects of the Basin's hydrogeology necessary for model development. This section references figure and text in Sections 3 and 4 of the GSP.

2.1. BEDFORD COLDWATER BASIN

The Basin is a subbasin of the Elsinore Basin and covers approximately 11 square miles in western Riverside County (**Figure 1**). The Basin is located between the Santa Ana Mountains to the west and the Perris Plain on the east. The Basin is separated from the Temescal Subbasin to the northwest by a groundwater divide near Bedford Wash. A jurisdictional boundary separates the Basin with the Elsinore Valley Subbasin to the south. The Basin is thin in some areas, which impedes groundwater flow especially at the northern and southern boundaries.

2.1.1. Physiography

Ground surface elevations along the valley floor are generally flat. Elevations range from approximately 1,000 feet above mean sea level (msl) at the northern boundary to approximately 1,200 feet above msl to the south, as shown by 200-foot contours on **Figure 1**. The tributary watersheds reach up to more than 5,600 feet msl at the highest peak in the Santa Ana Mountain watersheds west of the Basin. Watersheds east of the Basin are significantly lower in elevation and rise only to about 1,800 feet.

Annual precipitation varies from below 12 inches to more than 26 inches over the Study Area. The long-term average annual rainfall is between 12 and 14 inches per year on the Basin floor and increases to more than 20 inches along the top of the local watersheds in the Santa Ana Mountains to the west.

2.1.2. Hydrology

The Basin covers a portion of the Santa Ana River watershed. Main tributaries to the Santa Ana River include Temescal Wash which flows through the Basin from the southeast to northwest and the Bedford Wash flowing toward the northeast along the northern boundary of the Basin. These waterways are ephemeral and are dry much of the year, flowing mainly during the winter. Water enters the basin as surface runoff and subsurface inflow from watersheds draining into the basin. The overall watershed tributary to the Basin was divided into 15 sub-watersheds for the purpose of simulating inflow to the model, as shown on **Figure 2**.

2.1.3. Management Areas

Two management areas have been designated for the Basin. These are:

- Bedford Management Area (Bedford MA) consists of the eastern areas of the Basin including Temescal Wash, and the Bedford area extends from the Elsinore Valley Subbasin to the south to the Temescal Subbasin to the north.
- Coldwater Management Area (Coldwater MA) consists of the western areas of the Basin and is more than 800 feet thick (Todd and AKM, 2008). The Coldwater Area does not share a boundary with either the Elsinore Valley or the Temescal Subbasins.

The Glen Ivy fault separates the Bedford area from the Coldwater area, resulting in differing geology, water use, water quality, and sources of water between the two areas. The fault offsets the aquifer units in the Bedford MA from the units in the Coldwater MA by up to approximately 250 feet (Todd, 2019), with the total basin thickness greater on the west side of the fault (Coldwater MA) relative to the east side of the fault (Bedford MA). These differences serve as the basis for defining two management areas in the Basin for the purpose of facilitating implementation of the GSP. The Bedford and Coldwater MAs will be used in the water budget analysis for the surface water and groundwater modeling results.

The Bedford MA is the area east of the Glen Ivy fault and west of the Estelle Mountain area. Alluvial sediments are up to 500 feet thick in the Bedford MA (Todd and AKM, 2008). Land uses are primarily urban residential and commercial/industrial in the Bedford MA. Temescal Wash flows from the southeast to northwest along the full length of the Bedford MA along the northern boundary of the Basin.

The Coldwater MA is the area located in a deep basin area located west the Glen Ivy fault and east of the Santa Ana Mountains. Alluvial sediments are more than 800 feet thick in the Coldwater MA (Todd and AKM, 2008). The City of Corona and Elsinore Valley Municipal Water District established a production agreement in 2008 to ensure the sustainable use of groundwater in the Coldwater area (EVMWD, 2008). Glen Ivy Hot Springs is a community water system with one well in the Coldwater MA, it is estimated the water system serves 750 people.

2.2. REGIONAL GEOLOGY

The Basin is located within one of the structural blocks of the Peninsular Ranges of Southern California. The Basin occurs in a linear low-lying block, referred to as the Elsinore-Temecula trough, between the Santa Ana Mountains on the west and the Perris Plain on the east (Norris and Webb 1990). The trough extends from Corona to the southeast some 30 miles and was formed along an extensive northwest-southeast trending fault zone including the Elsinore, Chino, and related faults. The Elsinore fault zone, including the Glen Ivy Fault, bound the Basin on the west and trend along the mountain front.

2.2.1. Geologic Units

The Bedford-Coldwater Basin is composed of alluvial fan, recent alluvial along Temescal Wash and older sedimentary rocks. These deposits are sourced from the Santa Ana Mountains to the west of the Basin and the Peninsular Ranges to the east of the Basin. Alluvial deposits along Temescal Wash and local tributaries define the eastern boundary of the Basin. The alluvial fan deposits in the Coldwater area extend into the Bedford area and appear to have been disrupted by faulting (GSP, Section 3, Figure 3-5).

Both older and recent alluvial fans have been deposited along the mountain front on the western edge of the Basin. Although these deposits are relatively thick, the entire unit is heterogeneous. These aquifers from less than 40 feet up to 500 feet in the Bedford area (eastern portion of the Basin) and up to 800 feet in thickness in the deepest portions of the Coldwater area (western portion of the Basin). Alluvial thicknesses tend to increase toward the center of the basin away from the faults (MWH, 2004, Todd and AKM 2008).

Underlying much of the Basin is the Bedford Canyon Formation (a slightly metamorphosed sedimentary formation composed of interlayered argillite, slate, graywacke, conglomeratic graywacke, impure quartzite, and small masses of limestone and quartz-rich metasandstone) and adjacent granitic rocks are the primary source materials for these alluvial deposits. In the northern Bedford area, a variety of

Tertiary sedimentary units crop out including the Silverado (Paleocene), Vaqueros (Miocene), Topanga (Miocene), and Puente (Miocene) formations (GSP, Section 3, Figure 3-5).

These uplands surrounding the Basin are composed principally of granitic, volcanic and older sedimentary rocks of Jurassic and Cretaceous age. The Coldwater MA is surrounded by the metamorphic, volcanic and granitic basement rocks of the Santa Ana Mountains to the south and west. Around the Bedford MA is an area of sedimentary units of Tertiary age that crop out along the mountain front generally lying east of the Glen Ivy Fault within the Elsinore Fault Zone. This zone of sedimentary units broadens to the north and contains numerous mapped formations of Cretaceous and Tertiary age.

2.2.2. Faults

The Glen Ivy Fault is associated with the right lateral strike-slip-dominated Elsinore Fault Zone that extends approximately 200 km from Baja California north to the Corona area. Bedrock faulting in the area largely controls depth to bedrock and the resultant alluvial thickness (MWH, 2004). The units in the Basin are truncated by the Glen Ivy fault that separates the Bedford area from the Coldwater area.

The location and effect of the Glen Ivy fault on the units of the Basin are shown on cross sections presented in GSP Section 3 (Figures 3-6 through 3-8). As shown on these cross sections, the Glen Ivy fault and related faults offset the units approximately by as much as 250 feet. This offset is inferred from well logs that extend to bedrock near the fault. Groundwater flow in the Basin is strongly affected by the Glen Ivy fault (Todd and AKM 2008, WEI 2015b) and the fault appears to be a nearly complete barrier to subsurface flow (MWH, 2004)

2.2.3. Pull-Apart Basin

The Elsinore Fault Zone forms a complex series of pull-apart basins (Morton and Weber 2003). The deep portion of the Basin in the Coldwater MA is one of these pull-apart basins. Pull-apart basins are topographic depressions that form at releasing bends or steps in basement strike-slip fault systems. This initial deposition into the Basin is composed of rapid deposition of landslide and debris flow deposits which are extremely poorly sorted with a mixture of clay, sand, gravel and boulders as seen on the well logs at the lower depths. Since the movement on the faults is right-lateral, the oldest sediments will be located at the lower levels in the northern part of the Basin. As the pull-apart basin forms, progressively younger sediments will be deposited from north to south. Because of this type of deposition, the lower units of the pull-apart basin can be chaotic.

Pull-apart basins are topographic depressions that form at releasing bends or steps in basement strike-slip fault systems. Traditional plan view models of pull-apart basins usually show a rhombic to spindle-shaped depression developed between two parallel master vertical strike-slip fault segments. The basin is bounded longitudinally by a transverse system of oblique-extensional faults, termed “basin sidewall faults” (**Figure 3**). Basins commonly display a length to width ratio of 3:1 (Wu et.al., 2012).

The Coldwater area of the Basin is located within a pull-apart basin between the Glen Ivy fault and the Elsinore Fault Zone located at the base of the Santa Ana Mountains. Based on the geology, the Glen Ivy fault limits deep groundwater flow, resulting in a limitation of the hydraulic connection between the Coldwater ad Bedford areas. At depth, the offset geologic units place the alluvial deposits in the Coldwater area against the Tertiary Bedford Canyon Formation. When groundwater levels in the Coldwater area are low, there is reduced groundwater flow across the fault. This is especially apparent during the recent periods when the groundwater levels in the Coldwater area were especially low. During these low water periods in the Coldwater area, groundwater levels are higher across the fault in

the Bedford area resulting in minor inflows from Bedford into the Coldwater area. This is shown in some recent groundwater level data (GSP Sections 3 and 4). However, at shallower depths, the fault offset is across alluvial deposits. During periods, or areas, when groundwater levels in the Coldwater area are high, groundwater elevation data suggests these areas appear to be well-connected when groundwater elevations in the Basin are high (MWH, 2004, Todd and AKM 2008), indicating more compartmentalization with depth.

2.2.4. Definable Basin Bottom

The Basin bottom is defined by bedrock, which is shallow around the perimeter and deep in the center. Depth to bedrock ranges in depth from 10 feet to over 700 feet (Todd and AKM, 2008 and WEI, 2015b). The depth to the bottom of the alluvial materials in the Basin and the contact with the bedrock bottom of the Basin are shown in the contours presented in GSP, Section 3 (Figures 3-9). Aquifer thickness is greatest in the Coldwater portion of the Basin west of the Glen Ivy fault. Additional cross sections showing these relationships are provided in the GSP, Section 3 (Figures 3-6 through 3-8).

2.3. GROUNDWATER CONDITIONS

Understanding the groundwater conditions is important in development of the surface water and groundwater models. A summary of the discussion of the groundwater conditions and water balance based on the model results is provided in GSP Sections 4 and 5 is provided below.

2.3.1. Aquifer

The Basin is defined by the lateral extents of the alluvial material described above. This material is bounded by bedrock in the Santa Ana Mountain on the west and the Peninsular Ranges to the east. The southern and northern boundaries of the Basin are formed by areas of thin alluvial material over shallow bedrock in narrow valleys (Todd and AKM, 2008 and WEI, 2015b). The northeastern side of the valley is flanked primarily by granitic rocks of Cretaceous age. Erosion of these units has filled in the trough over time resulting in quaternary-age alluvial fan, channel, and other deposits making up the permeable portions of the groundwater Basin (Todd and AKM, 2008). The Basin is thin in some areas, which impedes groundwater flow. This is especially relevant at the northern and southern boundaries of the Basin. With the exception of the Glen Ivy fault described above, there are no other known aquifer characteristics impeding or impacting flow in the Basin.

The Basin aquifer is truncated by the Glen Ivy Fault that separates the Bedford area from the Coldwater area. The location and effect of the Glen Ivy Fault on the units of the Basin are shown on cross sections in GSP, Section 3 (Figures 3-6 through 3-8). As shown on these cross sections, the Glen Ivy Fault offsets the units by up to 250 feet. As noted above, these faults may sometimes impede groundwater flow, backing up groundwater west of the fault within the Coldwater MA and limiting flow into the Bedford MA (Todd 2019). However, there is insufficient groundwater elevation monitoring information to assess the extent of this potential barrier to flow and it is therefore not considered a complete barrier to groundwater flow in the Basin.

2.3.2. Recharge and Discharge Areas

Recharge to the Basin occurs primarily from infiltration of runoff, and to a lesser extent from deep percolation of precipitation and urban return flows, wastewater recharge, and subsurface inflow from outside the Basin. Most of the Basin recharge comes from the infiltration of runoff from precipitation in

the Santa Ana Mountains west of the Basin and the Peninsular Ranges east of the Basin. Large amounts of runoff from the mountains flows into unlined channels and the shallow subsurface at the edges of the Basin and then on into and through the Basin. The amount of water available for recharge varies annually with changes in rainfall and runoff. Runoff into the Basin is subject to evapotranspiration, infiltration, and continued surface flow to and in the Temescal Wash. The watersheds contributing to the Basin include multiple drainages, all of which flow across the Basin in generally east-west orientations. Wet years generate large amounts of water that exceeds the recharge capacity of the Basin (Todd and AKM 2008).

Return flows are those portions of applied water (e.g., landscape irrigation) that are not consumed by evapotranspiration and returned to the groundwater system through deep percolation or infiltration. Return flows associated with urban, industrial, and agricultural water uses all have the potential to contribute to recharge to the Basin (Todd and AKM 2008). Discharge from wastewater treatment and subsurface inflow occur to a limited extent in the Basin. Recharge associated with wastewater is associated with discharge at the wastewater treatment facilities. Subsurface inflow occurs along the Basin boundaries. This is not considered to be a significant source of recharge to the Basin (Todd and AKM 2008).

Sand and gravel mining has been the predominant industrial land use in the southern half of the Coldwater MA, an activity that continues today. Localized sand and gravel operations are also located along Temescal Wash in the Bedford MA. In addition, berms along washes, diversions of surface water, and the presence of large gravel pits enhance groundwater recharge of runoff in Coldwater area (Todd and AKM, 2008).

Discharge from the Basin is almost entirely from groundwater pumping, evapotranspiration, and mining operations. There is some limited discharge across the northern Basin boundary with the Temescal Subbasin, but the thin alluvial material in this area limits the volume and timing of subsurface outflow along this boundary (Todd and AKM, 2008).

2.3.3. Primary Groundwater Uses

The primary groundwater uses in the Basin are municipal pumping, with limited private pumping for small water system, commercial, industrial and residential users. Groundwater use estimates are included in GSP Section 5 (Water Budget). Groundwater in the principal aquifer in the Bedford area is primarily used for non-potable municipal and irrigation water supply. The principal aquifer in the Coldwater area is mostly used for municipal water supply. Most of the pumping in this area is from wells owned and operated by the BCGSA agencies, with some additional pumping by small community water system and small commercial users. There has historically also been non-potable pumping in this area to support agricultural, recreational, small residential, and industrial water uses.

Gravel operations in the Coldwater MA extract water for industrial use to support sand and gravel mining. Their pumping amounts have ranged from about 100 AFY to 300 AFY, except for a period of increased production from 1975 through 1980 when production averaged about 450 AFY (Todd and AKM 2008).

3. RAINFALL-RUNOFF-RECHARGE MODEL

A rainfall-runoff-recharge model developed by Todd Groundwater was used to prepare estimates of groundwater recharge from rainfall, irrigation, bedrock inflow, and pipe leaks. It also generated the estimates of groundwater use for agricultural irrigation and flows in ungauged streams tributary to or within the basin. Several commercially available software programs were used to prepare model input and evaluate model output, such as Microsoft Excel and ArcGIS. Finally, the rainfall-runoff-recharge model and several pre-processing utility programs were developed in the Fortran 90 programming language by Todd Groundwater.

3.1. APPROACH

The rainfall-runoff-recharge model is built around a soil moisture balance of the root zone, which is simulated continuously using daily time steps for the 29-year calibration period. Numerous variables are involved in the physical processes of rainfall, interception, runoff, infiltration, root zone soil moisture storage, evapotranspiration, irrigation, shallow groundwater storage, recharge of deeper regional aquifers from shallow groundwater, and lateral flow of shallow groundwater into streams. Accordingly, the groundwater basin and tributary watersheds were divided into small recharge zones over which the most influential variables were relatively homogeneous. The daily water balance was then simulated for each zone, and the results aggregated geographically to cells in the groundwater model grid and temporally to the model stress periods.

The rainfall-runoff-recharge model provides several benefits to the groundwater modeling effort:

- It represents the hydrological processes with governing equations that reflect the actual physical processes, at least in a simplified way. This allows sensitivity or suspected errors to be traced to specific assumptions and processes.
- It enforces the principle of conservation of mass on the recharge and stream flow values. Beginning with rainfall, all water mass is accounted for as it moves through the hydrological system.
- It allows additional data sets to be included in model calibration. In tributary watersheds with gauged stream flow data, measured flows can be compared with simulated flows, which consist of the sum of direct runoff and shallow-groundwater seepage to streams. Simulated irrigation frequency can be compared with actual grower practices, and applied irrigation amounts can be compared with water delivery data recorded by the District. Simulated urban irrigation amounts can be compared with seasonal variations in measured urban water use, which are primarily related to urban irrigation.
- It provides estimates of stream flow in ungauged tributary streams, as well as runoff from valley floor areas within the active model domain.
- It provides estimates of inflow from bedrock and/or upland areas adjacent to the active model domain and constrains the amounts of inflow according to the water balance for each tributary watershed.
- It simulates the effects of runoff from impervious surfaces in urban areas, either to storm drainage systems or to adjacent pervious soils.
- It simulates changes in land use over the 29-year calibration period and the resulting changes in recharge and irrigation demand.

- It combines and parses all of these flows—plus estimated recharge from leaky water and sewer pipes—into recharge values by model cell and stress period in the format required by MODFLOW.

The following sections describe the input data sets and the assumptions and governing equations used to simulate each hydrologic process included in the rainfall-runoff-recharge model.

3.2. LAND USE AND RECHARGE ZONES

Recharge zones were developed by intersecting and editing numerous maps in GIS. The starting point was a map of the Bedford-Coldwater Basin and the boundaries of all surrounding watersheds that flow into it. The Basin area was divided into the Bedford MA and Coldwater MA. The Basin and tributary watersheds were then divided into numerous polygons reflecting land use as of 1990 and changes in land use since then. Land use was delineated into 13 categories based on DWR land use maps for Riverside County from 1993 and 2000, a statewide crop map developed by LandIQ for DWR in 2014 and Google Earth historical aerial imagery available for 1990-2018. The primary change in land use has been urbanization of undeveloped (natural vegetation) areas. Polygons were delineated to represent the locations of changes in land use so that a single, fixed set of polygons could accurately represent the evolution of land use by changing the use type of a polygon beginning in the year that land use changed. Additional divisions of polygons were made on the basis of soil texture, annual rainfall and watershed. This resulted in a total of 224 polygons ranging in size from 2 to 4,529 acres. A map of the zones and their land uses in 1990 and 2018 is shown in **Figure 4.**

Land use in each zone was assigned to one of thirteen categories. The only agricultural crop in the Basin is citrus, which occupied about 1,900 acres in 1990 and was almost entirely converted to residential during the 1990s. Natural land cover categories are grassland, shrubs/trees, dense riparian, sparse riparian and open water. Developed land uses are residential, low-density residential, turf, commercial, industrial, quarry and vacant. The natural and developed land uses were mapped by inspection of Google Earth aerial photography. The categories are listed in **Table 1** along with their total acreages in 1990, 2018 and 2068 (estimated) in the groundwater basin management areas and tributary watersheds.

Table 1. Bedford-Coldwater Basin Land Use (acres)

	Bedford Area			Coldwater Area			Tributary Watersheds		
Land Use	1990	2018	2068	1990	2018	2068	1990	2018	2068
Citrus	1,242	0	0	677	32	32	0	0	0
Grassland	1,700	1,454	385	171	87	33	16,703	16,429	16,174
Shrubs/Trees	226	110	30	173	138	82	13,777	13,693	13,693
Dense riparian	217	120	120	8	27	27	0	0	0
Sparse riparian	291	291	291	0	0	0	0	0	0
Open water	0	0	0	0	0	0	0	0	0
Low-density residential	159	175	132	66	88	88	0	0	0
Residential	179	1,023	2,255	76	405	547	0	94	327
Turf	7	225	288	0	170	226	0	85	107
Commercial	0	30	528	24	33	50	0	0	0
Industrial	232	469	469	0	0	0	0	0	0
Quarry	295	204	104	441	588	0	365	555	555
Vacant	648	1,030	494	38	105	0	0	0	0

Each land use category is further divided into irrigated, non-irrigated and impervious subareas. These are not explicitly mapped but are expressed as percentages of total zone area. Based on examination of aerial photographs and historical water use patterns, the percent impervious cover in urban land use areas was estimated to be 15 percent for low-density residential, 45 percent for residential, 70 percent for commercial and 80 percent for industrial. The corresponding percent irrigated area for those categories was estimated to be 14, 18, 10 and 0 percent, respectively.

3.3. RAINFALL

The distribution of average annual rainfall over the basin and tributary watersheds was obtained from PRISM climate modeling (http://www.prism.oregonstate.edu/). Each recharge zone was assigned an average annual rainfall value based on its location, as shown in **Figure 5**.

The surface hydrology model requires daily rainfall as one of two transient inputs. Daily rainfall for the Elsinore station was used for this purpose, with missing values supplied by correlation with rainfall at the Riverside Fire Station and Claremont-Pomona Stations, both of which also have long periods of record. Daily rainfall for each recharge zone was calculated as Elsinore daily rainfall multiplied by the ratio of zonal average-annual rainfall to Elsinore average-annual rainfall.

3.4. INTERCEPTION

Plant leaves intercept some of the rain that falls from the sky, and the amount is roughly proportional to the total leaf area of the vegetation canopy. The estimated interception on each day of rain ranged from zero for industrial, idle and vacant land uses, to 0.03 inch for turf and 0.06 inch for trees in full leaf. These estimates were inferred from published results of interception studies (Viessman and others, 1977). For each day of the simulation, rainfall reaching the land surface (throughfall) is calculated as rainfall minus interception. Interception storage is assumed to completely evaporate each day and is not carried over from one day to the next.

3.5. RUNOFF AND INFILTRATION

Most throughfall infiltrates into the soil, but direct runoff occurs when net rainfall exceeds a certain threshold. The threshold at which runoff commences and the percent of additional rainfall that runs off are significantly influenced by a number of variables, including soil texture, soil compaction, leaf litter, ground slope, and antecedent moisture. These factors can be highly variable within a recharge zone, and data are not normally available for them. Also, the intercept and slope of the rainfall-runoff relationship depend on the time increment of analysis. Most analytical equations for infiltration and runoff apply to spatial scales of a few square meters over periods of minutes to hours (Viessman and others, 1977). They are suitable for detailed analysis of individual storm events. The curve number approach to estimating runoff also applies to single, large storm events. It is not suitable for continuous simulation of runoff over the complete range of rainfall intensities (Van Mullen and others, 2002). The approach used in the rainfall-runoff-recharge model is similar but less complex than the approach used in popular watershed models such as HSPF (Bicknell and others, 1997).

In the rainfall-runoff-recharge model, daily infiltration is simulated as a three-segment linear function of throughfall, and throughfall in excess of infiltration is assumed to become runoff. The general shape of the relationship of daily infiltration to daily net rainfall is shown in **Figure 6** (upper graph). Below a specified runoff threshold, all daily throughfall is assumed to infiltrate. Above that amount, a fixed percentage of throughfall is assumed to infiltrate, which is the slope of the second segment of the

infiltration function. Finally, an upper limit is imposed that represents the maximum infiltration capacity of the soil. The runoff threshold, the percentage of excess net rainfall that infiltrates, and the maximum daily infiltration capacity were assumed to vary by land use and were among the variables adjusted for model calibration. The runoff threshold ranged from 0.2 inches per day (in/d) for unpaved areas in industrial and commercial zones to 1.0 in/d for turf and natural vegetation areas. The infiltration percentage for excess rainfall ranged from 60 percent in commercial and industrial areas to 94 percent in areas of natural vegetation. The maximum daily infiltration was set to 2.5 in/d in upland tributary areas and 4 in/d for zones overlying the Basin. These values were selected on the basis of calibration, although results were not very sensitive to this parameter.

The above parameter values are for soils that are relatively dry. Infiltration rates decrease as soils become more saturated. This phenomenon led to the development of the Antecedent Runoff Condition adjustment factor for rainfall-runoff equations (Rawls and others, 1993). However, application of the concept has been focused on individual storm events. For the purpose of the rainfall-runoff-recharge model, the adjustment provides a means of simulating empirical observations that a given amount of rainfall produces less runoff at the beginning of the rainy season when soils are relatively dry than at the end of the rainy season when soils are relatively wet. This effect is included in the recharge model as a multiplier that decreases the estimated infiltration as soil saturation increases. This multiplier is applied to the runoff threshold, the infiltration slope and the maximum infiltration rate. The multiplier decreases from 1.0 when the soil is dry to a user-selected value between 1.0 and 0.60 when the soil is fully saturated (lower graph in **Figure 6**). A low value has the effect of decreasing infiltration (and potential groundwater recharge) toward the end of the rainy season or in very wet years, and also to increase simulated peak runoff during large storm events. The multiplier under saturated conditions was assumed to be 0.75 for the Bedford-Coldwater rainfall-runoff-recharge model.

Runoff from impervious surfaces was assumed to equal 100 percent of rainfall. Runoff that flows into a storm drain system (known as “connected impervious runoff”) contributes to stream flow but not groundwater recharge. However, runoff from some impervious surfaces flows onto adjacent areas of pervious soils (“disconnected impervious runoff”). The surface hydrology model treats this type of runoff as if it were a large increment of additional rainfall where it flows over or ponds on the pervious soils. The excess water can quickly saturate the soil and initiate deep percolation. The model incorporates this process by means of a variable representing the fraction of impervious runoff that becomes deep percolation. Data and literature values are not available for this variable. It was estimated to be 20 percent in residential, commercial and industrial areas and 80 percent in low-density residential areas.

3.6. ROOT ZONE DEPTH AND MOISTURE CONTENT

The storage capacity of the root zone equals the product of the vegetation root depth and the available water capacity of the soil. The available water capacity for each recharge zone was a depth-weighted average for the dominant soil type, as reported in the soil survey (Natural Resources Conservation Service, 2015). Root depth is a complex variable. Except for cropland, vegetation cover typically consists of a mix of species with different root depths. At a very local scale, roots are deepest directly beneath a plant and shallower between plants. Root density and water extraction also typically decrease with depth within the root zone. To complicate matters, root depth is somewhat facultative for some plants, which means that roots will tend to grow deeper in soils with low available water capacity, such as sands. Finally, root depth in upland watershed areas can be restricted by shallow bedrock.

The root depth selected for each recharge zone essentially represents an average of all these factors. Simulated recharge and stream base flow are both quite sensitive to vegetation root depth, and values were adjusted during the joint calibration of the rainfall-runoff-recharge model and the groundwater flow model. Separate root depths were specified for irrigated and non-irrigated vegetation in each recharge zone. Root depths for turf and crops were required to be the same in all zones. In upland watersheds root depth can be affected by the depth to bedrock, which is often shallow. Outflow from individual tributaries flowing into the basin is not gaged, and uniform rooting depths for grass and shrubs/trees were used throughout all of the watersheds.

3.7. EVAPOTRANSPIRATION

Evapotranspiration is affected by meteorologic conditions, plant type, plant maturity, and soil moisture availability. All of these factors are included in the rainfall-runoff-recharge model. The evaporative demand created by meteorological conditions is represented by reference evapotranspiration (ETo). Numerous equations have been developed over the years relating ETo to solar radiation, air temperature, relative humidity and wind speed. For the purposes of this study, daily values of ETo were obtained from a microclimate station in Temecula (about 20 miles south of the Basin) that is part of the California Irrigation Management Information System (CIMIS) network.

Vegetation factors are lumped into multipliers called crop coefficients. Reference ET is the amount of water evapotranspired from a broad expanse of turf mowed to a height of 4-6 inches with ample irrigation. ETo is multiplied by a crop coefficient to obtain the actual ET of a different crop or vegetation type at a particular stage in its growth and development. Although primarily used for agricultural crops, crop coefficients can also be applied to urban landscape plants and natural vegetation. The only agricultural crop in the Basin is citrus trees, which have a crop coefficient that ranges from 0.5 in winter to 0.91 in mid-summer (U.N. Food and Agriculture Organization, 2006). Irrigated landscaping was assumed to consist primarily of turf, for which a crop coefficient of 0.8 was used in all months (Snyder and others, 2007). Non-irrigated natural grassland consists of annual grasses that go dormant in summer once soil moisture has been depleted. A crop coefficient of 1.0 was assigned in all months, but actual ET decreases to zero as the grasses lower soil moisture to the wilting point in summer. Natural shrubs/trees were assigned a crop coefficient of 0.8 year-round. Those perennial species have deeper roots and do not tend to fully deplete root zone soil moisture during a single dry season (Blaney and others, 1963). Many riparian phreatophytes are deciduous, and a crop coefficient of 0.75 was assigned for winter months to reflect a reduced leaf area index. Their tall stature and linear distribution within an arid landscape raises the crop coefficient in summer months, and a coefficient of 1.10 was assigned to reflect those factors.

3.8. IRRIGATION

Evapotranspiration gradually depletes soil moisture, and for irrigated areas the rainfall-runoff-recharge model triggers an irrigation event whenever soil moisture falls below a specified threshold. The amount of applied irrigation water is equal to the volume required to refill soil moisture storage to field capacity, divided by the assumed irrigation efficiency. An irrigation threshold equal to 70 percent of maximum soil moisture storage was used for citrus, and a threshold of 0.8 was used for urban landscaping. This variable primarily affects the frequency of irrigation; a higher threshold results in more frequent irrigation but approximately the same total amount of water applied annually. Ten percent of water applied to citrus was assumed to percolate past the root zone, and 15 percent was assumed for urban irrigation. This reflects nonuniformity of applied water, such as uneven overlap of sprinkler spray areas.

There are additional sources of irrigation inefficiency, such as evaporation of sprinkler spray mist and sprinkler overspray or runoff onto impervious surfaces in urban areas. Thus, total irrigation efficiency is less than 90 percent for citrus and 85 percent for urban landscaping. Total efficiency was used to estimate applied water, but only the deep percolation component was used to estimate deep percolation. Urban irrigation in the Basin is supplied by municipal water purveyors, and irrigation use is included in their metered deliveries. The rainfall-runoff-recharge model was only used to estimate groundwater pumping for citrus irrigation.

Because irrigation is assumed to completely refill soil moisture storage and is less than 100 percent efficient, simulated soil moisture exceeds capacity immediately following an irrigation event. The excess is assumed to become deep percolation beneath the root zone.

3.9. DEEP PERCOLATION FROM ROOT ZONE TO SHALLOW GROUNDWATER

The surface hydrology model updates soil moisture storage each day to reflect inflows and outflows. Rainfall infiltration and applied irrigation water are added to the ending storage of the previous day, and ET is subtracted. If the resulting soil moisture storage exceeds the root zone storage capacity, all of the excess is assumed to percolate down from the root zone to shallow groundwater on that day. In modeling parlance, this is known as a “bathtub model”; vertical unsaturated flow and preferential flow through cracks and root tubes in the soil are not considered.

3.10. MOVEMENT OF SHALLOW GROUNDWATER TO DEEP RECHARGE AND STREAM BASE FLOW

A shallow groundwater storage component may not be part of all groundwater systems, but its presence is sometimes indicated by groundwater hydrographs and stream base flow. In upland watersheds, for example, the shallow groundwater reservoir is what supplies base flow to streams. Without it, simulated stream flow consists of large flows occurring only on rainy days. Physically, it represents the overall permeability and storage capacity of deep soil horizons and bedrock fractures beneath hillsides bordering a gaining stream. It allows the integration of shallow and deep, fast and slow flow paths between the point of rainfall infiltration and the stream. In valley floor areas with flat terrain and deep deposits of unconsolidated basin fill, the presence of a shallow groundwater system is sometimes evident in a lack of response of deep well hydrographs to rainfall recharge events or even wet versus dry years. The shallow zone in that case attenuates the pulses of recharge percolating beneath the root zone into a relatively steady recharge flux, and there may be little outflow to streams.

In the surface hydrology model, the only inflow to shallow groundwater storage is deep percolation from the root zone. There are two outflows: laterally to a nearby creek and downward to the regional groundwater flow system. Outflow to streams is specified as a certain percentage of current groundwater storage, which results in a first-order logarithmic recession of stream base flow, consistent with gaged stream flows. Outflow to the regional groundwater system is simulated as a constant downward flux. This is consistent with flow across confining layers in which the vertical head gradient is near unity. Both outflows are calculated and subtracted from shallow groundwater storage each day. They continue until the storage has been exhausted, resuming whenever a new influx of deep percolation from the root zone arrives. There is no assumed maximum capacity of shallow groundwater storage.

The two parameters defining shallow groundwater flow are the recession constant for flow to streams and the constant downward flow rate for deep recharge. Both of these are obtained by calibration. The

recession constant can generally be calibrated by matching simulated to measured stream base flow in gaged watersheds. The deep recharge rate can be used to adjust the long-term partitioning of shallow groundwater mass into base flow versus recharge.

The shallow groundwater component of the surface hydrology model is simple but adequate to capture the fundamental behaviors of logarithmic stream base flow recession and attenuated deep recharge. Other watershed models invoke more complex systems of storage and flow to simulate these processes. For example, the Precipitation and Runoff Modeling System (PRMS) developed by the U.S. Geological Survey includes a total of seven storage components between the point where a raindrop reaches the ground and the stream into which it ultimately flows (Markstrom and others, 2015). This larger number of components and parameters enables relatively detailed matching of observed stream flow hydrographs but is unnecessarily complex for the purposes of groundwater modeling.

3.11. EVAPOTRANSPIRATION BY RIPARIAN VEGETATION

In locations where the water table is shallow, some plants (phreatophytes) can extract water directly from the water table to meet evaporative demand. The rainfall-runoff-recharge model was used to estimate the amount that would be drawn from the water table if a shallow water table were present. The potential use of groundwater by phreatophytes was assumed to equal the ET demand of the vegetation minus the amount that could be supplied by soil moisture. In practice, this was accomplished by temporarily simulating the vegetation as if it were irrigated using the rainfall-runoff-recharge model, then using the simulated irrigation rates as the maximum rate of withdrawal by roots from the water table. This rate of groundwater use is thought to decrease with increasing depth to the water table because fewer shrub and tree roots are able to reach the water table and the energetics of withdrawing the water become less favorable. The use of groundwater decreases from the maximum rate when the water table is at the land surface to zero when the water table is 15 feet or more below the ground surface. These calculations are applied at model cells where aerial photographs indicate the presence of dense, lush riparian vegetation, which is a sign of phreatophytic water use. These calculations were also made using the MODFLOW evapotranspiration (EVT) module.

3.12. GROUNDWATER INFLOW

Groundwater inflow into the basin from adjacent uplands—also called mountain front recharge—is difficult to estimate. If the basin is bounded by igneous or metamorphic rocks with very limited groundwater flow through fractures, it can be reasonable to assume that inflow from bedrock is negligibly small. If the bedrock is fractured, the total amount of inflow across the long “no-flow” boundaries on the east and west sides of the Basin can be cumulatively significant. Subsurface inflow across those boundaries was estimated using the rainfall-runoff-model results for the tributary watersheds. By this method, the estimates must be consistent with conservation of mass in the watersheds; that is, with the estimates of rainfall, ET, and surface outflow. The resulting estimates are still highly uncertain, however, because groundwater outflow from the watersheds—and surface outflow, too, for that matter—are both small compared to the two largest flows in the watershed water balances: rainfall and evapotranspiration. Thus, a small error in the estimate of either of those flows can result in a large error in groundwater outflow.

Ultimately, groundwater flows produced by the rainfall-runoff-recharge model were calibrated based on their effects on simulated groundwater levels at nearby wells within the basin and on the simulated amount of stream base flow exiting the watersheds. The initial groundwater inflow estimates were generally too high. The estimates were lowered primarily by increasing the estimated root depth of

natural vegetation in the watersheds, which is highly uncertain due to the effects of shallow bedrock on rooting depth.

Groundwater inflow from tributary watersheds was smoothed over time to reflect attenuation of recharge pulses that occur during wet months and wet years as they gradually flow through long, relatively slow flow pathways. Smoothing was accomplished by a moving average of simulated groundwater recharge in the tributary areas over the preceding 2-10 years. This range represents local variability that was indicated by rates of recession in stream base flow and groundwater levels near the basin boundary during prolonged droughts. The final estimate of average annual groundwater inflow during the calibration period was 5,400-7,200 AFY under normal climatic conditions.

3.13. CALIBRATION OF RAINFALL-RUNOFF-RECHARGE MODEL

Parameters in the rainfall-runoff-recharge model were jointly calibrated with the groundwater model. The total amount of dispersed recharge and annual variations in recharge influence simulated groundwater levels, and parameters in the rainfall-runoff-recharge model were adjusted to improve the fit between measured and simulated groundwater hydrographs. The rainfall-runoff-recharge model was also calibrated based on a comparison of measured and simulated daily stream flow at two gage locations: Coldwater Canyon Creek and Temescal Wash at the Lee Lake dam. Coldwater Canyon Creek flows into the adjacent Bedford-Coldwater Basin and is the only gaged stream draining the eastern slopes of the Santa Ana Mountains. Characteristics and model parameters for that watershed were assumed to also apply to similar watersheds along the western edge of the Basin. Unfortunately, the gage began operation in 2019, which is after the 1990-2018 model simulation period. Nevertheless, the general pattern of flow peaks and base flow recession simulated in prior years was similar to the gaged pattern in 2019-2020, as shown in **Figure 7**.

4. NUMERICAL GROUNDWATER MODEL DEVELOPMENT

The numerical model incorporated the hydrogeological data from the basin and hydrologic model and is capable of simulating historical and future conditions. The following section describes the development of each of the components in the MODFLOW model.

4.1. GENERAL APPROACH

The Bedford-Coldwater Model is a numerical groundwater model, which is a mathematical description of the hydrogeological conceptual model (Bear and Verruijt, 1987). The advantage of a numerical model is that, once in a mathematical format, the model quantitatively combines data on basin geometry, aquifer properties, recharge, and discharge to simulate changes in groundwater elevations and calculate the water balance over time.

The Bedford-Coldwater Model is setup to represent the physical features that influence groundwater flow including the geology, hydrology and climate. Each of these features is mapped onto a model grid that represents the vertical and horizontal distribution of parameters over the Basin based on the hydrogeological conceptual model. The parameters can also be varied through time over a defined base period to represent seasonal variations in precipitation, streamflow and groundwater pumping. A more detailed discussion of how each of these parameters was developed and entered into the Bedford-Coldwater Model is summarized below.

- Model Setup - representation of the physical groundwater basin
- Boundary Conditions – representation of the inflows and outflows from outside of the model
- Aquifer Properties – representation of the flow characteristics of the aquifer
- Initial Conditions – representation of groundwater conditions prior to the model period

The model development was focused on the HCM with emphasis on defining boundary conditions and flow paths. Aquifer parameters were assigned on a subregional basis within each MA and varied by model layer to represent reasonable aquifer properties for the geologic unit being simulated.

4.2. MODEL SETUP

The model also incorporates spatial distribution of the physical features of the Basin and the temporal distribution of time-varying parameters such as precipitation and recharge. The following describes the basic components required to construct a numerical model.

4.2.1. Model Code Selection

The model setup utilizes the MODFLOW modeling code developed by the United States Geological Survey (USGS). The Bedford-Coldwater Model uses MODFLOW-NWT (Niswonger *et al*, 2011), which is a standalone version of MODFLOW-2005 (Harbaugh, 2005) that includes an advanced mathematical solver that provides a more robust solution to complex conditions such as rewetting of dry model cells, unconfined conditions and groundwater-surface water interactions. These features improve the ability of the Model to evaluate complex groundwater-surface water interactions, potential conjunctive use, and other projects to increase future groundwater levels in the Basin.

4.2.2. Base Period

The update Bedford-Coldwater Model is setup using water years that run from October through to the following September to capture the cause and effect relationship on groundwater levels of wintertime rain and subsequent summertime groundwater pumping. The model simulates the 29-year base period from October 1989 through September 2018 to represent Water Years (WY) 1990 through 2018. This retains the starting date of prior models, which coincides with the beginning of some key data sets and also the beginning of the period of rapid land use conversion from agricultural to urban. The ending year is the most recent year for which all necessary model input data were available. The 29-year simulation period is desirable for model calibration purposes because it includes a wide range of hydrologic and water use conditions, including wet periods, droughts, changes in groundwater pumping and implementation of lake management measures.

To simulate this base period, the model is subdivided into time intervals termed stress periods. For each water year, monthly stress periods were defined to provide the ability of the model to evaluate temporal at a monthly scale. For the base period, a total of 348 stress periods were defined. Time-dependent parameters, such as groundwater pumping or precipitation recharge, are assigned to for each stress period.

Conditions during the stress period are constant, but parameters can be varied from stress period to stress period. A stress period can be subdivided into shorter time periods, or timesteps, to allow for more temporal resolution within each stress period to help with model convergence. For the Bedford-Coldwater Model, each stress period was simulated using three (3) timesteps. MODFLOW calculates the groundwater elevations and water balance for each time step. The model results provide the groundwater elevations for the final timestep of each stress period, and the summation of the water balance changes for all timesteps for each stress period.

4.2.3. Model Domain and Grid

MODFLOW requires the application of a rectangular grid that encompasses the entire area, or domain, that will be modeled. The model grid forms the mathematical framework for the model. Each grid cell has to be populated with aquifer properties. Physical features such as streams and wells are mapped onto the model grid. Using this information, the MODFLOW model calculates a groundwater elevation at each model grid cell for each timestep. The density of model grid cells is what defines the resolution of the model in resolving drawdown and other hydrologic effects.

The Basin covers about 11 square miles of the Santa Ana River Watershed that underlies the Elsinore Valley in western Riverside County. The extent of the model domain for the Bedford-Coldwater Model is shown on **Figure 8**. The Basin has two management areas that are defined within the model domain for water budget zone budgets (**Figure 9**). These include:

- **Bedford Management Area (Bedford MA)** occupies roughly the eastern two-thirds of the Basin. It is separated from the Coldwater MA by the Glen Ivy Fault, which is a partial barrier to groundwater flow. The Bedford MA connects to the Elsinore Subbasin in the south and the Temescal Basin at the north end of the Basin.,
- **Coldwater Management Area (Coldwater MA)** is the part of the Basin west of the Glen Ivy Fault. Because of downward movement on that side of the fault, Basin thickness is much greater than in the Bedford MA. A large open-pit mine is located in the southern part of this MA. Several streams enter the Coldwater MA from watersheds on the eastern slopes of the Santa Ana Mountains.

The Bedford-Coldwater Model consists of 250 rows, 365 columns and 3 layers. The rows and columns have a uniform spacing of 100 feet. Each 100-foot square represents a model cell. MODFLOW calculates one groundwater level for the center point of each grid cell for each timestep. The total number of grid cells in the Bedford-Coldwater Model is 273,750 cells, of which 87,882 are active cells where MODFLOW calculates a groundwater levels. The active areas represent the area within the groundwater basin where groundwater elevations are simulated.

Areas outside of the Basin are represented as no-flow cells where MODFLOW does not perform calculations. The high percentage of no-flow cells in the model grid is due to both the elongate shape of the Basin, the inclusion of narrow watersheds off of the main Basin, and because the distribution of active cells varies from layer to layer. The bottom of the lowest model layer is a no-flow boundary condition, representing the older bedrock formations that are assumed to be relatively impermeable.

4.2.4. Model Layers

The model layers represent the geologic the geologic units that compose the Principal Aquifer of the Basin based on the geology and HCM presented in summarized in **Section 2**. Model layers provide vertical resolution for the model to simulate variations in groundwater elevation, aquifer stresses, and water quality with depth. The model layers are based on an evaluation of the following data sets:

- Surficial geology,
- Faulting,
- Lithologic borehole logs.
- Well construction logs, and
- Previously completed local hydrogeologic conceptualizations and cross sections.

This information was collected and translated into a unified GIS compatible database structure for cross section construction and geographic evaluation. This approach allows any hydrostratigraphic structures relevant to groundwater flow in the Basin to be easily translated from GIS for use in other formats.

For the Bedford-Coldwater Model, three model layers were defined to simulate hydrogeologic character of the primary water-bearing sediments within the groundwater basin. The model layers are numbered from 1 through 3 from top to bottom. The top of Model Layer 1 represents the topography that is based on topographic elevation points every 10 meters were extracted from the National Elevation Dataset (http://ned.usgs.gov) throughout the model domain **Figure 10**.

The model layers represent the geologic units within each of the hydrologic areas. **Figures 11 through 13** show the areal extent and thickness of each of the model layers over the entire model domain. **Figures 14 and 15** show cross sections of the model grid along row 127 and column 230, respectively, to illustrate the shapes and relative thicknesses of the layers. The following provides a summary of the geologic units represented by each model layer in accordance with the HCM for the three hydrologic areas.

In the Bedford MA, three model layers were defined that represent the following geologic units:

- Model Layer 1 – Temescal Wash alluvium and shallow soils
- Model Layer 2 – Tertiary sedimentary units primarily the Bedford Canyon Formation
- Model Layer 3 - Weathered bedrock

The alluvium along Temescal Wash is the primary water supply unit in the Bedford MA (Todd and AKM 2008) where the larger wells are completed. The alluvial deposits are a mix of interlayered gravels, sands, silts, and clays resulting from alluvial fan and fluvial processes. Model Layer 1 ranges up to 80 feet

thick along the Temescal Wash. Alluvial aquifer materials are present in other parts of this hydrologic area, but their extent and production capacity are uncertain. In these areas, Model Layer 1 represents a relatively thin layer, with a minimum thickness of five feet, that overlies the Bedford Canyon Formation that is rarely saturated.

Model Layer 2 represent the Bedford Canyon Formation that is composed of alternating slate and fine-grained sandstone, underlies alluvial deposits in this hydrologic area and is generally less than 200 feet deep (Todd and AKM 2008). It is reported to have limited groundwater production potential (Todd and AKM 2008). The bottom of Model Layer 2 is defined based on depth to bedrock data in the Bedford MA that ranges from 25 feet to approximately 500 feet (Todd and AKM 2008). Model Layer 3 represents the weathered and fractured bedrock formations underlying Model Layer 2. These basement rocks have limited produce significant groundwater except in fractures (Todd and AKM 2008).

In the Coldwater MA for the areas outside of the deep basin area that are upgradient of the Wildomar and Glen Ivy Faults, three model layers were defined that represent the following geologic units:

- Model Layer 1 – Coldwater Basin alluvial fill sediments.
- Model Layer 2 - Older Alluvial deposits
- Model Layer 3 - Weathered Bedrock

The alluvium (both young and old) that fills the deep basin in the Coldwater Basin, represented by Model Layers 1 and 2, forms the majority of the Basin aquifer. These alluvial deposits may be more than 800 feet thick locally and are composed of interfingered gravels, sands, silts, and clays (MWH 2004, Todd and AKM 2008). Groundwater is generally unconfined in these aquifer units.

Model Layer 3 represents the weathered and fractured bedrock formations underlying Model Layer 2. Domestic wells competed along the margins and along the narrow canyons that extend from the main part of the groundwater basin are completed in weathered bedrock. Model Layer 3 is represented by a uniform thickness of 75 feet in the weathered bedrock based on well logs of domestic wells along the basin margin.

4.2.5. Faults

The Basin is dominated by the Glen Ivy Fault zone that forms a partial barriers to groundwater flow in the between the Bedford and Coldwater MAs based on water level differences and on analysis of sources of groundwater recharge across the fault (MWH 2004, Todd and AKM 2008). The location of the faults applied for the Bedford-Coldwater Model are shown on **Figure 16**. For the Bedford-Coldwater Model, all faults extended across Model Layers 1 through 3.

The faults were simulated using the Horizontal Flow Boundary (HFB) Package in MODFLOW that allows by defining a conductance parameter to be placed between adjacent model cells that can act to limit groundwater flow. All of the faults were simulated as a 10-foot wide zone. The lowest fault hydraulic conductivities were applied for the faults bordering the Back Basin where the hydraulic conductivity ranged from 0.0001 to 0.00001 ft/d. The fault hydraulic conductivities were based on an initial estimate that was refined during model calibration.

4.2.6. Aquifer Conditions

Groundwater conditions for each model layer can be defined as unconfined, fully-confined, or convertible between confined and unconfined based on the relation of the simulated groundwater level to the top of the model layer. Unconfined conditions exist when groundwater levels are below the top

of the physical aquifer layer whereas confined conditions exist when groundwater levels are above the top of the physical aquifer layer. For the Bedford-Coldwater Model, Model Layer 1 is defined as unconfined. Model Layers 2 and 3 are defined as convertible between confined and unconfined conditions.

Because of the historical changes in groundwater levels, areas within the Basin can be temporarily unsaturated. Prior MODFLOW versions set a dewatered cell to a no-flow condition for the rest of the simulation if the cell is dewatered. An important advantage of using MODFLOW-NWT compared to previous MODFLOW versions is that groundwater heads will be calculated for dry cells, whereas standard MODFLOW excludes these calculations (Niswonger et. al., 2011). This resaturation capability of MODFLOW-NWT was utilized for the Bedford-Coldwater Model.

In MODFLOW-NWT, cells can be reset to active using the rewetting option without setting a dewatered cell to no flow condition. MODFLOW-NWT will calculate a head in a dry cell while not allowing water to flow out of a dry cell that provides a continuous solution for groundwater flow. Inflow to a dry cell, either from adjacent cells, overlying cells, or an external source simulated by one of the stress packages, automatically flows downward to an underlying cell if there are deeper layers. A cell with head below the cell bottom has no water in storage, so changes in storage also are zero for these cells. The model accounts for this situation by setting the storage coefficient for a dry cell to zero. This allows for the continuous solution of head not to affect the overall water balance results (Niswonger et. al., 2011).

Because groundwater heads are calculated for dry cells using this approach, it is necessary for the model user to interpret the head in a cell relative to the cell bottom. If the head in a cell is at or below the cell-bottom altitude, then the water table is not contained within this cell (Niswonger et. al., 2011).

4.3. BOUNDARY CONDITIONS

Model boundary conditions represent the hydrologic budget by simulating where groundwater enters and exits the basin. Boundary condition data must be entered for each stress period at each model grid cell where a boundary condition is defined in the model. MODFLOW NWT provides a number of boundary condition options to numerically represent the different physical processes included in the hydrologic budget. The physical distribution and volumes of groundwater inflow and outflow for each budget component needs to be accounted for geographically within the model domain. A discussion of each boundary condition of the groundwater budget is provided below.

4.3.1. Surface Recharge

The surface recharge includes the contributions from precipitation and return flows within the Bedford-Coldwater Model. The surface recharge is applied using zones that are defined by the geology and land use. Surface recharge is applied using the MODFLOW recharge package and using the methods outlined below. This summary discusses implementation of surface recharge into the Bedford-Coldwater Model.

4.3.2. Streams

The groundwater model dynamically simulates groundwater recharge from stream percolation and groundwater discharge into streams. Percolation from streams is a function of stream flow and—where the water table is equal to or higher than the stream bed elevation—the difference in water level between the creek and water table.

The MODFLOW stream flow routing (SFR2) package is used to simulate these processes. Each stream in the basin is simulated as a sequence of reaches, each of which is a model grid cell along the alignment of the channel. Flow is specified at the upstream end of each stream segment and routed down the reaches, with flow to or from the aquifer calculated on the basis of wetted channel area, channel bed hydraulic conductivity and the difference in elevation between the stream surface and the simulated groundwater level at that reach. By this means conservation of mass is applied concurrently to the stream and the aquifer. Streams can dry up completely as they cross the basin; and conversely, groundwater discharge can create stream flow in a segment that is dry farther upstream. The stream flow routing module allows for a network of channel segments, with multiple inflows or diversions at the start of each segment.

The Bedford-Coldwater Model includes a network of 43 stream segments containing a total of 1,363 stream reaches (**Figure 17**). Twenty-two segments are used to simulate eleven streams that drain watersheds in the Santa Ana Mountains along the west side of the Basin. Streams that flow across the Coldwater MA onto the Bedford MA where they connect up with Temescal Wash are divided into multiple segments to represent varying underlying geologic conditions. Temescal Wash is composed of thirteen segments that represent reaches along Temescal Wash. Five segments represent the short sections of five streams that drain watersheds in the Estelle Mountain and other upland areas east of Temescal Wash. Three segments represent internal drainage within the Basin the receive valley floor runoff in the northern Bedford MA.

In general, most stream reaches are more than 20 feet above the water table and are not hydraulically coupled to groundwater. Percolation from those reaches is independent of groundwater levels and not affected by pumping. Reaches where groundwater appears to be hydraulically coupled to surface water primarily include most of the length of Temescal Wash, and the lower ends of some larger tributaries as they approach the wash. All streams in the Coldwater MA are detached from the groundwater except for limited areas in the small canyons along the western basin margin.

Stream bed permeability was estimated by model calibration. Calibrated values ranged from 0.1 to 1.0 feet per day (ft/d). The relationships of stream width and depth to stream flow were divided into two categories. For small tributary streams, the relationships were patterned after measured data at the Coldwater Canyon gage. Inflows for Temescal Wash are coordinated with output from the Elsinore Valley numerical model and the USGS gauge located downstream of Lee Lake just south of the basin boundary with the Basin.

To develop estimates of surface and subsurface inflows from these tributary areas to the groundwater basin, a rainfall-runoff-recharge model is used to simulate the entire watershed tributary to the Basin. This model simulates all near-surface hydrologic processes, including rainfall, runoff, infiltration, evapotranspiration, effects of impervious areas and irrigation, soil moisture storage and percolation to stream base flow and deep groundwater recharge. The calculated runoff is included in the SFR2 Package.

4.3.3. Mountain Front Recharge

Groundwater inflow into the basin from adjacent uplands—also called mountain front recharge—were calculated by the rainfall-runoff-recharge model (see Section 3). Mountain front recharge represents subsurface inflow of groundwater from the low-permeability rocks adjacent from the surrounding watershed to the groundwater Basin. the MODFLOW General Head Boundary (GHB) package was applied along the basin margin in Model Layer 3 which represents the weathered bedrock. The distribution of the GHB cells is shown on **Figure 18.**

The GHB package is a head dependent boundary condition; therefore, the amount of groundwater flowing into or out of this boundary was influenced by the relative hydraulic gradient between the basin and the boundary condition. To have the GHB package input the bedrock inflows determined by the rainfall-runoff-recharge model (see Section 3), the GHB was set up to act as a rate limited flux boundary. To do this, the reference head was a considerable distance away (one mile) from the recharge location, so it is well above the groundwater levels in the model. The conductance and elevation terms for the GHB package were back-calculated to get the appropriate flux. By setting the head at distance, the variability due to the changing heads in the groundwater model produces a variation of 1 to 2 percent in the GHB flux compared to the rainfall-runoff-recharge model values. The advantage of this approach is that the bedrock inflow can more easily be distributed to a large number of cells along the basin margin to maintain simulation stability. In addition, this approach allows the Bedford-Coldwater Model to simulate a consistent groundwater gradient flowing away from the margins to be consistent with the HCM.

4.3.4. Evapotranspiration

Evapotranspiration (ET) represents groundwater outflow from evaporation to the atmosphere and uptake by plants from the saturated zone. This is distinct from ET associated with soil moisture before it reaches the groundwater aquifer that is sustained by the total available precipitation not accounted for by runoff or recharge (see Section 3).

The MODFLOW Evapotranspiration (EVT) package is used simulate ET directly from the groundwater aquifer. ET is defined over the entire model domain; however, ET only occurs in areas of shallow groundwater. In the Basin, this is generally limited to riparian areas adjacent to streams. ET includes uptake from both phreatophytes (plants that require groundwater) and mesophytes (plants that can utilize groundwater) either directly from the saturated zone or from the overlying capillary fringe (Meinzer, 1927; Robinson, 1958; and Lewis and Burgy, 1964). ET from the capillary fringe is replenished with groundwater from the underlying aquifer, so it is also considered a loss of groundwater (Lubczynski, 2011).

The MODFLOW EVT package that the ET rate decreases with increasing depth to the water table because fewer shrub and tree roots are able to reach the water table and the energetics of withdrawing the water become less favorable. In the groundwater model, the consumptive use of groundwater due to ET decreases from the maximum rate when the water table is at the land surface and diminishes linearly down to zero when the water table reaches the extinction depth for that location.

In the Bedford-Coldwater Model, three ET zones were defined as shown on **Figure 19**. The first zone represents locations where aerial photographs indicate the presence of dense, lush riparian vegetation indicates areas of shallow groundwater where the plants (phreatophytes) can regularly uptake water directly from the water table to meet evaporative demand. These occur along the Temescal Wash and in the upper portions of some of the canyons along the basin margin. The extinction depth for these locations was set at 15 feet below the ground surface. Over most of the remaining model domain, the extinction depth was set at 7.5 feet to represent the vegetation in these areas. The third area represents areas where quarry lakes exist where the extinction depth was set at 3.0 feet to represent evaporation off of ponded water that periodically exists in these quarry areas. ET rates applied in the Bedford-Coldwater Model use the ET data from the rainfall-runoff-recharge model (see Section 3).

4.3.5. Groundwater Pumping

Groundwater pumpage is the most significant groundwater outflow component for the basin. Groundwater users in the Basin are required to report their pumping to Western Municipal Water District, which is one of several agencies responsible for administering adjudication decrees in the Upper Santa Ana River Watershed area. Thirty-eight wells within the Basin produced groundwater in one or more years during 1990-2018, and the reported annual pumping amounts were obtained from WMWD. **Figure 20** shows the locations of pumping in the Basin. Locations of agricultural pumping are distributed based on the estimated agriculture pumping requirements calculated using the rainfall-runoff model (**Figure 21**).

Annual production by all of the wells generally increased from 1990 to about 1999; however, from 2000 through 2007 annual production stabilized at about have the 1990-1999 rates, as shown in **Figure 22**. All pumping wells are included as analytical elements that are simulated by the MODFLOW well package in the model. **Table 2** presents the overall trend in average annual groundwater pumping over time along with the assigned model layer for each well. In 2008, the City of Corona and Elsinore Valley Water District came to an agreement to limit groundwater pumping

The citrus groves in the Basin were presumed to be irrigated by groundwater, although that pumping does not appear to be included in the WMWD production records. The amount of irrigation was estimated using the rainfall-runoff-recharge model and was assigned to hypothetical well locations at the center of each citrus recharge polygon. Some rural residences might be served by on-site domestic wells. The amount of pumping at those wells is assumed to be negligibly small in the context of the overall groundwater budget. Small domestic wells are not included in the WMWD database and are not included in the model.

4.3.6. Recycled Water Recharge Ponds

Reclaimed wastewater is percolated in ponds at the TVWD Water Reclamation Facility (WRF) (**Figure 23**). However, most of the reclaimed water is recycled for irrigation. Annual or monthly data describing the partitioning of reclaimed water into irrigation, pond percolation and discharge to Temescal Wash were obtained from TVWD and the City of Corona.

Discharges from the TVWD Water Reclamation Facility (WRF) to Temescal wash were discontinued in 2013. All of the plant outflow is recycled for irrigation during spring, summer, and fall (assumed April through November), and most or all of it is percolated in ponds at the WRF when irrigation demand is low (December through March). In recent years more of the outflow from the TVWD WRF has been percolated in ponds than has been recycled for irrigation. This proportion was assumed to reverse, such that all outflow would be recycled for irrigation during April through November and all would be percolated in ponds during November through March.

The MODFLOW Well Package was used to simulate recharge at the WRF recharge ponds. The wells were simulated as recharge wells. The volume of flow was distributed evenly over the area of the ponds. Prior to 2008, the recycled water recharge was applied to recharge located just south of the TVWD WRF. Starting 2008, recycled water recharge was applied to new recharge ponds located just north of the TVWD WRF. The simulated recharge locations are shown on **Figure 24**.

4.3.7. Quarries

Sand and gravel mining has been the predominant industrial land use in the southern half of the Coldwater MA, an activity that continues today. Localized sand and gravel operations are also located

along Temescal Wash in the Bedford MA (**Figure 23**). In addition, berms along washes, diversions of surface water, and the presence of large gravel pits enhance groundwater recharge of runoff in Coldwater area (Todd and AKM, 2008).

Discharge from the Coldwater MA quarry operations is from groundwater pumping, evapotranspiration, and other mining operations (MWH, 2004, Todd and AKM 2008). Losses also occur when the sand and gravel from the gravel pits, which contains groundwater used for washing, is transported from the Coldwater Basin. The estimated losses from gravel operations range from about 300 acre-feet per year (ft/yr to more than 900 acre-ft/yr (MWH, 2004). The average losses are approximately 700 acre-ft/yr (MWH, 2004). Quarry outflows were simulated using a combination of the EVT and Drain Packages. The ET rate and drain conductance were varied during model calibration to simulate the average annual losses from the MWH (2004) report that are listed above. The location of the boundary conditions for the Coldwater MA quarry operations are shown on **Figure 24**.

Quarry recharge represents inflows of surface water into existing quarries where it is allowed to recharge into the groundwater. In the Coldwater MA, streamflow from Mayhew Creek and some other smaller streams are directed into existing quarry areas where the water is contained and allowed to percolate. Coldwater Creek has been redirected around an existing quarry. Although Coldwater Creek is not currently directed into a quarry, there have been historic instances where flood flows have gone into the quarries, especially prior to 2005. A portion of the estimated streamflow from the rainfall-runoff-recharge model for each stream is recharged to groundwater at the quarry location. This recharge from streamflow directed into the quarries is simulated using the MODFLOW well package. A portion of the monthly streamflow assigned from the rainfall-runoff model was moved from the SFR2 Package to the Well Package to simulate quarry inflow recharge.

In the Bedford area, the Mobile Sand quarry located just north of the Temescal WRF is open to potential outflows to Temescal Wash. To estimate groundwater outflows from the quarry pit during high groundwater levels, the MODFLOW model applies a boundary condition based on the observed water level in the pit to estimate the volume of quarry outflow. This is a head-dependent boundary condition that is able to calculate either quarry recharge or outflow based on groundwater conditions. This was simulated using the MODFLOW river package. Since we can estimate the water surface based on topography, the River Package can allow the quarry pit ponds to alternative from recharge to discharge based on monthly hydrologic conditions.

Quarry recharge in the Bedford MA is from streamflow from Brown and McBride Creeks flow into the Mobile Sand quarry located just north of the TVWD WRF. In addition, streamflow from Temescal Wash can flow into the quarry location especially during high and flood flows. The quarry pit at this location is below the water table and is consistently flooded. To estimate the recharge, the MODFLOW model applies a boundary condition based on the observed water level in the pit to estimate the volume of quarry recharge. Similar to the Coldwater MA quarry recharge, recharge from streamflow directed into the quarries is simulated using the MODFLOW well package. A portion of the monthly streamflow assigned from the rainfall-runoff model was moved from the SFR2 Package to the Well Package to simulate quarry inflow recharge.

4.3.8. Subsurface Flow with Adjacent Groundwater Basins

To simulate potential subsurface groundwater and outflow with adjacent groundwater basins, a specified head boundary was defined using the MODFLOW constant head package. Constant head boundaries allow sufficient inflow or outflow at that model cell to achieve the specified head. Where the

Basin adjoins the Elsinore Valley and Temescal Basins, at the north and south ends of the model respectively, represent a very small percentage of the overall perimeter of the Basin.

Along the Elsinore Subbasin boundary, a constant head boundaries were set along a limited length of the boundary near Temescal Wash and another unnamed stream (**Figure 24**). The constant head along Temescal Wash was set at 1046.5 feet in Model Layer 2 and 3. Along the unnamed stream, the constant head was set at 1068.0 feet in Model Layer 2 and 3.

Along the Temescal Subbasin boundary, a similar set of constant head boundaries were set along a limited length of the boundary near Temescal Wash and another unnamed stream (**Figure 24**). The constant head along Temescal Wash was set at 765.0 feet in Model Layers 1, 2 and 3 for the first three years, and then set to 775.0 feet for the following twenty-six years. The constant head boundaries were based on an initial estimate that was refined during model calibration.

4.4. AQUIFER PROPERTIES

Aquifer properties represent the physical and hydrogeologic characteristics of the aquifers within the Basin that control groundwater flow. Aquifer properties must be assigned to each active grid cell in the model. The conceptual model provides the framework necessary to define aquifer properties.

4.4.1. Aquifer Characteristics

The groundwater model represents the basin fill materials in terms of their ability to store and transmit groundwater. Horizontal and vertical hydraulic conductivity define the permeability of the aquifer, which is its ability to transmit groundwater flow. The ability to store water consists of two components. At the water table, storage of water associated with filling or draining the empty (air-filled) interstices between mineral grains is represented by the specific yield of the aquifer. In deep aquifers, there is a much smaller ability to store and release groundwater that derives from the compressibility of the water and aquifer materials (specific storativity). Thus, the initial response to pumping from a deep aquifer is a large drop in water level (head) within that aquifer. With sufficient time, however, the decrease in head creates downward movement of groundwater that eventually accesses the storage capacity at the water table. In other words, the storage response of the aquifer depends partly on the duration of pumping and observation. For groundwater management purposes, storage responses over periods of months to decades are usually the most relevant.

Aquifer characteristics can be estimated in two ways. The first is by means of an aquifer test in which one well is pumped while water levels are measured at a nearby well. This approach typically measures horizontal hydraulic conductivity over distances of tens to hundreds of feet and storage responses over periods of 1-3 days. The second approach is to calibrate a groundwater flow model such that the aquifer characteristics reproduce measured historical water levels throughout the basin given estimates of historical recharge and pumping. The latter approach produces estimates of aquifer characteristics averaged over spatial scales of thousands to tens of thousands of feet and time scales of months to decades. The estimates account for preferential flow through localized sand and gravel lenses in the basin fill materials and for delayed water-table responses to deep pumping. Also, model calibration provides estimates of vertical hydraulic conductivity across the layers of alluvial deposits, which is rarely measured by aquifer tests. The temporal and spatial scales represented by the model calibration approach are better for addressing most long-term groundwater management questions.

4.4.2. Zone Approach

Because of the limited data for aquifer properties for the Basin, a zoned distribution pattern was used that applied aquifer properties over subregional areas with similar geologic conditions. Although the units are heterogeneous, the approach was to get a representative average value for each aquifer property for limited number of zones around the basin. This was to avoid the patchwork quilt type of aquifer property distribution that does not show any relation to the underlying geologic conditions that define the aquifer property.

Figures 25 shows the distribution of aquifer characteristics after calibration of hydraulic conductivity and specific storage, respectively. The initial estimates of hydraulic conductivity and specific yield were from available local data, which incorporated major geologic features such as relatively permeable sediments in the upper parts of alluvial fans.

4.4.3. Hydraulic Conductivity

Hydraulic conductivity represents the ability of the water to flow through the aquifer, and is defined horizontally within a model layer to represent groundwater flow through the aquifer and vertically between adjacent model layers to represent groundwater exchange between aquifers.

The definition of the horizontal hydraulic conductivity is based on an assessment of lithologic description, available aquifer test data and model calibration. Since each model layer represents a thick interval composed of varying lithologies, the horizontal hydraulic conductivity represents an average value over the entire vertical thickness that includes the finer-grained layers in addition to any specific sand and gravel zone. For the Bedford-Coldwater Model, horizontal hydraulic conductivity is defined using regionalized blocks based on the geologic character of the unit and refined during calibration.

The hydraulic conductivity used in the Bedford-Coldwater Model varies within a reasonable value range for the aquifer characteristics for each aquifer to achieve the model calibration. The horizontal hydraulic conductivities used in the Bedford-Coldwater Model are listed in **Table 3.**

4.4.4. Vertical Conductance

In general, groundwater flow within an aquifer is dominantly horizontal whereas flow between adjacent aquifers is essentially vertical. The application of vertical hydraulic conductivity recognizes the inherent isotropy present in natural geologic formations. Vertical groundwater flow is equivalent to Ohm's Law for serial electrical flow through different resistivity layers. Based on this analogy, vertical groundwater flow, similar to serial electrical flow, is limited by the lowest conductivity (or highest resistivity) layer encountered. Therefore, vertical groundwater flow is defined by the lowest-permeability, continuous layer that controls the exchange of groundwater between aquifer or model layers.

In MODFLOW, vertical groundwater flow between model layers is calculated using vertical conductance (VCONT) that is calculated as the conductance of two one-half cells in a series with continuous saturation between them (Harbaugh, 2005). This calculation is performed within MODFLOW and requires the input of a vertical hydraulic conductivity (Kz) for each layer. In general, Kz values were set to allow relatively free exchange between layers. The vertical hydraulic conductivity values used in the model to calculate the VCONT are summarized in **Table 3**.

4.4.5. Specific Yield and Specific Storage

Aquifer storage defines the ability of the aquifer to take in or release water. Under unconfined conditions, water released from or put into aquifer storage represents the physical draining of groundwater from interstitial pore space within the aquifer. Unconfined storage is defined by specific yield, which is typically consistent with the effective porosity of the aquifer. Under confined conditions, water released from or put into aquifer storage is derived from the compressibility of water as a result of changes in the aquifer pressure within the interstitial pore space.

MODFLOW 2005 requires the use of specific storage, which is in the units of $feet^{-1}$. Reasonable ranges for the specific yield and specific storage were varied within a reasonable range during the model calibration and the values are listed in **Table 3**, respectively.

4.5. INITIAL CONDITION

The model also requires that groundwater levels be specified at the start of the simulation. They were estimated based on contouring of available water level data. As the initial heads may be dynamic and not representative of stable initial conditions, the first stress period representing pre-1990 conditions were run as steady-state to facilitate the calculation of a stable hydrologic system.

The transient model was used to develop the initial groundwater elevations that serve as the starting condition for the transient model. For this, groundwater pumping was applied to represent the long-term average pumping prior to 1990. The surface recharge component used to estimate groundwater recharge was set to a predevelopment condition to reduce the effect of urbanization. The results of the transient model provided a reasonable groundwater elevation data representing the late 1980's to obtain an appropriate starting condition. This was an iterative process and the transient model used to develop the initial head was updated during the transient model calibration to incorporate significant changes in the model setup. **Figure 26** provides the starting head for Layers 2, which provides a reasonable representation of the groundwater conditions for Layers 1 and 3.

5. HISTORICAL MODEL RESULTS

The Bedford-Coldwater Model was calibrated using the developed calibration criteria to reduce uncertainty by matching model results to observed data. An extensive calibration process was designed to better constrain the range of aquifer properties and boundary conditions for the model, thereby reducing uncertainty in the results.

5.1. CALIBRATION METHODOLOGY

For the Bedford-Coldwater Model, the simulation is setup using a 29-year base period that covers Water Year (WY) 1990 to WY2018. This aspect of the calibration is important to demonstrate that the model has the capability to simulate historical changes in groundwater elevations, and is therefore capable of forecasting future changes in groundwater elevations. This capability is necessary for the model to serve as a useful groundwater management tool.

5.1.1. Approach

The transient calibration is a process that compares the simulated groundwater levels from the model to observed groundwater level measurements. During calibration, boundary condition parameters and aquifer properties are varied within the reasonable range defined by the hydrogeological conceptual model. Different combinations are tested to determine the set of parameters and properties that produce an acceptable correlation simulated to measured groundwater elevations over time. Other data sets, such as key water budget components, surface water conditions, or hydrogeological conceptual model, may be used to further constrain the calibration.

There are multiple combinations of aquifer properties and boundary conditions that can be used to match a single set of groundwater elevation data. Calibrating to multiple data sets under differing stresses (i.e. recharge and discharge rates) reduces this “non-uniqueness”, thereby reducing the uncertainty. Performing a comprehensive calibration over a 29-year base period infers the calibration has been performed over wet, dry, and normal years with varying degrees of pumping. To that end, the Bedford-Coldwater Model was primarily calibrated using groundwater levels. The measures of calibration are primarily from a statistical analysis along with a visual assessment groundwater level trends from hydrographs. The groundwater elevation maps and water budget data considered during the model calibration are assessed in context with the model results, so are discussed in the next section.

5.1.2. Calibration Methodology

Joint calibration of the rainfall-runoff-recharge model, the surface water budget models and the groundwater flow model applied heuristic methods (i.e. trial-and-error adjustments) to selected variables, as informed by the timing and location of model residuals. In accordance with the principle of parsimony in modeling (DWR, 2016), calibration began with a small number of broad zones for hydraulic conductivity and storage. Zones were subdivided during calibration if a pattern of residuals at multiple wells warranted it. Although storage and hydraulic conductivity are not necessarily correlated, in practice they often are to some degree. Thus, for simplicity, similar zonation patterns were used for both variables.

In practice, most of the calibration effort focused on adjustments to horizontal and vertical hydraulic conductivity, the locations and conductances of faults, stream bed vertical hydraulic conductivity, and

several tributary watershed parameters: root depths of natural vegetation, rainfall-runoff thresholds and slopes, and the leakage and recession rates for shallow groundwater. Variables that were not adjusted during calibration include land use, crop root depths, pumping locations, and groundwater pumping.

Model performance during the calibration process was evaluated primarily by visual inspection of superimposed measured and simulated water-level hydrographs. Adjustments to model inputs and parameters were made only if two or more wells in a given area exhibited similar patterns of discrepancies between measured and simulated water levels. The process of manually calibrating a groundwater model also produces considerable insight into the groundwater flow system and the factors that influence it. Water levels for some wells were easy to reproduce with the model, while others were more difficult.

5.1.3. Primary and Alternative Calibration

In this report, we provide two sets of calibration results. Primarily, this was done to provide two variations for simulating the quarry operations in the Coldwater MA. These two calibration versions include:

- Primary Calibration – the Primary Calibration is the version of the historical model that is carried forward as the final model calibration that is used as the based for the projected future scenarios.
- Alternative Calibration – the Alternative Calibration is presented to demonstrate that uncertainty regarding the quarry operations, primarily in the Coldwater MA, may indicate a data gap. The Alternative Scenario is presented for informational purposes to document this work for future model updates, but it is not used for the projected future scenarios.

Quarry outflows represents outflows associated with active or passive quarry operations to account for observed water conditions within the deeper quarry pits. In the Coldwater area, excavations occur within the large quarry pits following periods of high groundwater levels for the period from 1990 to 2010. Based on available information, no additional pumping to maintain quarry water levels was assumed to occur. However, during model calibration, it was necessary to assume that additional pumping or other groundwater removal occurred during these operational periods to maintain the observed groundwater levels.

For the Primary Calibration, quarry outflows were simulated using a combination of the EVT and Drain Packages (**see Section 4.3.7**). From 1990 to 2010, the quarry outflows were allowed to be higher assuming some limited additional pumping may have occurred. However, after 2010, no additional pumping to maintain quarry water levels has occurred and that is supported by the historical model calibration. The ET rate and drain conductance were varied during model calibration to simulate the average annual losses from the MWH (2004) report. However, the calibration results (see following discussion) did not fully capture the high and low observed groundwater near the Coldwater MA quarries.

For the Alternative Calibration, a different simulation method was applied at the quarry locations. The emphasis of the Alternative calibration was to apply a boundary condition that would more forcefully simulate the observed groundwater levels. For the Alternative Calibration, the quarry operations were simulated using the MODFLOW river package. The River Package can allow the quarry pit ponds to alternate from recharge to discharge based on monthly hydrologic conditions. We estimated the water surface based on a review of Google Earth satellite images of the quarries and other local reports.

5.2. STATISTICAL CALIBRATION

The calibration was evaluated using a statistical comparison of difference (or residual) between measured and simulated groundwater elevations. The calibration was done for the entire Subbasin. In addition, a breakdown of the calibration results for each of the management areas is also provided.

5.2.1. Primary Calibration Results

For the Basin, the calibration is based on observed groundwater elevations from 3,736 measurements in 27 wells over the 29-year base period from October 1989 through September 2018 (WY1990-2018). The locations of these wells are shown on **Figures 27 and 28** for the Bedford MA and Coldwater MA, respectively.

Next, a more rigorous calibration was performed involving a statistical analysis to compare the difference or residual between measured and simulated groundwater elevations. An initial comparison is made with a scatter plot (**Figure 29**) that depicts this relationship of observed versus simulated groundwater elevations. As indicated on **Figure 29**, the scatter along the correlation line is minor in comparison to the range of the data. The correlation coefficient for the data on this graph is 0.905. The correlation coefficient ranges from 0 to 1 and is a measure of the closeness of fit of the data to a 1 to 1 correlation. A correlation of 1 is a perfect correlation. The correlation coefficient of 0.905 indicates a strong correlation between simulated and observed groundwater elevations.

A more detailed statistical analysis is provided that compares the difference, or residual, between measured and simulated groundwater elevations. **Table 4** summarizes statistical measures used to assess the calibration. A brief summary of the statistical measures used to evaluate the calibration results shown on **Table 4** is summarized below:

- The residual mean is computed by dividing the sum of the residuals by the number of residual data values. The closer this value is to zero, the better the calibration especially as related to the water balance and estimating the change in aquifer storage. The residual mean is 16.0 feet.
- The absolute residual mean is the arithmetic average for the absolute value of the residual so it provides a measure of the overall error in the model. The absolute residual mean is 42.1 feet.
- The residual standard deviation evaluates the scatter of the data. A lower standard deviation indicates a closer fit between the simulated and observed data. The standard deviation for the calibrated model is 31.5 feet.
- The Root Mean Square (RMS) Error is the square root of the arithmetic mean of the squares of the residuals is provides another measure of the overall error in the model. The RMS Error for the calibrated model is 45.0 feet.
- The scaled absolute residual the ratio of the absolute residual mean is divided by the range of observed groundwater elevations. This ratio helps to put the variation of the residuals into perspective with respect to the scale of the groundwater basin. This ratio for the Bedford-Coldwater Model is 0.077, which puts the statistical variability at less than 8 percent of the range. A ratio below 0.15 is generally considered a well calibrated (ESI 2011).

It should be noted that some degree of difference (or residual) between the observed and simulated groundwater elevations is expected. Residuals may be due in part to localized effects or data quality issues. For example, residuals can result from using groundwater elevations from pumping wells as calibration targets. MODFLOW calculates the groundwater elevation for the center of a model cell

rather than at the well location itself. MODFLOW also does not consider the impact of well efficiency on groundwater elevations at pumping wells. In addition, the timing of the observed groundwater elevations does not exactly match the model stress periods. Since the several calibration locations being pumping wells, the statistical parameters are considered reasonable indicating that the model is well calibrated. **Table 5 (following text)** provides a summary statistics for each of the 59 wells used in the calibration process.

Table 4. Summary of Primary Calibration for the Bedford-Coldwater Model

Calibration Measure	Complete GW Basin	Bedford MA	Coldwater MA
Units	**Feet**	**Feet**	
Residual Mean	16.0	1.0	26.5
Residual Standard Deviation	42.1	11.2	97.0
Absolute Residual Mean	31.5	8.1	47.8
Root Mean Square (RMS) Error	45.0	10.9	22.4
Scaled Absolute Residual Mean	0.077	0.034	0.084
Number of Locations	27	13	14
Number of Observations	3,736	1,535	2,201

The statistical comparison is also consistent when evaluated by management area (MA). **Table 4** includes the statistical calibration results for the Bedford-Coldwater Model by MA. The residual mean varies from 1.0 feet in the Bedford MA to 26.5 in the Coldwater MA. The standard deviation ranges from 11.2 feet in the Bedford MA to 97.0 feet in the Coldwater MA. The absolute residual mean ranges from 8.1 feet in the Bedford MA to 47.8 feet in the Coldwater MA. The scaled absolute residual mean ranges from 0.034 in the Bedford MA to 0.084 in the Coldwater MA.

The higher variability indicated in Coldwater MA is primarily attributed to the greater number of groundwater levels from active pumping that increases the variability of the observed data over the calibration period. Conversely, the Bedford MA has less variability because of less groundwater pumping and narrow range in groundwater levels over the calibration period. The statistical results are of high quality and indicate that each MA is well calibrated.

5.2.2. Alternative Calibration Results

For the Alternative Calibration, the boundary conditions were adjusted to simulate the observed groundwater levels more forcefully with no limitations on the effect on the water budget. For the Alternative Calibration, the quarry operations were simulated using the MODFLOW river package. The River Package can allow the quarry pit ponds to alternative from recharge to discharge based on monthly hydrologic conditions. We estimated the water surface based on a review of Google Earth satellite images of the quarries and other local reports.

A comparison of the statistical analysis for the Coldwater MA between the Primary and Alternative Calibration is provided in **Table 6**. A brief summary of the statistical measures used to evaluate the calibration results for the Coldwater MA are summarized on **Tables 4 and 6** below:

- The residual mean for the Alternative Calibration is -4.3 feet compared to 26.5 feet for the Primary Calibration.

- The absolute residual mean for the Alternative Calibration is 87.2 feet compared to 97.0 feet for the Primary Calibration.
- The residual standard deviation for the Alternative Calibration is 29.7 feet compared to 47.8 feet for the Primary Calibration.
- The Root Mean Square (RMS) Error for the Alternative Calibration is 20.1 feet compared to 22.4 feet for the Primary Calibration 45.0 feet.
- The scaled absolute residual ratio for the Alternative Calibration is 0.055 feet compared to 0.084 for the Primary Calibration.

The water budget results were considered to be unrealistically high for quarry operations, so they are not provided and the Primary Calibration is the selected calibration results for the GSP. However, the Alternative Calibration indicates that a significantly improved model calibration but this is currently limited by potential uncertainty regarding the historical quarry operations. Therefore, the Alternative Calibration suggests that the quarry operations present a potentially significant data gap moving forward. Therefore, an improved understanding quarry operations may help to enhance future model calibration.

Table 6. Summary of Alternative Calibration for the Bedford-Coldwater Model

Calibration Measure	Complete GW Basin	Bedford MA	Coldwater MA
Units	Feet	Feet	
Residual Mean	-1.6	2.2	-4.3
Residual Standard Deviation	30.9	11.4	87.2
Absolute Residual Mean	21.3	9.2	29.7
Root Mean Square (RMS) Error	30.9	11.3	20.1
Scaled Absolute Residual Mean	0.044	0.038	0.055
Number of Locations	27	13	14
Number of Observations	3,736	1,533	2,201

5.2.3. Comparison to Previous Model Calibration for Coldwater MA

The primary performance measure is to improve upon the calibration from the previous models. Previous groundwater models have been developed for the Coldwater MA; however, no previous groundwater model exist for the Bedford MA. In the MWH (2004) report, the model calibration results listed in the report was a general goal of a residual mean of less than 40-feet over the 1977 to 2010 simulation period. Both the Primary and Alternative Calibration both have residual means that are

- The residual mean of 26.5 feet for the Primary Calibration (**Table 4**) for the 2021 GSP Model is an improvement of 34 percent compared to the 2004 MWH Model.
- The residual mean of -4.3 feet for the Alternative Calibration (**Table 6**) for the 2021 GSP Model is an improvement of 89 percent compared to the 2004 MWH Model.

Overall, the results of the calibration showed significant improvement in the calibration over the 2004 MWH model. Although the data points used for both versions of the models are the same, the number of observations did vary. This indicates that the changes implemented for the Bedford-Coldwater Model were successful and resulted in improved model performance.

5.3. GROUNDWATER LEVEL TRENDS

Hydrographs provide a detailed time history of groundwater elevations for specific wells. This time history data includes the impact of varying climatic and pumping stresses on the groundwater basin. Comparing hydrographs of model results versus observed data provides a measure of how well the model handles these changing conditions through time. Groundwater elevation data for 26 hydrographs from different parts of the basin are included on **Figures 30 through 36** for the hydrograph evaluation. Locations of these well used for the hydrographs are shown on **Figures 27 and 28**.

For calibration purposes, the hydrographs were inspected to evaluate how well the model results matched the overall magnitude and trend of the observed groundwater elevation data over time. For the transient model, it was considered more important to honor the overall trend of the data. A hydrograph was considered a good match if the model simulated the trend, but the groundwater elevations were offset. The following is a discussion of the overall groundwater trends, comparison of simulated to measured data, and other hydrogeological inferences made from the historical simulation results shown on the **Figures 30 through 36** hydrographs.

5.3.1. Bedford MA Hydrographs

Hydrographs from twelve wells located in different areas within the Bedford MA are shown on **Figures 30 through 32**. Well locations are shown in **Figure 27**. To facilitate a comparison of the relative groundwater trends observed in these wells, a consistent vertical scale of 250 feet is used on **Figures 30 through 32**.

The North Temescal Wash Area is located along Temescal Wash in the northern portion of the Bedford MA. **Figures 30 and 31** show hydrographs for 8 wells located within this area. Groundwater levels in this area are generally characterized as having relatively stable trends over time. Also, depth to groundwater in many parts of this area are relatively shallow ranging from 5 to 50 feet. Data from Corona #4 prior to 1992 show that groundwater levels were lower during this period. Groundwater levels were relatively stable. From 2012 through 2018 groundwater levels become more variable reflecting changes in groundwater pumping and climatic conditions.

Hydrographs for four monitoring wells are located in the mid-Temescal Wash (**Figure 32**). Locations of these wells are shown on **Figure 27**. Three of these wells are located area near the TVWD WRF (TVWD#01A, TVWD#04, and LLWD_#01-Old). These wells show very stable water levels over the period of record. In this area, groundwater levels are stabilized by the level of Temescal Wash and the presence of two flooded gravel mine pits in the mined area north of TVWD WRF.

The New Sump well, also shown on **Figure 32**, a is located further upstream from the TVWD WRF near the confluence with Dawson Creek which flows in from the upland areas to the east. Groundwater levels show more variability due to pumping at this location and the narrow constricted configuration of the aquifer at this location.

For all twelve wells, the comparison of simulated to measured groundwater levels shows a close correlation which is consistent with the statistical data presented on Tables 4 and 5.

5.3.2. Coldwater MA Hydrographs

Hydrographs from thirteen wells located in different areas within the Coldwater MA are shown on **Figures 33 through 36**. Well locations are shown in **Figure 27**. To facilitate a comparison of the relative

groundwater trends observed in these wells, a consistent vertical scale of 600 feet is used on **Figures 33 through 36** to capture the full range and variability of groundwater levels in the Coldwater MA.

Figures 33 shows hydrographs for four wells located within in the Coldwater Creek area of the Coldwater MA. These wells are located near the Chandler gravel mining operations which is the northernmost gravel pit (**Figure 23**). It is in the Coldwater MA that the difference between the Primary and Alternative Calibration are most apparent. The measured groundwater levels for the four hydrographs on **Figure 33** shows a consistent pattern that is summarized below:

- From 1989 through 1992, groundwater levels are relatively low, with elevations ranging between 800 to 900 feet above mean sea level (msl). This is considered to represent a period of active mining operations and deepening of the pits to near or below the water table.
- During the period from 1993 through 1999, groundwater levels rapidly rise in 1993 due to flood events where flood flows are either directed into or breached berms to flood the mining areas. The result is a major recharge event during high rainfall events in 1993, 1995, 1997 and 1998. As a result, groundwater levels rise 150 to 200 feet to reach elevations between 1,000 and 1,050 feet elevation msl.
- From 2000 through 2004, groundwater levels decline between 100 to 200 feet with elevations ranging between 750 to 850 feet above mean sea level (msl). This is a period of active mining in the large, deep mining areas.
- In 2005, another large flooding event occurred that results in major recharge event with groundwater rising about 100 feet to reach elevations between 850 and 900 feet elevation msl.
- From 2006 through 2010, groundwater levels decline between 100 to 150 feet with elevations ranging between 750 to 800 feet above mean sea level (msl). This is a period of active mining in the large, deep mining areas.
- In 2010 and 2011, another large flooding event occurred that results in major recharge event with groundwater rising about 100 feet to reach elevations between 850 and 900 feet elevation msl.
- From 2011 through 2016, groundwater levels decline between 100 to 150 feet with elevations ranging between 750 to 800 feet above mean sea level (msl). This is a period of active mining in the large, deep mining areas and mine reclamation.
- From 2016 to 2018, groundwater levels rise about 50 feet to an elevation of about 800 feet msl. This represents a period where mining operations are occurring well above the water table. Deeper areas of the mine have undergone reclamation and are no longer active.

During model calibration, this pattern of groundwater elevation changes was not fully obtained by using reported pumping volumes, streamflow from the rainfall-runoff model, and local ET rates. The general form was achieved, but not the full extent, especially the high groundwater levels in the 1990s. The Alternative Calibration applied a boundary condition to more forcefully drive the simulation to simulate the measured groundwater levels; however, this resulted in significantly higher groundwater extraction or loss rates to achieve the decline from the high groundwater level periods in the 1990s, 2005 and 2011 to the corresponding low groundwater levels in 2004, 2010, and 2016. Because of the water budget issue, the model calibration used the Primary Calibration; however, the Alternative Calibration indicates a potentially significant data gap in understanding the effects of mining operations on groundwater levels.

Figures 34 and 35 show hydrographs for six wells located within in the Mayhew area of the Coldwater MA which is located south of the wells shown in **Figure 33**. A similar pattern of groundwater level change is shown in these areas; however, the mining operations in these areas are more typically above the groundwater table such that the difference between the Primary and Alternative Calibration is less significant than for the wells in **Figure 33**. These wells show relatively strong agreement between measured and simulated groundwater levels over the simulation period.

Figure 36 shows hydrographs for four wells located north of the Coldwater MA and north of the wells shown in **Figure 33**. The pattern in the change in groundwater levels shows a similar pattern but the magnitude of the changes is much less. These wells are located further away from the mining areas which suggests much of these changes are related to mining operations. The Primary and Alternative Calibrations show a general match to the pattern and magnitude of the groundwater level changes over the simulation period, but show some offset in simulating the groundwater elevation.

5.4. EVALUATION OF GROUNDWATER FLOW

The Bedford-Coldwater Model simulates monthly groundwater elevations for 348 months from October 1989 through September 2018. In general, the overall groundwater flow directions remain generally consistent over this time with some variations observed near the major groundwater pumping centers. To evaluate the range of groundwater elevations, we have selected a few key time periods. These include:

- **Figure 37** - End of Historical Simulation Period – September 2018
- **Figure 38** - Period of consistently high groundwater levels – March 1995
- **Figure 39** - Period of consistently low groundwater levels – October 2010

The high and low conditions represent a combination of climatic conditions and groundwater pumping demands. Groundwater maps for Layers 1 for each of the above time periods is presented. In general, groundwater levels in Layers 1, 2 and 3 are generally consistent. For the purposes of evaluating groundwater flow directions, we have selected Layer 1 as representative of these three layers.

Figure 37 shows the groundwater level contours and flow directions for Layer 1 at the end of the historical simulation period representing September 2018 conditions. On each of these maps, large blue arrows to better illustrate the groundwater flow directions. The groundwater contour represents a line of equal groundwater elevation, or equipotential. Groundwater flow occurs at right angles to the contour lines with the direction flow from the higher to lower groundwater elevation. In general, groundwater flow in the Bedford MA is generally towards or along Temescal Wash. Along the Glen Ivy Fault groundwater flow directions are generally parallel to the fault in the southern area, but flow is away from the fault in the northern areas of the Bedford MA.

In the Coldwater MA, groundwater flow is generally from the marginal areas towards the primary pumping wells located within the area of the large gravel mining operations (**Figure 37**). The thinner aquifer along the basin margins has limited capacity to store the recharge that occurs along the basin margins from runoff, stream recharge and bedrock inflows. This, along with the higher elevations, creates higher groundwater elevations along the margins that drives groundwater flow into the center of the basin.

The tightly-spaced contours along the Glen Ivy Fault (**Figure 37**) that separates the Bedford and Coldwater MA represent the flow restriction formed by the faults that limits inflows into the deep basin and maintains higher, relatively stable groundwater levels upgradient of the faults. Within the deep basin, the groundwater levels are several hundred feet lower than on the areas upgradient faults.

Figures 38 show the groundwater elevations during March 1995. During this period, widespread high groundwater levels were observed reflecting a period of high precipitation and below average groundwater pumping rates occurring in the basin. Even in this case, the general groundwater flow directions remain generally consistent with September 2018 (**Figure 37**). The main differences are increased groundwater levels in the Coldwater MA and northern Bedford MA reflect increased recharge from creek reaching this area along with lower pumping. Steeper groundwater levels are observed along the basin margins reflecting the higher recharge rates due to the high precipitation levels.

Figure 39 shows the groundwater elevations during October 2010. During this period, widespread low groundwater levels were observed reflecting several preceding dry years. In general the groundwater flow directions remain generally consistent with September 2018 (**Figures 37**). The main differences are lower groundwater levels in the Coldwater MA due to groundwater pumping with limited recharge. In the Bedford MA, groundwater levels are also generally lower across the area due to lower recharge. .

The groundwater flow is consistent with the hydrogeological conceptual model. These maps are included to demonstrate that the model provides reasonable simulation of groundwater elevation and flow direction even during the more extreme climatic periods during the base period. This further demonstrates that the model is well calibrated and can accurately simulate wet and dry weather periods.

5.5. MODEL-BASED HYDROLOGIC BUDGET

GSP regulations (§354.18(c)(2)(B)) indicate a need to identify an average hydrologic study period that cover as least 10 years that includes a range of hydrologic conditions (e.g. wet, normal, dry and critically dry) for purposes of the groundwater analyses in the basin-wide water budgets. In order to select a consistent study period, the Bedford-Coldwater GSA is using a 29-year base period covering Water Years (WY) 1990 through 2018. Water years used for the Bedford-Coldwater Model run from October through to the following September to capture the cause and effect relationship on groundwater levels of wintertime rain and subsequent summertime groundwater pumping. Additional analysis of the historical water budget is provided in Section 5 (“Water Budget”) of the GSP.

The model-derived groundwater budget for the entire Basin is presented in **Table 7**. Over the entire simulation period, groundwater inflows average about 9,300 AFY. Surface recharge from precipitation and return flows accounts for about 24 percent of the total recharge and average about 2,200 acre-feet per year (AFY). Groundwater-surface water interactions represent about 50 percent of the total recharge and average about 4,600 AFY. Mountain front recharge represents inflows from bedrock units into the basin from the surrounding watersheds. This accounts for about 15 percent of the total recharge and average about 1,350 AFY. Recharge from wastewater recharge ponds accounts for about 7 percent or 650 AFY. Groundwater inflow from the adjacent Temescal and Elsinore Valley Basins account about 4 percent of the total recharge and average about 370 AFY. Net recharge from quarry operations accounts for about 1 percent of the total recharge and averages about 100 AFY.

Outflows from the entire Basin, **Table 7**, average about 11,323 AFY. Groundwater pumping is the primary groundwater outflow accounting for about 63 percent of the outflow and averages about 7,100 AFY over the entire historical period. Quarry operations in both the Bedford MA and Coldwater MA account for about 21 percent of the outflow and averages about 2,400 AFY. Evapotranspiration (ET) accounts for about 7 percent of the outflow and averages about 780 AFY. Groundwater outflow from the adjacent Temescal and Elsinore Valley Basins account about 2 percent of the total recharge and average about 230 AFY.

Similar groundwater budget tables are presented for the each of the management areas defined within the Bedford-Coldwater GSA. These include:

- **Table 8** for the Bedford MA
- **Table 9** for the Coldwater MA

The difference between the model-derived inflows and outflows represents the change in groundwater in storage over the simulation period. **Table 10** summarizes the change in groundwater in storage for the entire Basin and for each of the individual subareas and are graphically illustrated on **Figure 40**. The overall change in storage over the simulation period for the entire Basin average a decline of about 2,000 AFY for a cumulative decline over the simulation period of about 59,000 AFY. OF this, the majority of the decline is experienced in the Coldwater MA where the majority of the groundwater pumping occurs. Most of the decline in groundwater in storage occurs prior 2002 when pumping rates were higher and quarry operations appear to be more active with respect to groundwater resources. Since 2008, EVWMD and the City of Corona have had an operating agreement for pumping within the Coldwater MA. As a results, the average change in groundwater in storage from 2005 through 2015 is an increase of 22 AFY for a cumulative increase of 240 acre-feet (**Table 10**).

6. SIMULATION OF FUTURE CONDITIONS

GSP regulations §354.18(c)(3) require simulation of several future scenarios to determine their effects on water balances, yield and sustainability indicators. The following scenarios to simulate future conditions include:

- **Baseline Scenario** - This represents a continuation of existing land and water use patterns, imported water availability, and climate.
- **Growth Plus Climate Change Scenario** - This scenario implements anticipated changes in land use and associated water use, such as urban expansion, and anticipated effects of future climate change on local hydrology (rainfall recharge and stream percolation) and on the availability of imported water supplies.

The historical period used for model calibration consisted of only 29 years (water years 1990-2018). The Sustainable Groundwater Management Act requires that future simulations cover a 50-year period. To obtain 50 years of hydrology, rainfall, reference ET and streamflow were assumed to repeat the 1993-2017 sequence twice. Rainfall during that period equaled 99 percent of the long-term average. Surface and subsurface inflows from tributary watersheds simulated using the rainfall-runoff-recharge model were also replicated to obtain 50 years of data. The initial conditions for the future baseline simulation equaled the ending water levels of the calibration simulation, or September 2018. Thus, the future simulation period nominally covers water years 2019 to 2068.

The future Baseline Scenario and Growth Plus Climate Change Scenario serve as a reference conditions against which to compare alternative management scenarios. Additional data and assumptions used in the future baseline simulation are described in Section 5 of the GSP ("Water Budget"). Inputs and results of other scenarios related to specific management actions recommended in the GSP are also described in Section 8 ("Management Actions").

6.1. BASELINE SCENARIO

The simulation is of a 50-year period, as required by SGMA regulations. For the simulations of future conditions, the hydrology is assumed to repeat the 1993 to 2017 calibration period twice to obtain 50 years of data. Specific assumptions and data included in the future baseline scenario are outlined below.

6.1.1. Baseline Assumptions

Municipal, commercial, and industrial (M&I) and private pumping were assumed to remain at existing levels. Initial estimates were obtained by calculating average pumping for each calendar month during 2010 through 2018 and applying those averages in every year of the future simulation. This approach omits additions to and withdrawals from Coldwater MA storage accounts by the three municipal agencies with wells in that MA. Municipal use of imported water was also assumed to remain at existing levels. From the standpoint of the groundwater budget, total municipal water use was used only to estimate pipe leaks. Use of imported water by the Temescal Valley Water District (TVWD) was obtained from that agency's 2015 Urban Water Management Plan (RMC/Woodard Curran 2017), and imported water use in the parts of the City of Corona (Corona) and Elsinore Valley Municipal Water District (EVMWD) service areas within the Basin were assumed to be the same on a per-acre basis for developed areas. Updated pumping volumes were input into the model with the MODFLOW well package.

Land use and water use were assumed to remain at their current patterns and levels throughout the 50-year period. Land use remains the same as actual, existing conditions. In the model these are represented by 2014 land use mapped by remote sensing methods and obtained from DWR, adjusted for subsequent urbanization identified in Google Earth imagery. These data were used in the rainfall-runoff-recharge model for estimated hydrologic parameters for MODFLOW model input.

Rainfall and reference evapotranspiration (ET_0) used historical monthly data for the 1993-2017 hydrologic period used in the model. The surface recharge was input using the MODFLOW recharge package and ET from groundwater rates are input using the MODFLOW EVT package.

Small stream inflows and bedrock inflow simulated for 1993 to 2017 of the calibration simulation were repeated twice to obtain 50 years of data Stream flows are entered in the MODFLOW model using the SFR2 package and the bedrock inflow is input using GHB package. Wastewater percolation and recycled water discharges to TVWD WRF recharge ponds and Temescal Wash were assumed to continue as under the current levels.

Initial water levels are simulated water levels for September 2018 from the historical calibration simulation. That year represents relatively recent, non-drought conditions. These simulated water levels are internally consistent throughout the model flow domain and reasonably matched measured water levels at wells with available data.

6.1.2. Baseline Water Budget Results

GSP regulations (§354.18(c)(2)(B)) require a 50-year simulation period of average hydrologic conditions (e.g. wet, normal, dry and critically dry) for purposes of the analyses in the projected-future basin-wide water budgets. The Future Baseline Scenario generally assumes a continuous of current groundwater operations and historical hydrology over the 50-year simulation period. Additional analysis of the historical water budget is provided in Section 5 ("Water Budget") of the GSP.

The model-derived groundwater budget for the entire Basin is presented in **Table 11**. Over the entire simulation period, groundwater inflows average about 10,100 AFY. Surface recharge from precipitation and return flows accounts for about 23 percent of the total recharge and average about 2,300 acre-feet per year (AFY). Groundwater-surface water interactions represent about 44 percent of the total recharge and average about 4,500 AFY. Groundwater-surface water interactions primarily account for recharge from streams, including wastewater and recycled water discharge to streams. Mountain front recharge represents inflows from bedrock units into the basin from the surrounding watersheds. This accounts for about 12 percent of the total recharge and average about 1,250 AFY. Recharge from wastewater recharge ponds accounts for about 19 percent or 1,850 AFY. Net recharge from quarry operations accounts for about 2 percent of the total recharge and averages about 160 AFY. Groundwater inflow from the adjacent Temescal and Elsinore Valley Basins account about 1 percent of the total recharge and average about 80 AFY.

Outflows from the entire Basin, **Table 11**, average about 9,200 AFY. Groundwater pumping is the primary groundwater outflow accounting for about 47 percent of the outflow and averages about 4,400 AFY over the entire historical period. Quarry operations in both Bedford and Coldwater MA account for about 26 percent of the outflow and averages about 2,400 AFY. Groundwater-surface water interactions represent about 11 percent of the total outflows and average about 1,000 AFY. ET accounts for about 10 percent of the outflow and averages about 900 AFY. Groundwater outflow from the adjacent Temescal and Elsinore Valley Basins account about 6 percent of the total recharge and average about 530 AFY.

Similar groundwater budget tables are presented for the each of the management areas defined within the Bedford-Coldwater GSA. These include:

- **Table 12** for the Bedford MA
- **Table 13** for the Coldwater MA

The difference between the model-derived inflows and outflows represents the change in groundwater in storage over the simulation period. **Table 14** summarizes the change in groundwater in storage for the entire Basin and for each of the individual subareas and are graphically illustrated on **Figure 51**. The overall change in storage over the simulation period for the entire Basin average is an increase of about 850 AFY for a cumulative increase over the 50-year simulation period of about 43,000 AFY. Of this, the majority of the increase is experienced in the Coldwater MA where the most significant changes to groundwater pumping occurs. The rate of the change in groundwater in storage increases from 140 AFY during the implementation period of the GSP (2018-2041). During the sustainability period of the GSP (2042-2068) the rate of the change in groundwater in storage increases from 830 AFY (**Table 14**).

6.1.3. Baseline Groundwater Flow Evaluation

A contour map of simulated groundwater elevations from the Baseline Scenario at the end of the simulation period (September 2068) is presented in **Figure 42**. In the Bedford MA, groundwater conditions remain generally consistent with September 2018 (**Figures 37**) with hydraulic gradients generally directed towards or along Temescal Wash. Only minor variations in groundwater levels are observed in the Bedford MA primarily related to shifts in groundwater pumping. This is consistent with the historical data which shows the Bedford MA with minimal change in groundwater in storage over time.

In the Coldwater MA, groundwater levels are generally about 100 feet or more higher in the center of the Coldwater MA. This is primarily due to the use of lower pumping rates in the Baseline that are consistent with present day pumping practices. The City of Corona and Elsinore Valley Municipal Water District established a production agreement in 2008 to ensure the sustainable use of groundwater in the Coldwater area (Corona and EVMWD, 2008). Prior to 2008, groundwater pumping in the Coldwater MA was much higher. Therefore, the Baseline Scenario results indicated that continued application of the 2008 agreement are anticipated to result in significant increases in groundwater levels over the 50-year simulation period.

6.2. GROWTH AND CLIMATE CHANGE SCENARIO

The growth plus climate change scenario incorporated anticipated effects of climate change, urban development and associated changes in water and wastewater management. The input parameters for the growth plus climate change scenario were input using the same MODFLOW packages as listed in the Baseline Scenario setup. Specific assumptions and data included in the growth plus climate change scenario are outlined below.

6.2.1. Growth and Climate Change Assumptions

For the growth plus climate change scenario, average annual groundwater pumping in the Coldwater MA was assumed to equal average historical pumping during 2010 through 2017, with an increase proportional to the estimated amount of irrigation return flow from future increased use of imported water. In the Bedford MA average annual groundwater pumping was assumed to be equal to 2020

production volumes. Municipal pumping in Coldwater was distributed among wells in proportion to their averages during 2010 to 2017 and in Bedford it was distributed as recorded in 2020. All remaining municipal water use was assumed to be obtained from imported water. Projected water use for irrigated turf in the rainfall-runoff-recharge model indicated that the combined effect of the warmer and drier climate will be to increase annual irrigation demand by about 10 percent.

A map of the zones and their land uses projected for 2068 is shown in **Figure 42.** The categories are listed in **Table 1** (**Section 3.2**) along with their total acreages in the groundwater basin management areas and tributary watersheds. Projected land use in 2068 was developed on the basis of population projections, land use designations in the Temescal Canyon Area Plan (Riverside County 2018), assumed urban infill, and topography. A comparison of land use acreage by land use category and management area for 1990, 2018, and 2068 was developed. Conversion of grassland to residential land use was the dominant change in both management areas and also occurred in tributary watershed areas.

Rainfall and reference evapotranspiration (ETo) were adjusted to 2070 conditions using monthly multipliers developed by DWR based on climate modeling studies. The climate in 2070 is expected to be drier and warmer than it presently is. The multipliers were applied to historical monthly data for the 1993-2017 hydrologic period used in the model. DWR prepared a unique set of multipliers for each 4-km^2 cell of a grid covering the entire state. Fourteen grid cells overlie the Basin and its tributary watershed areas. For each recharge analysis polygon in the rainfall-runoff-recharge model, multipliers from the nearest grid cell were used.

Bedrock inflow and surface inflow from tributary streams along the perimeter of the Basin were re-simulated using the rainfall-runoff-recharge model to reflect the effects of urban development in some of the tributary watersheds and of climate change. Urbanization also increased surface runoff within the Basin, which was routed to small streams and Temescal Wash.

Wastewater generation was assumed to double by 2068, in proportion to the increase in total urban water use. Wastewater disposal was assumed to change, however. In recent years more of the outflow from the TVWD WRF has been percolated in ponds than has been recycled for irrigation. This proportion was assumed to reverse, such that all outflow would be recycled for irrigation during April through November and all would be percolated in ponds during November through March. The small discharge from Corona WRF-3 to Temescal Wash at the northern end of the Basin was assumed to be eliminated, consistent with the City of Corona's plans to decommission that WRF.

Water pipe leak rates in the EVMWD and City of Corona service areas were assumed to decrease to 5 percent of delivered water from the rates reported in the 2015 Urban Water Management Plans (7.0 percent and 6.6 percent, respectively). The leak rate in the TVWD service area was assumed to continue at the low rate reported in 2015 (two percent).

In the growth plus climate change scenario, gravel mining operations were assumed to have ended and the mine areas to have been converted to stormwater control facilities with groundwater recharge capacity during high runoff periods.

6.2.2. Growth and Climate Change Scenario Water Budget Results

GSP regulations (§354.18(c)(2)(B)) require a 50-year simulation period of average hydrologic conditions (e.g. wet, normal, dry and critically dry) for purposes of the analyses in the projected-future basin-wide water budgets. The Growth with Climate Change Scenario includes planned changes in the groundwater operations in the basin along with projected climate change based on data provided by DWR. Additional analysis of the historical water budget is provided in Section 5 ("Water Budget") of the GSP.

The model-derived groundwater budget for the entire Basin is presented in **Table 15**. Over the entire simulation period, groundwater inflows average about 11,400 AFY. Surface recharge from precipitation and return flows accounts for about 26 percent of the total recharge and average about 2,900 acre-feet per year (AFY). Groundwater-surface water interactions represent about 39 percent of the total recharge and average about 4,500 AFY. Net recharge from quarry operations accounts for about 4 percent of the total recharge and averages about 470 AFY. Groundwater-surface water interactions primarily account for recharge from streams, including wastewater and recycled water discharge to streams. Mountain front recharge represents inflows from bedrock units into the basin from the surrounding watersheds. This accounts for about 11 percent of the total recharge and average about 1,250 AFY. Recharge from wastewater recharge ponds accounts for about 19 percent or 2,200 AFY. Groundwater inflow from the adjacent Temescal and Elsinore Valley Basins account about 1 percent of the total recharge and average about 80 AFY.

Outflows from the entire Basin, **Table 15**, average about 10,600 AFY. Groundwater pumping is the primary groundwater outflow accounting for about 48 percent of the outflow and averages about 5,000 AFY over the entire historical period. Quarry operations in both Bedford and Coldwater MA account for about 23 percent of the outflow and averages about 2,500 AFY. Groundwater-surface water interactions represent about 13 percent of the total outflows and average about 1,400 AFY. ET accounts for about 11 percent of the outflow and averages about 1,200 AFY. Groundwater outflow from the adjacent Temescal and Elsinore Valley Basins account about 4 percent of the total recharge and average about 470 AFY.

Similar groundwater budget tables are presented for the each of the management areas defined within the Bedford-Coldwater GSA. These include:

- **Table 16** for the Bedford MA
- **Table 17** for the Coldwater MA

The difference between the model-derived inflows and outflows represents the change in groundwater in storage over the simulation period. **Table 18** summarizes the change in groundwater in storage for the entire Subbasin and for each of the individual subareas and are graphically illustrated on **Figure 52**. The overall change in storage over the simulation period for the entire Basin average is an increase of about 850 AFY for a cumulative increase over the 50-year simulation period of about 42,600 AFY. Of this, the majority of the increase is experienced in the Coldwater MA where the most significant changes to groundwater pumping occurs. The rate of the change in groundwater in storage increases from 150 AFY during the implementation period of the GSP (2018-2041). During the sustainability period of the GSP (2042-2068) the rate of the change in groundwater in storage increases from 800 AFY (**Table 18**).

6.2.3. Future Growth and Climate Change Groundwater Map

A contour map of simulated groundwater elevations from the Growth and Climate Change Scenario at the end of the simulation period (September 2068) is presented in **Figure 45**. In the Bedford MA, groundwater conditions remain generally consistent with September 2018 (**Figures 37**) with hydraulic gradients generally directed towards or along Temescal Wash. Only minor variations in groundwater levels are observed in the Bedford MA primarily related to shifts in groundwater pumping. Furthermore, the groundwater conditions remain generally consistent with September 2068 Baseline Scenario results (**Figures 42**). The Growth and Climate Change Scenario adds an additional 1,200 AFY in groundwater pumping; however, a similar increase in groundwater recharge, primarily from urban return flows, generally balances these results.

As with the Baseline Scenario, groundwater levels for the Growth and Climate Change Scenario are generally about 100 feet in the center of the Coldwater MA due to the use of lower pumping rates compared to the historical pumping. The City of Corona and Elsinore Valley Municipal Water District established a production agreement in 2008 to ensure the sustainable use of groundwater in the Coldwater area (Corona and EVMWD, 2008). Prior to 2008, groundwater pumping in the Coldwater MA was much higher. Therefore, the Growth and Climate Change Scenario results indicated that continued application of the 2008 agreement are anticipated to result in significant increases in groundwater levels over the 50-year simulation period.

7. SGMA REQUIREMENTS

As noted in the SGMA Modeling Best Management Practices (BMP) guidelines (DWR, 2016), the description of the model application should include detailed information on the model conceptualization, assumptions, data inputs, boundary conditions, calibration, sensitivity and uncertainty analysis, and there applicable modeling elements such as model limitations. A DWR requirement for using model results in future water budget reporting for Annual Reports is to report the model accuracy. The following information addresses these reporting requirements.

7.1. MODEL DATA GAPS

When evaluating model results, it is important to consider the strengths and limitations of the numerical model. The horizontal and vertical resolution used to construct the model dictates the range of scales that the model can evaluate. The Bedford-Coldwater Model is designed as a regional or basin-wide model to evaluate long-term, regional trends and the overall groundwater inflow and outflow to the basin. Within that scale, conditions are averaged. However, this model may not contain the site-specific details necessary to evaluate some localized conditions due to geologic complexity or unique localized effects. For these areas, a more localized model may be required if such a detailed analysis is necessary. The regional model can provide a broader regional context to support the development of these localized models.

The groundwater flow model is an appropriate tool for evaluating groundwater conditions at the basin and subarea scale over periods of months to decades. Given its reasonable calibration under a wide range of historical hydrologic and water management conditions, it should produce reliable results under a similar range of future conditions. However, some aspects of the model and some types of applications may be less reliable. Limitations in model accuracy and in types of applications include the following:

- Understanding of water use and groundwater interaction with deep mining operations that intersect the groundwater present a data gap that presented challenges during the calibration. These issues were most prominent in the Coldwater MA, but also influenced some localized areas around the TVWD WRF in the Bedford MA. The Alternative Calibration indicates that calibration is limited by uncertainty regarding the historical quarry operations. A better understanding of quarry operations could provide an improved understanding to help enhance future model calibration.
- As with any regional model, the model cannot simulate details of water levels and flow at spatial scales smaller than one model cell. It cannot, for example, simulate drawdown within a pumping well. It can only simulate the average effect of that pumping on the average water level of the cell in which the well is located.
- The monthly stress periods of the model preclude simulation of brief hydrologic stresses. For example, the model cannot simulate the effects of daily pumping cycles on water levels, or the amount of recharge associated with peak stream flow events.
- Surface and subsurface inflows from tributary watersheds around the perimeter of the basin remain uncertain. The new rainfall-runoff-recharge model simulates watershed hydrology explicitly but flows from the watersheds to the groundwater basin are small compared to rainfall and ET. Accurate data for those variables within the watershed areas are not available, and a small error in rainfall or ET can result in a large error in simulated watershed outflow.

- Model calibration is better in some parts of the basin than others. For any future model application that focuses on a particular subarea, it would be prudent to evaluate the quality of model calibration for that area before conducting simulations of alternative conditions.

7.2. MODEL ACCURACY

A numerical model mathematically describes the conceptual model by solving the mass balance and motion equations that govern groundwater flow and chemical transport (Bear and Verruijt 1987). To solve these equations, an iterative method is used to solve the matrix equations. For these iterative techniques, the procedure is repeated until the convergence criteria are met. The convergence criteria may be groundwater elevation change, mass balance difference, or both. Convergence defines whether the model is mathematically stable and capable of producing reliable results.

For this model, the Newton (NWT) Solver Package was used (Niswonger *et al*, 2011). The convergence criteria for NWT included both a maximum change in groundwater elevation and a maximum mass balance differential for a cell. For this model, the convergence parameter for groundwater elevation was set at 0.001 feet and 50 cubic feet per day for mass balance differential. Convergence is evaluated at the grid cell level. If a single cell does not meet the requirement, then the solution procedure is repeated. The model was able to successfully converge using the set convergence parameters.

The primary method to check whether the model is numerically stable is to evaluate the differential in mass balance. Iterative techniques provide an approximate solution for the model; therefore, there is always a mass balance differential. This differential should be small, and typically a differential of less than 1.00 percent is considered as a good solution. The mass balance differential for Bedford-Coldwater Model is 0.03%. These values further indicate that numerical model that is accurately simulating the flow of groundwater in the Basin.

The model calibration and comparison of the hydrologic budget results demonstrate that the model is consistent with the conceptual model to produce these results. The calibration correlation coefficient of 0.905 demonstrates a strong comparison between measured and simulated groundwater elevations. Other statistical calibration parameters show that the scaled ratio of the parameter to the range of observed groundwater levels is about 10 percent. Based on these parameters, the accuracy of the Bedford-Coldwater Model is considered to range between 10 to 15 percent.

7.3. LIMITATIONS TO CALIBRATION

All inputs to a model are estimates that are subject to errors or uncertainty, but some are better known than others. Also, some have relatively pronounced effects on simulation results. For example, the amount of water pumped by municipal wells is metered and is considered highly accurate compared to most model inputs. Accordingly, the amount of municipal pumping was not adjusted during calibration.

Data gaps with the water use with quarry operations and the groundwater interactions with the deep mining operation pits presented a challenge for calibration. Variables were selected for adjustment during calibration based on their relative uncertainty, the sensitivity of results to that variable, and whether the variable might logically be connected to an observed pattern of residuals based on hydrologic processes.

The measured water levels that serve as the basis for calibration are themselves subject to uncertainty stemming from wellhead elevation errors, effects of recent pumping at the measured well, and wells that for unknown reasons have water levels inconsistent with water levels at nearby wells. Almost all of

the wells used to monitor water levels are active water supply wells. If a well was pumping shortly before the water level is measured, the water level will be much lower (by feet to tens of feet) than if the well had been idle for a day or more. In some hydrographs, pumping-affected water levels stand out as obvious anomalies. A number of those points were removed from the calibration data set. In other cases, water levels fluctuate over a wide range seasonally and between measurements, and pumping effects could not be systematically identified and eliminated.

8. REFERENCES CITED

Bear, J. and A. Verruijt, 1987, Modeling Groundwater Flow and Pollution, D. Reidel Publishing Company, Boston, 414 p.

Bicknell, B.R., Imhoff, J.C., Kittle, J.L., Jr., Donigian, A.S., Jr., and Johanson, R.C., 1997, Hydrological Simulation Program--Fortran, User's manual for version 11: U.S. Environmental Protection Agency, National Exposure Research Laboratory, Athens, Ga., EPA/600/R-97/080, 755 .

Blaney, H.F., P.R. Nixon, G.P. Lawless and E.J. Wiedmann. October 1963. ,Utilization of the waters of the Santa Ynez River basin for agriculture in southern Santa Barbara County, California. U.S. Department of Agriculture, Agricultural Research Service., Riverside, CA.

California Department of Water Resources (DWR).), 2003. , Bulletin 118.

California Department of Water Resources (DWR).), 2016. Management Practices for the Sustainable Management of Groundwater, Modeling BMP, Sacramento, CA: Technical Memorandum.

California Department of Water Resources (DWR).),April 1975. , Vegetative Water Use Inin California, 1974. Bulletin 113-3. Sacramento, CA.,

California Geological Survey (CGS), 2002, Wagner, D.L., H.G. Greene, G.J. Saucedo, and C.I. Primdore, Geologic Map of Monterey 30' x 60' Quadrangle and Adjacent Areas, California: A Digital Database, Publication No. CD 2002-04, 2002.

Clark, W.O. 1924. Ground water in Santa Clara Valley, California. Water-Supply Paper 519. U.S. Geological Survey, Washington, D.C.

Corona and Elsinore Valley Municipal Water District (EVMWD), 2008, Agreement Concerning Water Production from Coldwater, December.

Environmental Simulations, Inc. 2011. Guide to Using Groundwater Vistas, Version 6. Reinholds, PA.

Fetter, C.W. 1994. Applied hydrogeology. 3rd edition. Prentice Hall. Upper Saddle River, NJ.

Harbaugh, A.W. 2005. MODFLOW 2005, the U.S. Geological Survey modular ground-water model—the ground-water flow process. Chapter 16, Book 6--modeling techniques, Techniques and Methods 6-A16. U.S. Geological Survey, Reston, VA.

Irrigation Training and Research Institute (ITRC). January 2003. California crop and soil evapotranspiration for water balances and irrigation scheduling/design. ITRC Report 03-001. San Luis Obispo, CA. Prepared for CALFED/DWR/USBR, Sacramento, CA.

Kilburn, C. August 31, 1972. Ground-Water Hydrology Of The Hollister And San Juan Valleys, San Benito County, California, 1913-68. Open-File Report 73-144. U.S. Geological Survey, Menlo Park, CA.

Lewis, D.C. and R.H. Burgy, 1964, The Relationship between oak tree roots and groundwater in fractured rock as determined by tritium tracing, Journal of Geophysical Research, Vol. 69 No. 12, 15 June 1964, p 2579-2588.

Lubczynski, M.W., 2011, Groundwater Evapotranspiration – Underestimated Role of Tree Transpiration and Bare Soil Evaporation in Groundwater Balances of Dry Lands, in Climate Change and its Effects on Water Resources, NATO Science for Peace and Security Series C: Environmental Security Volume 3, 2011, pp 183-190.

Markstrom, S.L., Regan, R.S., Hay, L.E., Viger, R.J., Webb, R.M.T., Payn, R.A., and LaFontaine, J.H., 2015, PRMS-IV, the precipitation-runoff modeling system, version 4: U.S. Geological Survey Techniques and Methods, book 6, chap. B7, 158 p., http://dx.doi.org/10.3133/tm6B7.

Meinzer, O.E., 1927, Plants as indicators of ground water: USGS Water-Supply Paper 577.

Micko, Jeff. December 2014. Report On Simulation Model For The Multi-Purpose Operation Of Pacheco Reservoir In The Pacheco Creek Sub-Watershed Of The Pajaro River. Micko Consultants. Prepared for the California Department of Fish and Wildlife, Sacramento, CA.

MWH, 2004, Coldwater Basin Recharge Feasibility Study, a technical report submitted to the Elsinore Valley Municipal Water District, March 2004, 177 p.

Natural Resources Conservation Service. 2015. SSURGO soil survey on-line map database available at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx . Downloaded 27 March 2015.

Niswonger, R.G., S. Panday, and M. Ibaraki, 2011, MODFLOW-NWT, A Newton Formulation for MODFLOW-2005, U.S. Geological Survey Techniques and Methods G-A37, 44p.

Pritchard, T. 2009. Irrigation management of wine grapes with a limited water supply. University of California Cooperative Extension. Davis, CA.

Rantz, S.E. 1969. Mean annual precipitation in the California region. Basic-Data Compilation 1020-01. U.S. Geological Survey, Menlo Park, CA.

Rawls, W.J., L.R. Ahuja, D.L. Brakensiek and A. Shirmohammadi. 1993. , Infiltration and Soil Water Movement. Chapter 5 *in* D.R. Maidment, ed. Handbook of Hydrology, McGraw-Hill, Inc. New York, NY.

RMC and Woodard & Curran, 2017, 2015 Urban Water Management Plan, Temescal Valley Water District, December, available at:
https://www.temescalvwd.com/pdf/TVWD_UWMP_Public%20Draft%20w%20Appendices.pdf

Robinson, T.W., 1958, Phreatophytes: USGS Water-Supply Paper 1428.

Snyder, R.L., M. Orang, K. Bali and S. Eching, Revised 2007, Basic Irrigation Scheduling (BIS), Computer software manual, Department of Land, Air and Water Resources, University of California. Davis, CA.

Todd Engineers and AKM Consulting Engineers (Todd and AKM), 2008, AB3030 Groundwater Management Plan, prepared for City of Corona, June.

United Nations Food and Agriculture Organization (UNFAP). 2006. Crop evapotranspiration. Technical Report No. 56. Rome, Italy.

Van Mullen, J.A., D.E. Woodward, R.H. Hawkins, and A.T. Hjelmfelt, Jr., No date (but after 2001), Runoff curve number method: beyond the handbook, Curve-Number Working Group, Natural Resources

Viessman, W., Jr., J.W. Knapp, G.L. Lewis, and T.E. Harbaugh., 1977, Introduction to Hydrology, 2nd edition, Harper & Row, Publishers. New York, NY.

Wildermuth Environmental, Inc. (WEI), 2015b, Draft Feasibility Investigation (Phase I) to Develop a Potable Water-Supply from the Bedford Basin, prepared for the City of Corona, Elsinore Valley Water District, and Lee Lake Water District, August.

Williams, L.E. 2001. Irrigation of wine grapes in California. Practical Winery & Vineyard Journal. November/December 2001.

Wu, J.E., K. McClay, P. Whitehouse, and T. Dooley, 2012, 25 - 4D analogue modelling of transtensional pull-apart basins, in Regional Geology and Tectonics: Principles of Geologic Analysis, Editor(s): D.G. Roberts, A.W. Bally, Elsevier, 2012, Pages 700-730, https://doi.org/10.1016/B978-0-444-53042-4.00025-X.

TABLES

Table 2 - Annual Groundwater Pumping Volumes by Well (acre-feet per year)

Well_Name	HA	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Corona #04	Bedford	291	253	305	269	33	332	173	103	215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Flager #02	Bedford	620	940	1,001	279	54	418	289	606	606	202	656	560	420	643	578	523	16	147	495	517	19	0	0	0	0	0	0	0	0	0	0
Flager #03	Bedford	679	614	392	432	117	337	61	111	287	1	1	141	533	705	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flagler #02A	Bedford	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	289	420	444	36	0	0	37	207
Flagler #03A	Bedford	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	475	458	699	16	0	0	42	202
Foster	Bedford	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	220	275	169	185
New Sump	Bedford	501	479	570	379	57	128	185	328	429	45	336	575	439	435	239	342	33	2	241	358	295	388	57	12	198	200	13	288	680	414	278
Non Potable #01	Bedford	0	0	0	0	0	0	0	0	0	0	0	0	0	0	245	0	0	0	0	0	0	258	28	1	1	1	450	368	185	243	380
Non Potable #02	Bedford	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	177	131	151	253	268	327	0	0	1	1	1	0	0	0	0	0
Old Ranch	Bedford	0	1	19	18	248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Old Sand Plant	Bedford	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rose #02	Bedford	84	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rose #03	Bedford	56	16	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rose #04	Bedford	153	52	7	168	238	206	8	18	0	0	31	30	4	12	6	1	4	3	3	3	1	1	1	1	1	1	440	295	476	385	410
Rose #09	Bedford	236	130	475	523	887	0	0	262	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TVWD 1	Bedford	172	51	166	183	230	34	207	0	0	0	31	30	4	29	6	1	4	3	3	3	1	1	1	1	1	1	442	163	445	354	425
TVWD TP1	Bedford	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	324	205
TVWD TP2	Bedford	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	174	96
Coldwater City Park	Coldwater	110	160	680	1,020	1,300	260	1,300	19	16	16	17	1	1	15	17	17	18	17	0	0	0	0	0	0	0	0	0	0	0	0	0
Corona #01	Coldwater	1,278	1,062	1,001	1,174	1,663	1,285	1,685	1,680	1,629	1,614	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corona #02	Coldwater	157	0	0	394	1,152	1,059	1,191	1,256	1,016	1,067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corona #03	Coldwater	1,155	1,024	1,107	1,192	1,368	1,072	1,391	1,297	1,349	1,110	770	506	4	1	237	380	978	1,316	1,083	999	897	952	491	559	83	392	881	460	3	0	0
Corona #20	Coldwater	0	0	0	0	0	0	0	0	0	0	1,489	0	0	0	0	0	338	801	430	361	186	238	186	57	212	196	19	0	0	0	0
Corona #21	Coldwater	0	0	0	0	0	0	0	0	0	2,461	4,364	3,493	2,528	2,579	2,345	2,401	1,506	1,609	2,004	1,955	2,018	1,942	761	662	1,432	1,658	1,254	1,508	764	178	0
Div Box Well	Coldwater	0	0	0	0	388	419	563	468	125	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mayhew #01	Coldwater	921	662	678	212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mayhew #02	Coldwater		0	0	235	853	1,108	356	727	436	649	737	587	462	318	348	219	596	493	377	432	383	413	457	436	467	747	400	286	575	174	748
Noble #1 Maitri Rd	Coldwater	147	135	112	90	75	69	65	81	95	101	170	37	139	172	207	348	16	23	0	0	507	477	497	547	558	547	535	556	586	565	522
SantaAna #1 UpperCyn	Coldwater	81	44	80	88	86	100	111	113	5	83	110	12	45	0	0	0	0	0	0	0	0	0	27	102	41	26	44	34	66	45	45
SantaAna #2 LowerCyn	Coldwater	9	9	11	12	18	18	9	14	3	30	22	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	2	8	9	8
Smith #2	Coldwater	32	32	32	32	32	32	38	40	41	37	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smith Lower #1	Coldwater	35	35	35	35	35	35	33	35	30	27	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smith Upper #2	Coldwater	5	5	5	5	5	5	3	3	2	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Station #26	Coldwater	164	165	116	89	14	3	30	109	77	20	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Station #71	Coldwater	632	476	306	500	858	577	881	930	1,226	690	318	551	378	399	241	185	30	139	216	131	120	100	0	111	238	388	24	97	92	0	175
Station #72	Coldwater	344	302	303	332	369	345	322	288	200	126	337	456	422	353	276	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Warm Sprg	Coldwater	73	73	73	73	73	62	72	73	73	72	67	72	75	72	71	73	72	71	72	72	68	0	0	0	0	0	0	54	57	56	57
Well #1	Coldwater	83	89	71	57	37	26	31	40	47	53	62	8	3	2	2	11	555	620	608	569	0	0	0	0	0	0	0	0	0	0	0
Subtotals																																
Bedford	Bedford	2,792	2,570	2,935	2,251	1,864	1,455	923	1,428	1,537	248	1,055	1,336	1,400	1,824	1,078	1,046	188	306	995	1,149	643	648	87	780	1,080	1,347	1,397	1,334	2,061	2,142	2,389
Coldwater	Coldwater	5,226	4,273	4,610	5,540	8,326	6,475	8,081	7,173	6,370	8,284	8,550	5,723	4,057	3,911	3,744	3,634	4,110	5,089	4,791	4,520	4,179	4,122	2,419	2,475	3,032	3,955	3,157	2,998	2,152	1,027	1,555
Total		8,018	6,843	7,545	7,791	10,190	7,930	9,004	8,601	7,907	8,532	9,605	7,059	5,457	5,735	4,822	4,680	4,298	5,395	5,786	5,669	4,822	4,770	2,506	3,255	4,112	5,302	4,554	4,332	4,213	3,169	3,944

Table 3 - Aquifer Properties for MODFLOW Zones by Model Layer

Horizontal Hydraulic Conductivity (feet/day)					
Zone	**Name**	**MA**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**
1	Mayhew Area	Coldwater	5	2	1
2	Mid Wash	Bedford	100	10	1
3	Bedford Canyon	Bedford	5	2	1
4	Midlands South	Bedford	2	2	1
5	North Wash	Bedford	100	10	1
6	South Wash	Bedford	40	5	1
7	Coldwater Creek	Coldwater	10	2	1
8	North Area	Coldwater	2.5	2	1
9	Midlands North	Bedford	2	1	1
Vertical Hydraulic Conductivity (feet/day)					
Zone	**Name**	**MA**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**
1	Mayhew Area	Coldwater	1	0.2	0.5
2	Mid Wash	Bedford	5	5	0.5
3	Bedford Canyon	Bedford	2.5	0.2	0.1
4	Midlands South	Bedford	0.4	0.2	0.1
5	North Wash	Bedford	5	5	5.0E-01
6	South Wash	Bedford	4	0.5	5.0E-01
7	Coldwater Creek	Coldwater	1	0.2	0.5
8	North Area	Coldwater	0.25	0.2	5.0E-01
9	Midlands North	Bedford	0.4	0.1	1.0E-01
Specific Storage (1/feet)					
Zone	**Name**	**MA**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**
1	Mayhew Area	Coldwater	1.0E-04	2.0E-05	1.0E-05
2	Mid Wash	Bedford	2.0E-04	1.0E-04	1.0E-05
3	Bedford Canyon	Bedford	1.0E-04	2.0E-05	1.0E-05
4	Midlands South	Bedford	1.0E-04	2.0E-05	1.0E-05
5	North Wash	Bedford	5.0E-04	1.0E-04	1.0E-05
6	South Wash	Bedford	1.0E-03	1.0E-04	1.0E-05
7	Coldwater Creek	Coldwater	1.0E-03	2.0E-05	1.0E-05
8	North Area	Coldwater	2.0E-03	1.0E-05	1.0E-05
9	Midlands North	Bedford	1.0E-04	1.0E-05	1.0E-05
Specific Yield (percentage)					
Zone	**Name**	**MA**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**
1	Mayhew Area	Coldwater	0.05	0.03	0.02
2	Mid Wash	Bedford	0.15	0.1	0.02
3	Bedford Canyon	Bedford	0.05	0.03	0.02
4	Midlands South	Bedford	0.05	0.03	0.02
5	North Wash	Bedford	0.15	0.1	0.02
6	South Wash	Bedford	0.11	0.1	0.02
7	Coldwater Creek	Coldwater	0.08	0.05	0.02
8	North Area	Coldwater	0.05	0.02	0.02
9	Midlands North	Bedford	0.05	0.01	0.02

Table 5 - Statistical Calibration by Well

Well ID	Model Layer	Count	Residual Mean (feet)	Absolute Residual Mean (feet)	Standard Deviation (feet)	Management Area
B_Well	1	106	47.7	47.7	12.8	Coldwater
Corona#01	1	152	31.8	43.2	38.6	Coldwater
Corona#02	1	108	48.7	59.0	42.6	Coldwater
Corona#03	1	378	15.8	35.5	40.4	Coldwater
Corona#04	1	183	-5.9	12.7	16.6	Bedford
Corona#20	1	181	-35.7	44.3	45.3	Coldwater
Corona#21	1	99	18.8	26.6	28.0	Coldwater
Div_Box_Well	1	71	46.8	46.8	21.4	Coldwater
Flager#02	1	276	5.9	6.4	4.6	Bedford
Flager#03	1	145	8.5	10.7	8.2	Bedford
Flagler#02A	1	133	0.4	4.9	7.6	Bedford
Flagler#03A	1	196	-3.3	5.2	7.4	Bedford
Flagler#04	1	90	5.3	6.9	5.8	Bedford
LLWD_#01-Old	1	11	-2.6	5.5	5.6	Bedford
Mayhew#01	1	261	36.4	52.8	52.7	Coldwater
Mayhew#02	1	15	43.0	64.4	65.1	Coldwater
New_Sump	1	352	0.9	9.8	13.4	Bedford
Non-Potable#01	1	64	-2.1	6.3	7.5	Bedford
Non-Potable#02	1	62	-3.8	7.3	10.1	Bedford
OLD_SUMP	1	1	3.6	3.6	NA	Bedford
Station#22	1	58	58.0	58.7	38.2	Coldwater
Station#26	1	154	92.7	93.0	28.6	Coldwater
Station#71	1	309	4.9	40.2	50.5	Coldwater
Station#72	1	214	46.6	55.0	44.3	Coldwater
Trilogy	1	95	-7.3	32.8	35.1	Coldwater
TVWD#01A	1	11	-1.1	4.5	5.2	Bedford
TVWD#04	1	11	-3.0	5.0	4.8	Bedford
Basin Average		**3736**	**16.02**	**31.6**	**42.49**	
Bedford Average		**1535**	**0.21**	**6.83**	**8.05**	
Coldwater Average		**2201**	**32.02**	**50.00**	**38.84**	

Table 7 - Bedford/Coldwater GW Basin Water Balance (in acre-feet per year) - Historical

	INFLOWS							OUTFLOWS							
Simulation Year	Surface Recharge	GW-SW	Mountain Front Recharge	Net Quarry Ops	WRF Perc Ponds	Boundary Inflow	Total Inflow	Wells	Net Quarry Ops	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
1990	1,027	1,194	1,656	74	0	1,173	5,125	10,621	5,276	1,086	446	57	17,486	-12,361	-12,361
1991	1,954	6,303	1,660	7	0	1,218	11,142	10,130	2,014	747	445	59	13,395	-2,253	-14,614
1992	1,576	4,486	1,654	18	0	776	8,510	9,579	1,012	520	342	46	11,498	-2,988	-17,602
1993	7,001	19,899	1,641	418	0	206	29,167	11,724	1,214	1,588	1,090	370	15,986	13,181	-4,421
1994	961	1,366	1,645	314	0	399	4,684	11,391	1,006	1,011	537	117	14,062	-9,378	-13,799
1995	3,167	9,420	1,973	121	20	245	14,946	10,957	1,297	1,123	686	105	14,169	777	-13,022
1996	939	562	2,012	111	40	384	4,049	11,610	1,252	582	428	48	13,921	-9,871	-22,893
1997	1,007	345	1,721	11	62	685	3,831	10,893	1,112	234	267	33	12,539	-8,707	-31,601
1998	4,730	13,989	1,467	36	107	253	20,582	10,377	1,471	838	674	287	13,647	6,935	-24,666
1999	864	342	1,355	1	210	242	3,014	11,517	1,558	413	369	117	13,974	-10,960	-35,626
2000	1,154	527	1,047	14	309	415	3,466	9,543	2,383	117	501	33	12,577	-9,111	-44,737
2001	1,975	5,127	989	85	373	497	9,047	7,351	2,713	194	721	30	11,009	-1,962	-46,699
2002	734	73	1,161	56	473	928	3,425	6,803	2,751	94	740	24	10,412	-6,987	-53,686
2003	2,286	5,187	957	29	691	645	9,795	5,714	2,425	154	872	41	9,205	590	-53,096
2004	1,047	316	731	37	891	562	3,582	5,313	5,314	83	807	30	11,547	-7,965	-61,061
2005	9,460	23,787	1,390	1	1,029	124	35,791	5,075	2,336	2,387	1,654	631	12,083	23,708	-37,353
2006	1,872	3,870	1,855	38	854	87	8,577	5,978	1,989	2,174	977	783	11,901	-3,324	-40,676
2007	600	1,045	1,805	0	801	143	4,393	6,168	1,972	1,114	1,183	184	10,622	-6,229	-46,906
2008	582	695	1,680	0	525	313	3,795	5,829	3,525	666	813	44	10,877	-7,082	-53,988
2009	1,642	2,582	1,588	72	291	148	6,323	5,157	4,159	639	868	200	11,023	-4,700	-58,688
2010	3,801	8,513	1,214	14	285	80	13,906	4,919	3,743	953	1,226	541	11,382	2,524	-56,165
2011	4,804	10,308	1,241	30	0	75	16,459	3,162	1,875	1,584	1,256	869	8,746	7,713	-48,452
2012	1,086	1,174	1,452	18	487	94	4,310	3,124	1,689	1,187	759	355	7,114	-2,804	-51,256
2013	848	931	1,460	22	1,575	165	5,002	3,982	2,455	831	625	74	7,966	-2,964	-54,220
2014	1,108	792	1,429	25	1,646	399	5,399	5,090	2,438	568	564	49	8,708	-3,309	-57,529
2015	1,370	757	1,094	178	1,462	192	5,053	4,560	2,241	450	816	278	8,345	-3,292	-60,821
2016	1,083	565	463	252	386	92	2,841	4,244	1,232	257	306	324	6,362	-3,521	-64,342
2017	3,793	8,905	506	404	3,438	80	17,126	4,046	3,736	662	1,088	599	10,131	6,995	-57,348
2018	876	931	659	353	2,862	72	5,753	2,812	3,062	433	916	460	7,682	-1,929	-59,276
Average Water Budget over Simulation Period (1990-2018)															
Average	2,184	4,620	1,362	94	649	369	9,279	7,161	2,388	782	758	234	11,323	-2,044	
Total	63,346	133,989	39,506	2,740	18,818	10,696	269,094	207,669	69,249	22,689	21,977	6,787	328,370	-59,276	
Average Water Budget over Early Historical period (1993-2002)															
Average	2,253	5,165	1,501	117	159	426	9,621	10,217	1,676	619	601	116	13,230	-3,608	
Total	22,533	51,651	15,011	1,167	1,594	4,255	96,212	102,166	16,758	6,194	6,014	1,164	132,296	-36,084	
Average Water Budget over Late Historical period (2005-2015)															
Average	2,470	4,950	1,473	36	814	166	9,910	4,822	2,584	1,141	977	364	9,888	22	
Total	27,172	54,452	16,208	399	8,956	1,821	109,007	53,044	28,421	12,553	10,742	4,007	108,768	240	
Average Water Budget over Long Historical period (1993-2015)															
Average	2,306	4,852	1,431	71	527	317	9,504	7,228	2,301	825	802	228	11,383	-1,879	
Total	53,037	111,605	32,908	1,632	12,132	7,283	218,597	166,237	52,918	18,984	18,435	5,242	261,816	-43,220	
Average Water Budget over Current period (2008-2018)															
Average	1,908	3,287	1,162	124	1,178	156	7,815	4,266	2,741	748	840	345	8,940	-1,125	
Total	20,992	36,152	12,786	1,368	12,957	1,711	85,966	46,925	30,154	8,230	9,236	3,792	98,337	-12,371	

Table 8 - Bedford MA Water Balance (in acre-feet per year) - Historical

Simulation Year	INFLOWS							OUTFLOWS							
	Surface Recharge	GW-SW	Quarry Recharge	Mountain Front Recharge	WRF Perc Ponds	Boundary Inflow	Total Inflow	Wells	GW-SW	Quarry Outflow	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
1990	693	863	74	980	0	1,493	4,103	4,309	731	973	394	57	6,464	-2,361	-2,361
1991	1,270	2,248	7	981	0	1,514	6,020	4,056	559	1,153	369	59	6,196	-176	-2,537
1992	1,000	1,344	18	979	0	1,054	4,395	3,216	409	1,012	306	46	4,988	-593	-3,130
1993	4,800	3,920	418	977	0	423	10,538	3,230	1,495	1,214	768	370	7,076	3,462	332
1994	644	1,042	314	978	0	637	3,614	2,939	950	1,006	531	117	5,544	-1,930	-1,598
1995	2,085	2,422	121	1,185	20	427	6,260	2,349	1,080	1,297	609	105	5,441	819	-779
1996	654	494	111	1,194	40	563	3,057	2,554	563	1,252	427	48	4,845	-1,787	-2,566
1997	733	206	11	1,046	62	849	2,907	2,607	233	1,112	267	33	4,252	-1,345	-3,911
1998	3,219	3,159	36	897	107	354	7,772	1,462	832	1,471	545	287	4,597	3,174	-736
1999	647	341	1	833	210	342	2,375	1,861	413	1,558	369	117	4,318	-1,944	-2,680
2000	785	146	14	629	309	499	2,381	2,086	117	1,373	195	33	3,804	-1,423	-4,103
2001	1,274	1,731	85	592	373	556	4,611	2,040	193	1,108	294	30	3,664	947	-3,155
2002	475	72	56	693	473	977	2,746	2,212	94	1,145	268	24	3,743	-998	-4,153
2003	1,401	1,655	29	547	691	654	4,978	1,641	152	1,447	341	41	3,622	1,356	-2,796
2004	707	153	37	393	891	562	2,743	1,440	83	1,490	311	20	3,344	-601	-3,398
2005	6,337	4,947	1	848	1,029	124	13,287	902	2,377	2,279	1,037	553	7,149	6,138	2,740
2006	1,232	2,135	38	1,119	854	87	5,466	954	2,170	1,982	773	743	6,622	-1,157	1,584
2007	411	1,031	0	1,080	801	143	3,466	1,167	1,114	1,972	497	166	4,917	-1,451	133
2008	397	682	0	1,019	525	313	2,936	1,136	666	1,542	350	20	3,714	-778	-646
2009	1,023	1,205	72	969	291	148	3,707	795	637	1,290	418	150	3,291	416	-230
2010	2,511	2,888	14	706	285	80	6,483	669	949	1,654	626	457	4,355	2,128	1,898
2011	3,209	3,069	30	765	0	75	7,148	235	1,580	1,583	919	762	5,080	2,069	3,967
2012	768	1,172	18	894	487	94	3,434	632	1,187	1,689	759	270	4,537	-1,103	2,864
2013	604	931	22	897	1,575	165	4,194	1,032	831	2,455	625	-11	4,932	-738	2,126
2014	762	664	25	894	1,646	399	4,390	1,308	568	2,438	564	-46	4,831	-440	1,686
2015	954	577	178	686	1,462	192	4,049	1,202	450	2,241	429	171	4,493	-444	1,242
2016	744	403	252	297	386	92	2,174	1,191	257	1,232	292	207	3,178	-1,005	237
2017	2,521	2,847	404	341	3,438	80	9,631	1,625	660	3,736	585	463	7,069	2,562	2,800
2018	584	727	353	382	2,862	72	4,980	1,444	433	3,062	359	357	5,655	-675	2,125
Average Water Budget over Simulation Period (1990-2018)															
Average	1,464	1,485	94	821	649	447	4,960	1,803	751	1,647	491	195	4,887	73	
Total	42,446	43,072	2,740	23,800	18,818	12,970	143,845	52,295	21,784	47,766	14,227	5,649	141,721	2,125	
Average Water Budget over Early Historical period (1993-2002)															
Average	1,532	1,353	117	902	159	563	4,626	2,334	597	1,254	427	116	4,728	-102	
Total	15,317	13,532	1,167	9,022	1,594	5,627	46,261	23,341	5,970	12,537	4,272	1,164	47,284	-1,023	
Average Water Budget over Late Historical period (2005-2015)															
Average	1,655	1,755	36	898	814	166	5,324	912	1,139	1,920	636	294	4,902	422	
Total	18,208	19,300	399	9,877	8,956	1,821	58,560	10,033	12,529	21,124	6,999	3,235	53,920	4,640	
Average Water Budget over Long Historical period (1993-2015)															
Average	1,549	1,506	71	863	527	377	4,893	1,585	815	1,591	518	194	4,703	190	
Total	35,633	34,641	1,632	19,840	12,132	8,664	112,542	36,455	18,735	36,599	11,922	4,459	108,170	4,372	
Average Water Budget over Current period (2008-2018)															
Average	1,280	1,379	124	714	1,178	156	4,830	1,024	747	2,084	539	255	4,649	181	
Total	14,077	15,164	1,368	7,849	12,957	1,711	53,127	11,269	8,219	22,920	5,926	2,800	51,135	1,992	

Table 9 - Coldwater MA Water Balance (in acre-feet per year) - Historical

Simulation Year	INFLOWS						OUTFLOWS							
	Surface Recharge	GW-SW	Mountain Front Recharge	Net Quarry Ops	Boundary Inflow	Total Inflow	Wells	Net Quarry Ops	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
1990	334	331	676	0	0	1,341	6,312	4,303	355	52	320	11,342	-10,000	-10,000
1991	684	4,055	678	0	0	5,418	6,074	861	188	76	296	7,495	-2,077	-12,077
1992	576	3,141	675	0	0	4,393	6,363	0	111	37	277	6,787	-2,395	-14,472
1993	2,201	15,979	665	0	0	18,845	8,493	0	93	323	217	9,126	9,719	-4,753
1994	317	324	667	0	0	1,308	8,451	0	61	6	238	8,756	-7,448	-12,201
1995	1,082	6,998	788	0	0	8,868	8,608	0	43	77	182	8,909	-42	-12,243
1996	285	68	818	0	0	1,171	9,056	0	19	2	179	9,255	-8,084	-20,327
1997	274	139	675	0	0	1,088	8,285	0	1	1	164	8,451	-7,363	-27,690
1998	1,511	10,831	570	0	0	12,912	8,915	0	5	129	101	9,151	3,761	-23,929
1999	217	1	522	0	0	740	9,656	0	0	0	100	9,756	-9,017	-32,946
2000	369	381	419	0	0	1,169	7,457	1,010	0	306	84	8,857	-7,688	-40,634
2001	702	3,396	397	0	0	4,494	5,312	1,605	2	427	59	7,404	-2,909	-43,544
2002	259	1	468	0	0	728	4,591	1,606	0	472	49	6,718	-5,990	-49,533
2003	884	3,532	410	0	0	4,826	4,073	977	2	531	9	5,592	-766	-50,300
2004	340	163	338	0	10	850	3,873	3,824	0	496	0	8,193	-7,344	-57,643
2005	3,122	18,840	542	0	77	22,582	4,173	57	10	617	0	4,857	17,724	-39,919
2006	641	1,735	736	0	40	3,152	5,024	7	4	204	0	5,238	-2,087	-42,005
2007	189	14	725	0	18	945	5,001	0	0	685	0	5,687	-4,741	-46,747
2008	185	13	661	0	24	883	4,693	1,983	0	463	0	7,139	-6,256	-53,002
2009	619	1,377	619	0	51	2,667	4,361	2,869	2	450	0	7,681	-5,015	-58,017
2010	1,290	5,625	508	0	83	7,506	4,250	2,089	4	601	0	6,943	562	-57,455
2011	1,595	7,239	476	0	106	9,416	2,927	292	4	337	0	3,560	5,856	-51,598
2012	317	1	558	0	85	961	2,492	0	0	0	0	2,492	-1,531	-53,129
2013	244	1	562	0	85	892	2,950	0	0	0	0	2,950	-2,058	-55,187
2014	346	127	536	0	95	1,104	3,783	0	0	0	0	3,783	-2,679	-57,866
2015	416	180	408	0	107	1,111	3,358	0	0	387	0	3,745	-2,633	-60,499
2016	339	162	166	0	117	784	3,053	0	0	14	0	3,067	-2,282	-62,782
2017	1,272	6,058	165	0	136	7,631	2,421	0	2	503	0	2,926	4,705	-58,077
2018	292	205	277	0	123	896	1,368	0	0	557	0	1,924	-1,028	-59,105
Average Water Budget over Simulation Period (1990-2018)														
Average	721	3,135	542	0	40	4,437	5,358	741	31	267	78	6,475	-2,038	
Total	20,901	90,917	15,706	0	1,158	128,682	155,373	21,483	905	7,750	2,275	187,786	-59,105	
Average Water Budget over Early Historical period (1993-2002)														
Average	722	3,812	599	0	0	5,132	7,882	422	22	174	137	8,638	-3,506	
Total	7,216	38,118	5,989	0	0	51,323	78,824	4,221	224	1,742	1,372	86,384	-35,061	
Average Water Budget over Late Historical period (2005-2015)														
Average	815	3,196	576	0	70	4,656	3,910	663	2	340	0	4,916	-260	
Total	8,964	35,152	6,331	0	772	51,219	43,011	7,297	24	3,743	0	54,075	-2,856	
Average Water Budget over Long Historical period (1993-2015)														
Average	757	3,346	568	0	34	4,705	5,643	710	11	283	60	6,706	-2,001	
Total	17,404	76,965	13,068	0	782	108,218	129,782	16,319	250	6,513	1,381	154,245	-46,027	
Average Water Budget over Current period (2008-2018)														
Average	629	1,908	449	0	92	3,077	3,241	658	1	301	0	4,201	-1,123	
Total	6,915	20,988	4,937	0	1,012	33,852	35,655	7,233	11	3,310	0	46,210	-12,358	

Table 10 - Change in Groundwater in Storage (in acre-feet per year) - Historical

Simulation Year	Net Change in Groundwater in Storage		Annual Change in Groundwater in Storage	Cumulative Storage Change
	Coldwater Hydrologic Area	Bedford Hydrologic Area		
1990	-10,000	-2,361	-12,361	-12,361
1991	-2,077	-176	-2,253	-14,614
1992	-2,395	-593	-2,988	-17,602
1993	9,719	3,462	13,181	-4,421
1994	-7,448	-1,930	-9,378	-13,799
1995	-42	819	777	-13,022
1996	-8,084	-1,787	-9,871	-22,893
1997	-7,363	-1,345	-8,707	-31,601
1998	3,761	3,174	6,935	-24,666
1999	-9,017	-1,944	-10,960	-35,626
2000	-7,688	-1,423	-9,111	-44,737
2001	-2,909	947	-1,962	-46,699
2002	-5,990	-998	-6,987	-53,686
2003	-766	1,356	590	-53,096
2004	-7,344	-622	-7,965	-61,062
2005	17,724	5,984	23,708	-37,354
2006	-2,087	-1,237	-3,324	-40,677
2007	-4,741	-1,488	-6,229	-46,906
2008	-6,256	-826	-7,082	-53,989
2009	-5,015	314	-4,700	-58,689
2010	562	1,961	2,524	-56,165
2011	5,856	1,856	7,713	-48,453
2012	-1,531	-1,273	-2,804	-51,257
2013	-2,058	-907	-2,964	-54,221
2014	-2,679	-630	-3,309	-57,530
2015	-2,633	-659	-3,292	-60,822
2016	-2,282	-1,243	-3,526	-64,348
2017	4,705	2,287	6,992	-57,356
2018	-1,028	-881	-1,909	-59,264
Average Water Budget over Simulation Period (1990-2018)				
Average	-2,038	-6	-2,044	
Total	-59,105	-160	-59,264	
Average Water Budget over Early Historical period (1993-2002)				
Average	-3,506	-102	-3,608	
Total	-35,061	-1,023	-36,084	
Average Water Budget over Late Historical period (2005-2015)				
Average	-260	281	22	
Total	-2,856	3,096	239	
Average Water Budget over Long Historical period (1993-2015)				
Average	-2,001	122	-1,879	
Total	-46,027	2,807	-43,220	
Average Water Budget over Current period (2008-2018)				
Average	-1,123	0	-1,123	
Total	-12,358	0	-12,358	

Table 11 - Bedford/Coldwater GW Basin Water Balance (in acre-feet per year) - Projected Future Baseline Scenario

	INFLOWS							OUTFLOWS							
Simulation Year	Surface Recharge	GW-SW	Mountain Front Recharge	Net Quarry Ops	WRF Perc Ponds	Boundary Inflow	Total Inflow	Wells	Net Quarry Ops	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	7,126	16,193	1,580	107	1,856	71	26,933	4,319	2,911	1,486	1,278	660	10,654	16,279	16,279
2020	1,173	1,667	1,581	151	1,856	88	6,515	4,330	2,546	1,285	975	602	9,736	-3,221	13,058
2021	3,514	7,565	1,578	128	1,856	83	14,723	4,318	2,647	1,410	1,142	662	10,179	4,544	17,602
2022	905	1,120	1,587	173	1,856	91	5,732	4,333	2,358	1,008	923	524	9,146	-3,414	14,188
2023	1,089	1,008	1,592	185	1,856	91	5,822	4,330	2,220	795	850	451	8,646	-2,824	11,364
2024	4,977	10,445	1,436	118	1,856	77	18,908	4,326	2,652	1,357	1,159	669	10,163	8,744	20,108
2025	852	1,005	1,335	167	1,856	91	5,306	4,333	2,392	957	906	539	9,128	-3,822	16,287
2026	1,189	1,122	1,040	184	1,856	90	5,480	4,326	2,225	632	739	430	8,351	-2,871	13,416
2027	2,199	5,764	979	159	1,856	84	11,040	4,321	2,383	807	782	519	8,812	2,228	15,644
2028	526	652	1,097	194	1,856	92	4,417	4,335	2,179	580	656	409	8,158	-3,742	11,902
2029	2,586	5,375	887	159	1,856	84	10,947	4,315	2,293	615	764	492	8,479	2,468	14,370
2030	923	760	678	194	1,856	88	4,500	4,329	2,152	429	618	386	7,915	-3,415	10,955
2031	9,183	19,552	1,292	82	1,856	63	32,029	4,316	2,934	2,000	1,620	760	11,630	20,399	31,354
2032	1,672	2,232	1,673	136	1,856	83	7,652	4,324	2,667	1,633	1,152	701	10,476	-2,824	28,530
2033	457	1,082	1,612	183	1,856	91	5,281	4,332	2,320	1,051	847	474	9,023	-3,743	24,787
2034	473	934	1,498	194	1,856	91	5,047	4,321	2,161	865	665	389	8,402	-3,355	21,432
2035	1,529	2,031	1,426	182	1,856	84	7,108	4,324	2,183	774	709	424	8,413	-1,305	20,126
2036	3,554	8,626	1,055	133	1,856	80	15,304	4,324	2,577	1,055	966	614	9,535	5,768	25,895
2037	4,546	10,266	1,117	110	1,856	79	17,975	4,319	2,767	1,460	1,206	718	10,470	7,505	33,400
2038	985	1,013	1,313	168	1,856	91	5,426	4,326	2,400	963	922	529	9,139	-3,713	29,687
2039	726	780	1,322	189	1,856	91	4,965	4,334	2,207	718	755	423	8,436	-3,472	26,215
2040	973	652	1,296	199	1,856	92	5,066	4,332	2,094	507	698	374	8,005	-2,938	23,277
2041	1,240	549	980	195	1,856	92	4,911	4,331	2,065	372	614	359	7,740	-2,829	20,448
2042	920	477	405	205	1,856	92	3,955	4,329	2,015	244	543	331	7,461	-3,507	16,942
2043	3,490	8,003	461	152	1,856	80	14,042	4,327	2,363	560	773	510	8,533	5,509	22,450
2044	7,064	15,871	1,102	99	1,856	71	26,063	4,328	2,855	1,696	1,396	739	11,014	15,050	37,500
2045	1,172	1,713	1,539	150	1,856	87	6,518	4,330	2,578	1,354	1,005	613	9,880	-3,362	34,138
2046	3,514	7,700	1,843	126	1,856	83	15,122	4,318	2,669	1,546	1,195	675	10,403	4,719	38,856
2047	901	1,306	2,055	167	1,856	91	6,377	4,349	2,427	1,221	1,008	545	9,550	-3,173	35,683
2048	1,080	1,183	1,799	182	1,887	93	6,224	4,398	2,340	966	936	485	9,125	-2,902	32,781
2049	5,091	10,927	1,443	116	1,897	77	19,551	4,399	2,763	1,525	1,247	696	10,631	8,921	41,702
2050	819	1,088	1,339	169	1,897	93	5,405	4,406	2,481	1,048	953	557	9,445	-4,040	37,662
2051	1,187	1,346	1,043	184	1,897	92	5,748	4,400	2,314	722	781	450	8,667	-2,919	34,743
2052	2,200	6,108	982	156	1,887	85	11,418	4,388	2,475	894	830	564	9,152	2,266	37,009
2053	481	713	1,105	196	1,897	93	4,485	4,407	2,257	641	687	441	8,432	-3,948	33,061
2054	2,625	5,771	891	158	1,897	85	11,427	4,389	2,401	699	808	532	8,829	2,597	35,659
2055	910	944	678	193	1,897	90	4,712	4,403	2,245	510	657	421	8,236	-3,524	32,135
2056	9,323	20,087	1,301	78	1,887	65	32,740	4,383	3,030	2,213	1,713	797	12,136	20,604	52,739
2057	1,661	2,378	1,688	137	1,897	85	7,846	4,396	2,729	1,723	1,190	733	10,772	-2,926	49,813
2058	414	1,141	1,622	186	1,897	93	5,352	4,405	2,389	1,113	872	492	9,271	-3,920	45,893
2059	428	981	1,508	197	1,897	93	5,104	4,394	2,233	919	683	400	8,630	-3,526	42,367
2060	1,523	2,348	1,429	178	1,887	85	7,450	4,392	2,285	839	745	467	8,728	-1,278	41,090
2061	3,639	8,910	1,050	133	1,897	81	15,710	4,397	2,669	1,154	1,007	648	9,875	5,835	46,925
2062	4,601	10,532	1,112	111	1,897	81	18,333	4,392	2,854	1,569	1,254	746	10,815	7,517	54,442
2063	952	1,078	1,323	175	1,687	93	5,309	4,411	2,274	1,032	948	546	9,211	-3,902	50,540
2064	685	837	1,331	193	1,887	93	5,026	4,401	2,257	777	779	434	8,649	-3,623	46,917
2065	940	738	1,309	201	1,897	93	5,178	4,404	2,165	562	721	387	8,239	-3,061	43,856
2066	1,204	656	986	195	1,897	93	5,032	4,404	2,150	419	637	384	7,995	-2,963	40,893
2067	881	565	401	206	1,897	94	4,043	4,402	2,104	275	564	353	7,698	-3,654	37,238
2068	3,528	8,291	458	152	1,887	82	14,398	4,394	2,464	620	810	534	8,822	5,576	42,815
Average Water Budget over Simulation Period (2019-2068)															
Average	2,273	4,442	1,243	162	1,868	86	10,073	4,357	2,422	992	914	532	9,217	856	
Total	113,627	222,085	62,156	8,086	93,385	4,313	503,652	217,845	121,121	49,597	45,687	26,587	460,838	42,815	
Average Water Budget over Implementation Period (2022-2041)															
Average	2,029	3,748	1,261	165	1,856	86	9,146	4,326	2,362	929	877	509	9,003	142	
Total	40,583	74,968	25,213	3,304	37,120	1,728	182,915	86,528	47,231	18,577	17,549	10,183	180,069	2,846	
Average Water Budget over Sustainability Period (2042-2068)															
Average	2,268	4,507	1,193	163	1,878	87	10,095	4,383	2,437	994	916	536	9,267	828	
Total	61,232	121,692	32,204	4,396	50,698	2,344	272,566	118,350	65,788	26,840	24,743	14,481	250,200	22,366	
Average Water Budget over GSP Period (2019-2021)															
Average	3,937	8,475	1,580	128	1,856	80	16,057	4,322	2,701	1,394	1,132	641	10,190	5,867	
Total	11,812	25,425	4,740	385	5,568	241	48,171	12,967	8,103	4,181	3,395	1,923	30,569	17,602	

Table 12 - Bedford MA Water Balance (in acre-feet per year) - Projected Future Baseline Scenario

	INFLOWS							OUTFLOWS							
Simulation Year	Surface Recharge	GW-SW	Quarry Recharge	Mountain Front Recharge	WRF Perc Ponds	Boundary Inflow	Total Inflow	Wells	GW-SW	Quarry Outflow	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	4,825	3,730	107	1,008	1,856	71	11,597	1,310	1,479	2,911	1,125	514	7,339	4,258	4,258
2020	799	1,440	151	1,008	1,856	88	5,341	1,307	1,284	2,546	828	494	6,459	-1,118	3,140
2021	2,312	2,389	128	1,007	1,856	83	7,775	1,309	1,407	2,647	992	558	6,913	862	4,001
2022	622	1,070	173	1,010	1,856	91	4,823	1,305	1,008	2,358	766	439	5,876	-1,053	2,948
2023	758	887	185	1,012	1,856	91	4,791	1,303	795	2,220	685	369	5,373	-582	2,367
2024	3,335	2,923	118	905	1,856	77	9,214	1,312	1,351	2,652	1,005	571	6,891	2,323	4,689
2025	598	1,004	167	846	1,856	91	4,562	1,305	957	2,392	751	461	5,867	-1,305	3,385
2026	769	798	184	653	1,856	90	4,351	1,304	632	2,225	587	358	5,106	-754	2,630
2027	1,428	2,282	159	613	1,856	84	6,421	1,306	806	2,383	643	442	5,580	841	3,471
2028	354	652	194	668	1,856	92	3,816	1,303	580	2,179	508	344	4,914	-1,099	2,372
2029	1,695	1,843	159	518	1,856	84	6,155	1,306	614	2,293	615	416	5,245	910	3,283
2030	619	624	194	377	1,856	88	3,758	1,303	429	2,152	467	317	4,668	-910	2,372
2031	6,177	4,284	82	788	1,856	63	13,251	1,313	1,990	2,934	1,455	654	8,346	4,905	7,277
2032	1,101	1,682	136	1,015	1,856	83	5,873	1,309	1,632	2,667	1,012	638	7,258	-1,385	5,893
2033	299	1,082	183	973	1,856	91	4,485	1,303	1,051	2,320	701	442	5,817	-1,332	4,560
2034	314	934	194	918	1,856	91	4,308	1,302	865	2,161	532	364	5,225	-917	3,643
2035	964	1,276	182	877	1,856	84	5,238	1,304	773	2,183	568	388	5,216	22	3,666
2036	2,336	2,744	133	628	1,856	80	7,777	1,309	1,051	2,577	811	564	6,312	1,465	5,131
2037	3,023	2,732	110	699	1,856	79	8,499	1,310	1,457	2,767	1,061	662	7,257	1,243	6,374
2038	697	1,013	168	819	1,856	91	4,645	1,305	963	2,400	767	504	5,939	-1,294	5,079
2039	509	780	189	823	1,856	91	4,248	1,303	718	2,207	601	411	5,240	-991	4,088
2040	661	594	199	819	1,856	92	4,220	1,303	507	2,094	533	364	4,801	-581	3,507
2041	861	494	195	624	1,856	92	4,121	1,303	372	2,065	456	343	4,538	-417	3,091
2042	621	397	205	270	1,856	92	3,442	1,302	244	2,015	378	309	4,247	-805	2,286
2043	2,305	2,556	152	313	1,856	80	7,263	1,307	559	2,363	606	466	5,300	1,963	4,248
2044	4,780	3,528	99	720	1,856	71	11,053	1,313	1,690	2,855	1,233	674	7,764	3,289	7,537
2045	798	1,486	150	981	1,856	87	5,359	1,307	1,354	2,578	859	587	6,685	-1,326	6,211
2046	2,312	2,433	126	1,168	1,856	83	7,978	1,309	1,543	2,669	1,044	655	7,220	758	6,970
2047	620	1,256	167	1,281	1,856	95	5,275	1,310	1,221	2,427	851	545	6,354	-1,078	5,891
2048	754	1,053	182	1,131	1,887	103	5,110	1,325	965	2,340	767	485	5,882	-772	5,119
2049	3,417	3,052	116	918	1,897	77	9,477	1,333	1,519	2,763	1,091	681	7,388	2,090	7,209
2050	580	1,088	169	855	1,897	102	4,691	1,327	1,048	2,481	795	557	6,208	-1,517	5,692
2051	771	992	184	663	1,897	111	4,618	1,326	722	2,314	628	450	5,440	-823	4,869
2052	1,431	2,460	156	623	1,887	98	6,655	1,328	893	2,475	688	564	5,948	707	5,576
2053	327	713	196	681	1,897	120	3,934	1,325	641	2,257	538	441	5,200	-1,267	4,309
2054	1,725	2,082	158	528	1,897	100	6,488	1,329	698	2,401	656	532	5,617	872	5,181
2055	614	781	193	384	1,897	110	3,979	1,325	510	2,245	503	421	5,005	-1,026	4,155
2056	6,274	4,461	78	802	1,887	65	13,566	1,334	2,202	3,030	1,546	769	8,880	4,686	8,841
2057	1,097	1,783	137	1,031	1,897	103	6,047	1,330	1,722	2,729	1,048	733	7,562	-1,515	7,326
2058	274	1,141	186	985	1,897	149	4,631	1,325	1,113	2,389	724	492	6,044	-1,413	5,912
2059	287	981	197	931	1,897	160	4,452	1,324	919	2,233	548	400	5,425	-973	4,940
2060	961	1,531	178	884	1,887	139	5,581	1,325	839	2,285	601	467	5,517	64	5,004
2061	2,398	2,849	133	628	1,897	113	8,018	1,330	1,151	2,669	850	648	6,649	1,369	6,373
2062	3,058	2,844	111	699	1,897	103	8,712	1,332	1,566	2,854	1,106	746	7,604	1,108	7,481
2063	679	1,078	175	833	1,687	154	4,607	1,340	1,032	2,274	790	546	5,981	-1,375	6,106
2064	484	837	193	837	1,887	171	4,409	1,324	777	2,257	622	434	5,414	-1,006	5,100
2065	643	666	201	835	1,897	173	4,415	1,325	562	2,165	554	387	4,992	-577	4,523
2066	840	592	195	636	1,897	166	4,325	1,325	419	2,150	476	384	4,755	-429	4,094
2067	599	473	206	274	1,897	161	3,609	1,324	275	2,104	396	353	4,451	-842	3,252
2068	2,334	2,704	152	318	1,887	121	7,516	1,328	618	2,464	639	534	5,583	1,933	5,185
Average Water Budget over Simulation Period (2019-2068)															
Average	1,521	1,661	162	776	1,868	102	6,090	1,315	990	2,422	760	498	5,986	104	
Total	76,037	83,075	8,086	38,820	93,385	5,077	304,480	65,768	49,519	121,121	38,010	24,878	299,295	5,185	
Average Water Budget over Implementation Period (2022-2041)															
Average	1,356	1,485	165	779	1,856	86	5,728	1,305	927	2,362	726	453	5,773	-46	
Total	27,119	29,699	3,304	15,588	37,120	1,728	114,557	26,109	18,550	47,231	14,525	9,052	115,468	-911	
Average Water Budget over Sustainability Period (2042-2068)															
Average	1,518	1,697	163	748	1,878	115	6,119	1,323	993	2,437	761	528	6,041	78	
Total	40,982	45,817	4,396	20,209	50,698	3,108	165,210	35,732	26,798	65,788	20,539	14,260	163,116	2,094	
Average Water Budget over GSP Period (2019-2021)															
Average	2,645	2,520	128	1,008	1,856	80	8,237	1,309	1,390	2,701	982	522	6,904	1,334	
Total	7,936	7,559	385	3,023	5,568	241	24,712	3,926	4,170	8,103	2,945	1,566	20,711	4,001	

Table 13 - Coldwater MA Water Balance (in acre-feet per year) - Projected Future Baseline Scenario

	INFLOWS							OUTFLOWS						
Simulation Year	Surface Recharge	GW-SW	Mountain Front Recharge	Net Quarry Ops	Boundary Inflow	Total Inflow	Wells	Net Quarry Ops	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	2,301	12,463	572	0	145	15,481	3,009	0	7	153	0	3,169	12,312	12,312
2020	374	227	573	0	108	1,282	3,023	0	0	146	0	3,169	-1,887	10,425
2021	1,202	5,176	571	0	104	7,053	3,009	0	3	151	0	3,162	3,891	14,315
2022	283	50	577	0	85	994	3,028	0	0	157	0	3,185	-2,191	12,124
2023	331	121	580	0	82	1,113	3,026	0	0	165	0	3,192	-2,079	10,045
2024	1,642	7,522	530	0	98	9,792	3,015	0	6	153	0	3,174	6,618	16,664
2025	254	0	490	0	78	822	3,028	0	0	155	0	3,183	-2,362	14,302
2026	420	323	386	0	72	1,201	3,022	0	0	151	0	3,173	-1,972	12,330
2027	771	3,482	366	0	77	4,696	3,015	0	1	139	0	3,155	1,541	13,870
2028	172	0	429	0	65	666	3,031	0	0	147	0	3,179	-2,512	11,358
2029	891	3,533	369	0	76	4,868	3,009	0	1	149	0	3,159	1,709	13,066
2030	304	137	301	0	70	812	3,026	0	0	151	0	3,177	-2,365	10,701
2031	3,006	15,268	504	0	105	18,883	3,003	0	11	164	0	3,178	15,704	26,405
2032	571	549	658	0	62	1,841	3,015	0	2	140	0	3,156	-1,315	25,091
2033	157	0	638	0	33	828	3,028	0	0	145	0	3,174	-2,345	22,745
2034	159	0	579	0	25	764	3,019	0	0	133	0	3,152	-2,388	20,357
2035	565	756	549	0	35	1,905	3,021	0	0	141	0	3,162	-1,257	19,100
2036	1,217	5,882	428	0	51	7,577	3,015	0	3	155	0	3,173	4,404	23,505
2037	1,523	7,535	418	0	56	9,531	3,009	0	3	145	0	3,157	6,374	29,879
2038	288	0	493	0	24	806	3,021	0	0	155	0	3,176	-2,370	27,509
2039	217	0	499	0	11	728	3,031	0	0	154	0	3,185	-2,458	25,051
2040	312	57	477	0	10	856	3,029	0	0	165	0	3,193	-2,337	22,714
2041	380	55	356	0	16	806	3,028	0	0	158	0	3,186	-2,379	20,334
2042	299	79	134	0	22	535	3,027	0	0	165	1	3,193	-2,658	17,676
2043	1,185	5,447	148	0	44	6,823	3,020	0	1	168	1	3,190	3,633	21,309
2044	2,284	12,343	382	0	65	15,075	3,015	0	7	163	0	3,184	11,892	33,201
2045	374	227	558	0	26	1,184	3,023	0	0	146	0	3,169	-1,985	31,216
2046	1,202	5,267	675	0	20	7,164	3,009	0	3	151	0	3,164	4,000	35,216
2047	281	50	774	0	0	1,105	3,039	0	0	158	3	3,200	-2,095	33,121
2048	325	130	669	0	0	1,124	3,074	0	0	169	10	3,253	-2,129	30,991
2049	1,674	7,875	525	0	16	10,090	3,066	0	6	155	0	3,227	6,863	37,854
2050	239	0	484	0	0	724	3,079	0	0	158	9	3,246	-2,523	35,331
2051	415	354	380	0	0	1,150	3,073	0	0	154	20	3,246	-2,097	33,235
2052	768	3,649	359	0	0	4,776	3,061	0	1	142	13	3,217	1,559	34,794
2053	154	0	424	0	0	578	3,083	0	0	149	27	3,259	-2,681	32,113
2054	901	3,689	363	0	0	4,953	3,061	0	1	152	14	3,227	1,726	33,839
2055	295	164	295	0	0	754	3,077	0	0	154	20	3,251	-2,497	31,341
2056	3,048	15,626	500	0	28	19,202	3,049	0	11	167	0	3,228	15,974	47,315
2057	564	596	657	0	0	1,816	3,066	0	2	142	18	3,228	-1,411	45,904
2058	140	0	636	0	0	777	3,080	0	0	148	56	3,283	-2,507	43,398
2059	142	0	577	0	0	719	3,070	0	0	135	67	3,272	-2,553	40,845
2060	563	817	545	0	0	1,924	3,067	0	0	144	54	3,265	-1,341	39,503
2061	1,241	6,062	422	0	0	7,725	3,066	0	3	157	32	3,258	4,466	43,969
2062	1,542	7,688	413	0	0	9,643	3,060	0	3	148	22	3,234	6,409	50,378
2063	273	0	490	0	0	763	3,072	0	0	158	61	3,290	-2,527	47,851
2064	200	0	494	0	0	695	3,078	0	0	157	77	3,312	-2,617	45,234
2065	297	72	473	0	0	842	3,080	0	0	167	80	3,327	-2,484	42,750
2066	364	64	351	0	0	779	3,079	0	0	161	73	3,313	-2,533	40,216
2067	283	91	127	0	0	501	3,078	0	0	168	69	3,316	-2,815	37,401
2068	1,194	5,587	141	0	0	6,922	3,067	0	2	170	42	3,280	3,641	41,043
Average Water Budget over Simulation Period (2019-2068)														
Average	752	2,780	467	0	34	4,033	3,042	0	2	154	15	3,212	821	
Total	37,590	139,010	23,337	0	1,709	201,646	152,078	0	78	7,677	770	160,603	41,043	
Average Water Budget over Implementation Period (2022-2041)														
Average	673	2,263	481	0	57	3,474	3,021	0	1	151	0	3,173	301	
Total	13,464	45,269	9,625	0	1,131	69,489	60,419	0	27	3,024	0	63,470	6,019	
Average Water Budget over Sustainability Period (2042-2068)														
Average	750	2,810	444	0	8	4,013	3,060	0	2	156	29	3,246	767	
Total	20,250	75,875	11,995	0	221	108,341	82,618	0	41	4,204	770	87,633	20,708	
Average Water Budget over GSP Period (2019-2021)														
Average	1,292	5,955	572	0	119	7,939	3,014	0	3	150	0	3,167	4,772	
Total	3,877	17,865	1,716	0	357	23,816	9,041	0	10	450	0	9,501	14,315	

Table 14 - Change in Groundwater in Storage (in acre-feet per year) - Projected Future Baseline Scenario

Simulation Year	Net Change in Groundwater in Storage		Annual Change in Groundwater in Storage	Cumulative Storage Change
	Coldwater Hydrologic Area	Bedford Hydrologic Area		
2019	12,312	3,967	16,279	16,279
2020	-1,887	-1,334	-3,221	13,058
2021	3,891	654	4,544	17,602
2022	-2,191	-1,223	-3,414	14,188
2023	-2,079	-745	-2,824	11,364
2024	6,618	2,126	8,744	20,108
2025	-2,362	-1,460	-3,822	16,287
2026	-1,972	-898	-2,871	13,416
2027	1,541	687	2,228	15,644
2028	-2,512	-1,229	-3,742	11,902
2029	1,709	759	2,468	14,369
2030	-2,365	-1,050	-3,415	10,954
2031	15,704	4,695	20,399	31,353
2032	-1,315	-1,509	-2,824	28,529
2033	-2,345	-1,397	-3,743	24,786
2034	-2,388	-967	-3,355	21,431
2035	-1,257	-48	-1,305	20,126
2036	4,404	1,364	5,768	25,894
2037	6,374	1,131	7,505	33,399
2038	-2,370	-1,343	-3,713	29,686
2039	-2,458	-1,014	-3,472	26,215
2040	-2,337	-601	-2,938	23,276
2041	-2,379	-449	-2,829	20,448
2042	-2,658	-854	-3,512	16,936
2043	3,633	1,874	5,506	22,442
2044	11,892	3,158	15,050	37,491
2045	-1,985	-1,377	-3,362	34,129
2046	4,000	718	4,719	38,848
2047	-2,095	-1,078	-3,173	35,674
2048	-2,129	-772	-2,902	32,773
2049	6,863	2,058	8,921	41,693
2050	-2,523	-1,517	-4,040	37,654
2051	-2,097	-823	-2,919	34,734
2052	1,559	707	2,266	37,000
2053	-2,681	-1,267	-3,948	33,053
2054	1,726	872	2,597	35,650
2055	-2,497	-1,027	-3,524	32,126
2056	15,974	4,630	20,604	52,730
2057	-1,411	-1,515	-2,926	49,803
2058	-2,507	-1,413	-3,920	45,883
2059	-2,553	-973	-3,526	42,358
2060	-1,341	64	-1,278	41,080
2061	4,466	1,369	5,835	46,915
2062	6,409	1,108	7,517	54,432
2063	-2,527	-1,375	-3,902	50,530
2064	-2,617	-1,006	-3,623	46,908
2065	-2,484	-577	-3,061	43,846
2066	-2,533	-429	-2,963	40,884
2067	-2,815	-847	-3,662	37,222
2068	3,641	1,931	5,572	42,794
Average Water Budget over Simulation Period (2019-2068)				
Average	821	35	856	
Total	41,043	1,751	42,794	
Average Water Budget over Implementation Period (2022-2041)				
Average	301	-159	142	
Total	6,019	-3,173	2,846	
Average Water Budget over Sustainability Period (2042-2068)				
Average	767	61	828	
Total	20,708	1,638	22,346	
Average Water Budget over GSP Period (2019-2021)				
Average	4,772	1,096	5,867	
Total	14,315	3,287	17,602	

Table 15 - Bedford/Coldwater GW Basin Water Balance (in acre-feet per year) - Projected Future Growth plus Climate Change Scenario

	INFLOWS							OUTFLOWS							
Simulation Year	Surface Recharge	GW-SW	Mountain Front Recharge	Net Quarry Ops	WRF Perc Ponds	Boundary Inflow	Total Inflow	Wells	Net Quarry Ops	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	8,073	16,119	1,632	299	2,139	71	28,334	5,021	2,866	1,737	1,553	607	11,784	16,549	16,549
2020	1,871	1,689	1,632	456	2,139	88	7,874	5,019	2,504	1,637	1,216	551	10,927	-3,053	13,497
2021	4,391	7,441	1,628	409	2,139	83	16,091	5,018	2,595	1,838	1,480	572	11,503	4,588	18,085
2022	1,545	1,258	1,637	490	2,139	91	7,160	5,027	2,405	1,396	1,143	476	10,445	-3,285	14,800
2023	1,743	1,172	1,642	510	2,139	91	7,298	5,028	2,321	1,142	1,076	398	9,965	-2,668	12,132
2024	5,728	10,357	1,470	380	2,139	77	20,151	5,016	2,658	1,837	1,543	605	11,660	8,492	20,624
2025	1,343	1,112	1,344	486	2,139	91	6,516	5,026	2,408	1,316	1,124	496	10,371	-3,855	16,768
2026	1,939	1,359	1,069	512	2,139	90	7,108	5,025	2,322	997	955	373	9,673	-2,564	14,204
2027	3,177	5,660	1,045	472	2,139	84	12,578	5,010	2,420	1,285	1,057	442	10,213	2,364	16,568
2028	910	824	1,185	528	2,139	92	5,678	5,021	2,292	940	853	361	9,466	-3,788	12,780
2029	3,419	5,353	975	475	2,139	84	12,445	5,009	2,358	1,033	1,055	401	9,856	2,589	15,370
2030	1,563	999	779	523	2,139	88	6,092	5,024	2,289	817	863	334	9,327	-3,235	12,134
2031	10,087	19,400	1,313	304	2,139	63	33,306	5,019	2,885	2,591	2,221	717	13,432	19,874	32,009
2032	2,152	2,186	1,613	432	2,139	83	8,606	5,021	2,590	2,048	1,442	644	11,744	-3,138	28,871
2033	838	1,097	1,503	518	2,139	91	6,187	5,022	2,348	1,284	987	418	10,059	-3,872	24,999
2034	842	950	1,400	542	2,139	91	5,965	5,020	2,244	1,049	770	320	9,403	-3,438	21,561
2035	2,277	2,241	1,322	513	2,139	84	8,577	5,012	2,301	1,067	884	367	9,630	-1,053	20,507
2036	4,385	8,461	1,048	416	2,139	80	16,529	5,017	2,562	1,470	1,292	535	10,877	5,652	26,159
2037	5,604	10,141	1,131	370	2,139	79	19,465	5,014	2,705	1,976	1,647	634	11,976	7,489	33,648
2038	1,490	1,153	1,327	488	2,139	91	6,689	5,026	2,415	1,356	1,138	487	10,423	-3,734	29,915
2039	1,144	912	1,343	528	2,139	91	6,159	5,023	2,288	1,038	927	359	9,635	-3,476	26,438
2040	1,555	817	1,324	515	2,139	92	6,442	5,030	2,237	819	887	276	9,249	-2,808	23,631
2041	1,869	796	1,026	529	2,139	92	6,452	5,018	2,213	726	821	286	9,064	-2,612	21,019
2042	1,517	642	482	542	2,139	93	5,415	5,029	2,197	548	751	271	8,796	-3,381	17,638
2043	4,321	7,838	537	448	2,139	80	15,364	5,021	2,427	958	1,105	424	9,935	5,429	23,066
2044	7,992	15,635	1,143	330	2,139	71	27,310	5,020	2,831	2,272	1,939	674	12,737	14,574	37,640
2045	1,874	1,766	1,570	454	2,139	87	7,891	5,019	2,532	1,804	1,303	569	11,226	-3,335	34,305
2046	4,391	7,564	1,856	406	2,139	83	16,439	5,019	2,616	2,008	1,556	587	11,786	4,653	38,958
2047	1,538	1,399	2,048	486	2,139	91	7,701	5,046	2,440	1,640	1,229	505	10,861	-3,159	35,799
2048	1,717	1,380	1,817	512	2,176	93	7,695	5,104	2,407	1,352	1,171	450	10,484	-2,789	33,010
2049	5,802	10,901	1,480	380	2,197	77	20,836	5,100	2,749	2,042	1,632	639	12,163	8,674	41,684
2050	1,267	1,175	1,358	495	2,197	93	6,585	5,110	2,481	1,413	1,163	521	10,687	-4,102	37,582
2051	1,912	1,614	1,072	517	2,197	92	7,403	5,109	2,402	1,100	999	399	10,008	-2,605	34,977
2052	3,151	5,993	1,043	471	2,176	85	12,920	5,086	2,494	1,385	1,104	487	10,557	2,363	37,339
2053	819	877	1,188	540	2,197	93	5,715	5,105	2,353	1,004	879	389	9,730	-4,015	33,324
2054	3,438	5,762	981	475	2,197	85	12,938	5,093	2,450	1,134	1,094	442	10,213	2,725	36,049
2055	1,522	1,214	783	529	2,197	90	6,334	5,108	2,370	903	902	374	9,657	-3,322	32,726
2056	10,185	20,021	1,321	294	2,176	65	34,062	5,102	2,969	2,827	2,323	764	13,985	20,077	52,803
2057	2,105	2,442	1,629	439	2,197	85	8,897	5,104	2,659	2,167	1,493	683	12,107	-3,210	49,593
2058	750	1,154	1,520	529	2,197	93	6,243	5,105	2,416	1,360	1,012	448	10,341	-4,097	45,495
2059	751	989	1,413	554	2,197	93	5,997	5,104	2,311	1,101	786	334	9,637	-3,639	41,856
2060	2,247	2,545	1,333	512	2,176	85	8,898	5,088	2,375	1,150	921	401	9,936	-1,037	40,819
2061	4,436	8,786	1,039	419	2,197	81	16,958	5,101	2,639	1,580	1,346	571	11,237	5,722	46,540
2062	5,639	10,443	1,122	372	2,197	81	19,854	5,098	2,795	2,086	1,698	669	12,346	7,508	54,049
2063	1,415	1,199	1,337	498	2,197	93	6,739	5,110	2,479	1,422	1,164	509	10,684	-3,945	50,103
2064	1,060	954	1,346	540	2,176	93	6,169	5,100	2,337	1,082	948	372	9,839	-3,670	46,433
2065	1,481	919	1,330	553	2,197	93	6,574	5,112	2,288	880	906	315	9,501	-2,927	43,506
2066	1,793	934	1,027	539	2,197	93	6,584	5,102	2,289	800	847	315	9,354	-2,770	40,736
2067	1,437	799	476	550	2,197	94	5,553	5,113	2,275	614	783	299	9,083	-3,530	37,206
2068	4,323	8,167	530	451	2,176	82	15,728	5,098	2,508	1,050	1,146	475	10,277	5,451	42,657
Average Water Budget over Simulation Period (2019-2068)															
Average	2,937	4,492	1,263	471	2,161	86	11,410	5,055	2,466	1,382	1,183	471	10,557	853	
Total	146,828	224,610	63,167	23,530	108,057	4,314	570,506	252,772	123,318	69,080	59,134	23,544	527,849	42,657	
Average Water Budget over Implementation Period (2022-2041)															
Average	2,680	3,812	1,275	477	2,139	86	10,470	5,020	2,413	1,309	1,134	446	10,323	147	
Total	53,609	76,249	25,495	9,532	42,790	1,728	209,402	100,408	48,262	26,185	22,684	8,930	206,469	2,934	
Average Water Budget over Sustainability Period (2042-2068)															
Average	2,922	4,560	1,214	475	2,180	87	11,437	5,085	2,485	1,396	1,193	477	10,636	801	
Total	78,884	123,112	32,780	12,835	58,849	2,345	308,804	137,306	67,091	37,684	32,201	12,885	287,166	21,638	
Average Water Budget over GSP Period (2019-2021)															
Average	4,778	8,416	1,631	388	2,139	80	17,433	5,019	2,655	1,737	1,417	577	11,405	6,028	
Total	14,335	25,249	4,892	1,164	6,418	241	52,299	15,058	7,965	5,211	4,250	1,730	34,214	18,085	

Table 16 - Bedford MA Water Balance (in acre-feet per year) - Projected Future Growth plus Climate Change Scenario

	INFLOWS							OUTFLOWS							
Simulation Year	Surface Recharge	GW-SW	Quarry Recharge	Mountain Front Recharge	WRF Perc Ponds	Boundary Inflow	Total Inflow	Wells	GW-SW	Quarry Outflow	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	5,577	3,665	299	1,082	2,139	71	12,833	1,895	1,730	2,866	1,388	453	8,332	4,501	4,501
2020	1,355	1,462	456	1,081	2,139	88	6,581	1,883	1,637	2,504	1,055	429	7,508	-927	3,574
2021	3,032	2,266	409	1,080	2,139	83	9,009	1,884	1,835	2,595	1,315	448	8,078	932	4,506
2022	1,125	1,210	490	1,083	2,139	91	6,138	1,880	1,396	2,405	972	372	7,025	-888	3,618
2023	1,285	1,052	510	1,085	2,139	91	6,163	1,882	1,142	2,321	895	298	6,538	-375	3,243
2024	3,966	2,841	380	965	2,139	77	10,368	1,888	1,831	2,658	1,375	485	8,238	2,130	5,373
2025	996	1,111	486	885	2,139	91	5,709	1,881	1,316	2,408	952	402	6,959	-1,250	4,123
2026	1,359	1,036	512	712	2,139	90	5,848	1,879	997	2,322	791	281	6,270	-422	3,701
2027	2,181	2,180	472	696	2,139	84	7,752	1,881	1,283	2,420	905	341	6,830	922	4,623
2028	656	824	528	764	2,139	92	5,003	1,879	940	2,292	691	276	6,078	-1,074	3,548
2029	2,383	1,824	475	605	2,139	84	7,511	1,880	1,032	2,358	891	304	6,466	1,045	4,593
2030	1,118	863	523	469	2,139	88	5,201	1,882	817	2,289	697	244	5,929	-728	3,865
2031	6,947	4,146	304	822	2,139	63	14,422	1,891	2,581	2,885	2,041	589	9,987	4,435	8,300
2032	1,550	1,641	432	1,005	2,139	83	6,851	1,884	2,046	2,590	1,289	563	8,373	-1,522	6,778
2033	595	1,097	518	943	2,139	91	5,383	1,879	1,284	2,348	828	370	6,709	-1,325	5,453
2034	600	950	542	903	2,139	91	5,226	1,878	1,049	2,244	626	280	6,076	-849	4,603
2035	1,580	1,486	513	868	2,139	84	6,670	1,878	1,067	2,301	730	309	6,284	385	4,989
2036	3,004	2,586	416	686	2,139	80	8,912	1,883	1,467	2,562	1,122	461	7,496	1,416	6,405
2037	3,878	2,612	370	751	2,139	79	9,829	1,886	1,973	2,705	1,487	556	8,607	1,223	7,627
2038	1,110	1,153	488	861	2,139	91	5,843	1,880	1,356	2,415	969	444	7,063	-1,220	6,407
2039	839	912	528	871	2,139	91	5,381	1,878	1,038	2,288	758	329	6,292	-910	5,497
2040	1,126	760	515	870	2,139	92	5,503	1,879	819	2,237	707	246	5,889	-386	5,111
2041	1,392	744	529	692	2,139	92	5,588	1,878	726	2,213	648	246	5,712	-123	4,988
2042	1,094	565	542	359	2,139	93	4,793	1,878	548	2,197	570	222	5,416	-623	4,365
2043	3,017	2,399	448	402	2,139	80	8,486	1,882	957	2,427	922	351	6,538	1,948	6,312
2044	5,514	3,300	330	790	2,139	71	12,145	1,892	2,266	2,831	1,763	585	9,336	2,808	9,121
2045	1,358	1,540	454	1,046	2,139	87	6,625	1,883	1,803	2,532	1,143	524	7,884	-1,259	7,862
2046	3,032	2,299	406	1,219	2,139	83	9,178	1,884	2,006	2,616	1,391	544	8,441	738	8,600
2047	1,121	1,350	486	1,319	2,139	91	6,507	1,888	1,640	2,440	1,059	487	7,514	-1,007	7,593
2048	1,274	1,250	512	1,185	2,176	93	6,490	1,910	1,352	2,407	987	438	7,093	-603	6,989
2049	4,026	3,023	380	981	2,197	77	10,683	1,919	2,037	2,749	1,462	600	8,767	1,916	8,905
2050	952	1,175	495	903	2,197	93	5,815	1,911	1,413	2,481	988	511	7,304	-1,489	7,416
2051	1,351	1,253	517	722	2,197	92	6,131	1,910	1,100	2,402	832	394	6,637	-506	6,910
2052	2,172	2,343	471	700	2,176	85	7,948	1,910	1,384	2,494	949	471	7,209	740	7,650
2053	601	877	540	772	2,197	98	5,086	1,909	1,004	2,353	715	389	6,371	-1,285	6,365
2054	2,407	2,078	475	615	2,197	85	7,858	1,911	1,133	2,450	928	431	6,854	1,004	7,369
2055	1,101	1,046	529	478	2,197	90	5,441	1,913	903	2,370	734	369	6,288	-848	6,521
2056	7,020	4,413	294	832	2,176	65	14,800	1,926	2,817	2,969	2,140	713	10,566	4,234	10,756
2057	1,529	1,838	439	1,022	2,197	85	7,109	1,915	2,166	2,659	1,338	681	8,759	-1,650	9,106
2058	542	1,154	529	962	2,197	130	5,514	1,909	1,360	2,416	850	448	6,983	-1,469	7,637
2059	546	989	554	919	2,197	142	5,347	1,908	1,101	2,311	640	334	6,294	-947	6,690
2060	1,567	1,722	512	882	2,176	112	6,972	1,906	1,150	2,375	765	401	6,597	375	7,065
2061	3,050	2,727	419	681	2,197	86	9,161	1,914	1,577	2,639	1,173	571	7,874	1,286	8,351
2062	3,906	2,762	372	746	2,197	81	10,064	1,917	2,083	2,795	1,534	666	8,995	1,068	9,419
2063	1,068	1,199	498	874	2,197	131	5,967	1,911	1,422	2,479	992	509	7,312	-1,345	8,074
2064	788	954	540	878	2,176	149	5,485	1,906	1,082	2,337	776	372	6,474	-989	7,086
2065	1,085	847	553	880	2,197	149	5,712	1,908	880	2,288	723	315	6,114	-402	6,684
2066	1,349	869	539	698	2,197	138	5,790	1,908	800	2,289	672	315	5,985	-195	6,489
2067	1,048	705	550	360	2,197	129	4,990	1,909	614	2,275	599	299	5,695	-705	5,784
2068	3,026	2,579	451	402	2,176	88	8,722	1,910	1,048	2,508	960	475	6,901	1,821	7,604
Average Water Budget over Simulation Period (2019-2068)															
Average	2,064	1,714	471	828	2,161	93	7,331	1,895	1,380	2,466	1,015	423	7,179	152	
Total	103,198	85,678	23,530	41,405	108,057	4,674	366,543	94,735	69,009	123,318	50,737	21,140	358,938	7,604	
Average Water Budget over Implementation Period (2022-2041)															
Average	1,884	1,551	477	827	2,139	86	6,965	1,881	1,308	2,413	969	370	6,941	24	
Total	37,689	31,029	9,532	16,534	42,790	1,728	139,301	37,625	26,161	48,262	19,376	7,395	138,819	482	
Average Water Budget over Sustainability Period (2042-2068)															
Average	2,057	1,750	475	801	2,180	100	7,364	1,905	1,394	2,485	1,022	460	7,267	97	
Total	55,545	47,256	12,835	21,628	58,849	2,705	198,818	51,447	37,646	67,091	27,603	12,415	196,202	2,617	
Average Water Budget over GSP Period (2019-2021)															
Average	3,321	2,465	388	1,081	2,139	80	9,474	1,887	1,734	2,655	1,253	443	7,973	1,502	
Total	9,964	7,394	1,164	3,243	6,418	241	28,423	5,662	5,202	7,965	3,758	1,330	23,918	4,506	

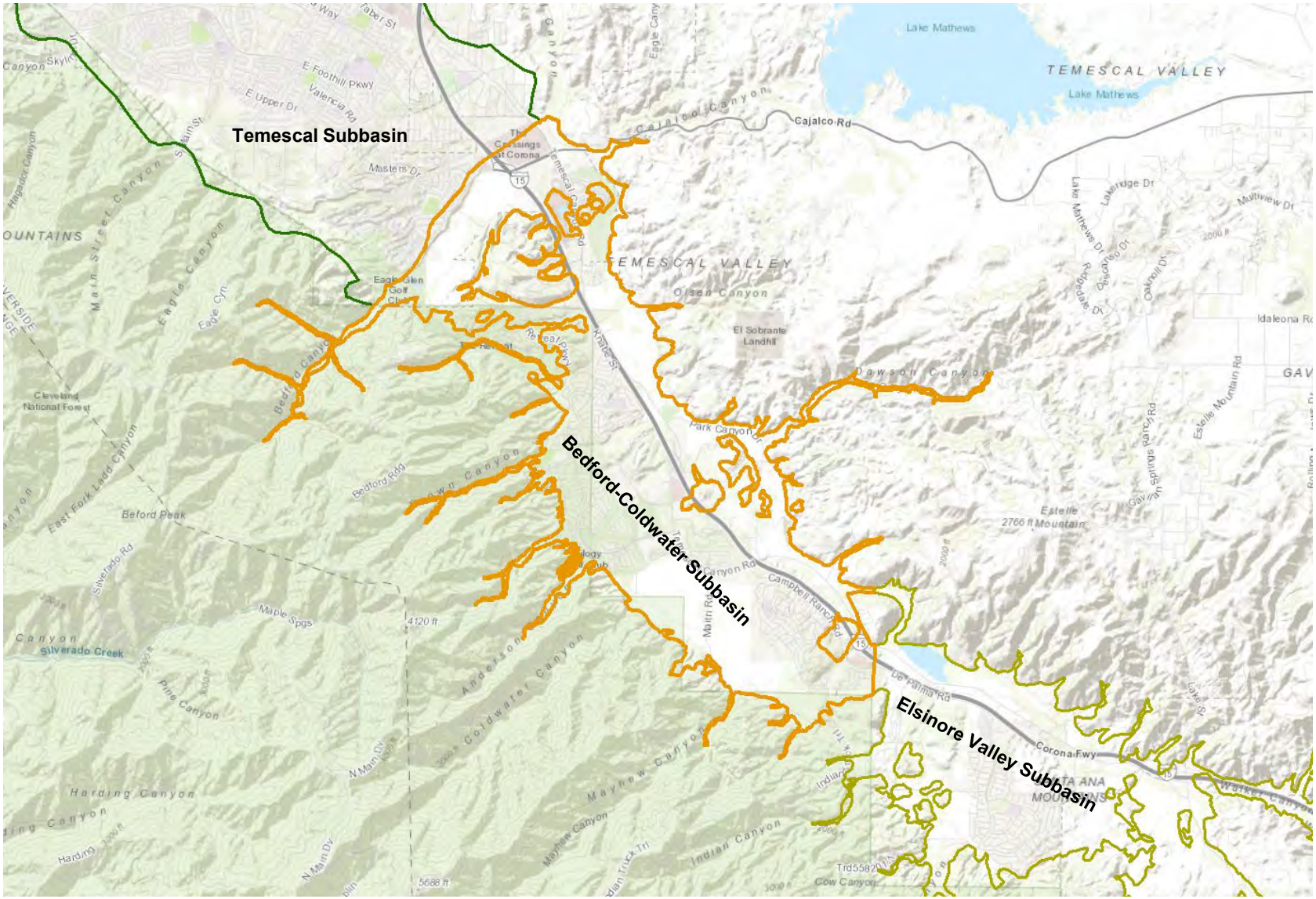
Table 17 - Coldwater MA Water Balance (in acre-feet per year) - Projected Future Growth plus Climate Change Scenario

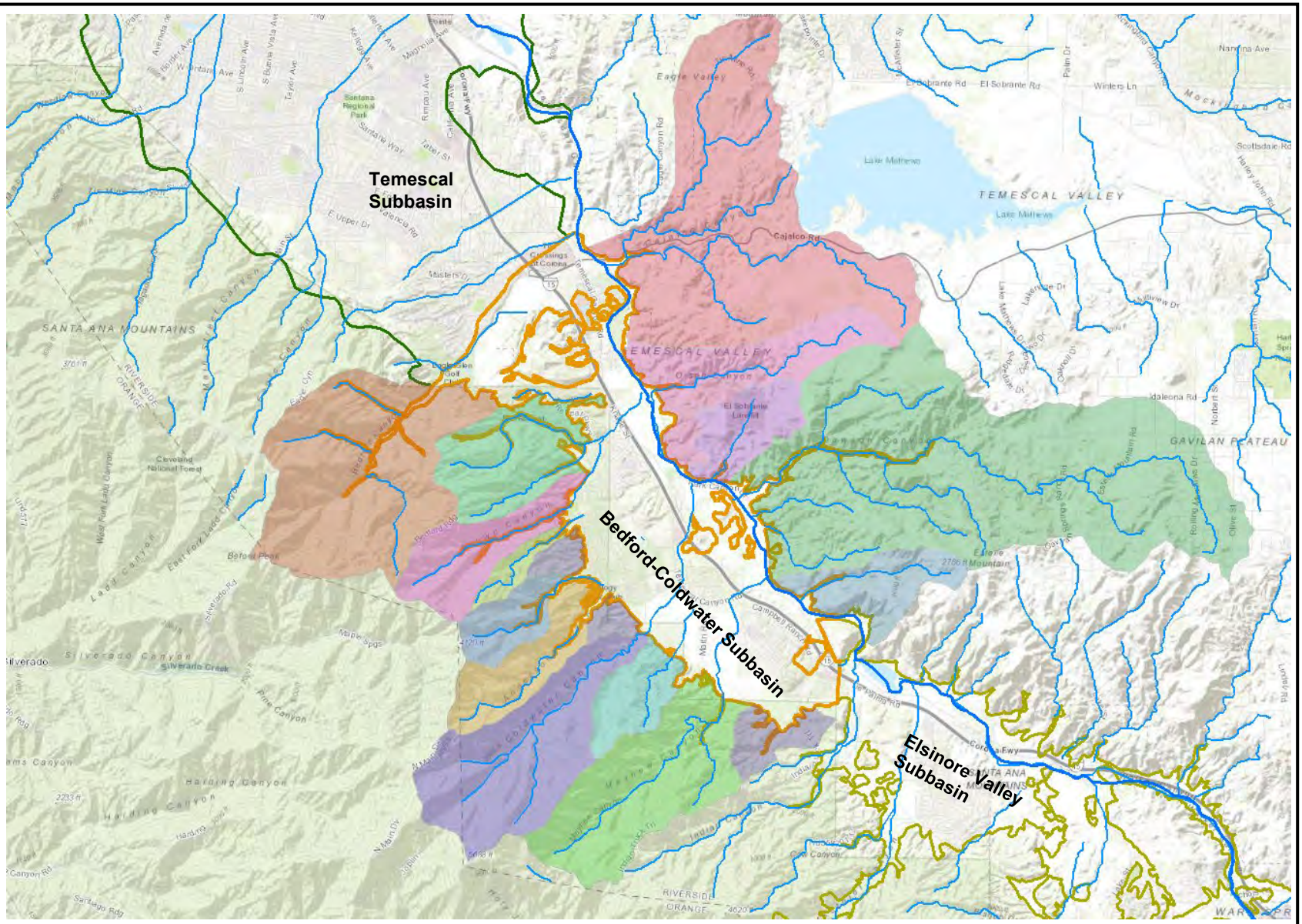
	INFLOWS							OUTFLOWS						
Simulation Year	Surface Recharge	GW-SW	Mountain Front Recharge	Net Quarry Ops	Boundary Inflow	Total Inflow	Wells	Net Quarry Ops	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	2,496	12,454	550	0	154	15,655	3,126	0	6	166	0	3,298	12,357	12,357
2020	516	227	551	0	122	1,415	3,136	0	0	161	0	3,297	-1,882	10,475
2021	1,359	5,175	548	0	123	7,205	3,134	0	2	165	0	3,302	3,903	14,378
2022	420	49	554	0	103	1,126	3,147	0	0	170	0	3,317	-2,191	12,187
2023	458	120	557	0	100	1,235	3,146	0	0	181	0	3,327	-2,092	10,095
2024	1,762	7,516	505	0	120	9,903	3,128	0	5	168	0	3,301	6,602	16,697
2025	348	0	459	0	95	902	3,146	0	0	172	0	3,318	-2,416	14,280
2026	580	323	357	0	92	1,353	3,146	0	0	165	0	3,310	-1,958	12,323
2027	996	3,480	350	0	102	4,928	3,129	0	1	151	0	3,281	1,646	13,969
2028	255	0	421	0	85	760	3,142	0	0	162	0	3,304	-2,544	11,426
2029	1,036	3,529	370	0	97	5,032	3,128	0	1	164	0	3,293	1,739	13,164
2030	445	136	310	0	91	982	3,142	0	0	165	0	3,308	-2,326	10,838
2031	3,139	15,254	491	0	127	19,011	3,128	0	10	179	0	3,317	15,694	26,532
2032	602	545	608	0	81	1,836	3,136	0	2	153	0	3,291	-1,455	25,078
2033	243	0	560	0	48	852	3,143	0	0	159	0	3,302	-2,450	22,627
2034	242	0	497	0	40	778	3,143	0	0	144	0	3,287	-2,509	20,118
2035	698	755	455	0	58	1,965	3,134	0	0	154	0	3,288	-1,323	18,795
2036	1,380	5,875	362	0	74	7,691	3,134	0	3	170	0	3,307	4,384	23,179
2037	1,726	7,530	380	0	78	9,714	3,128	0	3	160	0	3,291	6,423	29,602
2038	380	0	466	0	44	890	3,146	0	0	170	0	3,316	-2,426	27,177
2039	305	0	472	0	30	807	3,145	0	0	169	0	3,313	-2,506	24,670
2040	428	57	454	0	30	969	3,151	0	0	180	0	3,331	-2,362	22,309
2041	477	52	334	0	40	903	3,140	0	0	172	0	3,312	-2,409	19,899
2042	422	77	123	0	49	671	3,151	0	0	180	1	3,332	-2,661	17,239
2043	1,305	5,439	134	0	73	6,951	3,140	0	1	183	1	3,325	3,627	20,865
2044	2,479	12,334	353	0	89	15,255	3,129	0	6	177	0	3,312	11,943	32,809
2045	516	226	523	0	45	1,311	3,136	0	0	160	0	3,296	-1,985	30,823
2046	1,359	5,265	637	0	43	7,304	3,134	0	2	166	0	3,303	4,001	34,824
2047	417	48	729	0	18	1,213	3,158	0	0	171	0	3,329	-2,116	32,709
2048	444	130	632	0	12	1,218	3,194	0	0	184	0	3,379	-2,161	30,547
2049	1,776	7,878	499	0	39	10,192	3,181	0	6	170	0	3,357	6,835	37,382
2050	314	0	455	0	9	779	3,199	0	0	175	0	3,374	-2,595	34,788
2051	560	361	350	0	4	1,276	3,199	0	0	167	0	3,366	-2,090	32,698
2052	979	3,650	343	0	16	4,988	3,177	0	1	154	0	3,332	1,655	34,353
2053	218	0	416	0	0	634	3,195	0	0	164	5	3,364	-2,730	31,622
2054	1,031	3,684	366	0	11	5,091	3,181	0	1	167	0	3,349	1,742	33,365
2055	420	168	305	0	5	898	3,195	0	0	168	0	3,364	-2,465	30,900
2056	3,165	15,608	488	0	51	19,313	3,176	0	10	183	0	3,369	15,944	46,844
2057	576	605	607	0	2	1,791	3,189	0	2	155	0	3,346	-1,556	45,288
2058	208	0	559	0	0	766	3,196	0	0	162	37	3,395	-2,629	42,660
2059	205	0	494	0	0	700	3,196	0	0	147	49	3,392	-2,692	39,968
2060	680	823	451	0	0	1,954	3,182	0	0	157	27	3,366	-1,412	38,556
2061	1,386	6,060	357	0	0	7,803	3,187	0	3	172	5	3,368	4,435	42,991
2062	1,733	7,681	376	0	3	9,793	3,181	0	3	163	0	3,347	6,446	49,437
2063	346	0	463	0	0	810	3,199	0	0	173	38	3,410	-2,601	46,837
2064	272	0	468	0	0	739	3,193	0	0	172	56	3,421	-2,682	44,155
2065	396	72	450	0	0	918	3,204	0	0	182	56	3,443	-2,525	41,630
2066	444	65	329	0	0	838	3,193	0	0	176	45	3,414	-2,575	39,055
2067	389	94	116	0	0	599	3,204	0	0	184	38	3,426	-2,827	36,228
2068	1,297	5,587	128	0	0	7,012	3,188	0	2	186	8	3,383	3,628	39,856
Average Water Budget over Simulation Period (2019-2068)														
Average	873	2,779	435	0	48	4,135	3,161	0	1	168	7	3,337	797	
Total	43,629	138,932	21,762	0	2,405	206,727	158,037	0	71	8,397	366	166,871	39,856	
Average Water Budget over Implementation Period (2022-2041)														
Average	796	2,261	448	0	77	3,582	3,139	0	1	165	0	3,306	276	
Total	15,920	45,220	8,961	0	1,535	71,636	62,783	0	25	3,307	0	66,115	5,521	
Average Water Budget over Sustainability Period (2042-2068)														
Average	864	2,809	413	0	17	4,104	3,180	0	1	170	14	3,365	739	
Total	23,338	75,856	11,152	0	470	110,816	85,859	0	37	4,598	366	90,859	19,957	
Average Water Budget over GSP Period (2019-2021)														
Average	1,457	5,952	550	0	133	8,092	3,132	0	3	164	0	3,299	4,793	
Total	4,371	17,856	1,649	0	400	24,275	9,396	0	9	492	0	9,897	14,378	

Table 18 - Change in Groundwater in Storage (in acre-feet per year) - Projected Future Growth plus Climate Change Scenario

Simulation Year	Net Change in Groundwater in Storage		Annual Change in Groundwater in Storage	Cumulative Storage Change
	Coldwater Hydrologic Area	Bedford Hydrologic Area		
2019	12,357	4,193	16,549	16,549
2020	-1,882	-1,171	-3,053	13,497
2021	3,903	685	4,588	18,085
2022	-2,191	-1,094	-3,285	14,800
2023	-2,092	-575	-2,668	12,132
2024	6,602	1,890	8,492	20,624
2025	-2,416	-1,439	-3,855	16,768
2026	-1,958	-607	-2,564	14,204
2027	1,646	718	2,364	16,568
2028	-2,544	-1,244	-3,788	12,780
2029	1,739	850	2,589	15,370
2030	-2,326	-910	-3,236	12,134
2031	15,694	4,181	19,874	32,008
2032	-1,455	-1,683	-3,138	28,870
2033	-2,450	-1,422	-3,872	24,998
2034	-2,509	-929	-3,438	21,560
2035	-1,323	270	-1,053	20,507
2036	4,384	1,268	5,652	26,159
2037	6,423	1,066	7,489	33,648
2038	-2,426	-1,308	-3,734	29,914
2039	-2,506	-970	-3,476	26,438
2040	-2,362	-446	-2,808	23,630
2041	-2,409	-203	-2,612	21,018
2042	-2,661	-726	-3,386	17,632
2043	3,627	1,800	5,426	23,058
2044	11,943	2,631	14,574	37,632
2045	-1,985	-1,350	-3,335	34,297
2046	4,001	652	4,653	38,950
2047	-2,116	-1,043	-3,159	35,791
2048	-2,161	-628	-2,789	33,002
2049	6,835	1,839	8,674	41,676
2050	-2,595	-1,508	-4,102	37,573
2051	-2,090	-515	-2,605	34,968
2052	1,655	707	2,363	37,331
2053	-2,730	-1,285	-4,015	33,316
2054	1,742	982	2,725	36,040
2055	-2,465	-858	-3,323	32,717
2056	15,944	4,132	20,077	52,794
2057	-1,556	-1,655	-3,210	49,584
2058	-2,629	-1,469	-4,097	45,487
2059	-2,692	-947	-3,639	41,847
2060	-1,412	375	-1,037	40,810
2061	4,435	1,286	5,722	46,532
2062	6,446	1,062	7,508	54,040
2063	-2,601	-1,345	-3,945	50,094
2064	-2,682	-989	-3,670	46,424
2065	-2,525	-402	-2,927	43,497
2066	-2,575	-195	-2,770	40,727
2067	-2,827	-710	-3,537	37,190
2068	3,628	1,819	5,447	42,637
Average Water Budget over Simulation Period (2019-2068)				
Average	797	56	853	
Total	39,856	2,781	42,637	
Average Water Budget over Implementation Period (2022-2041)				
Average	276	-129	147	
Total	5,521	-2,588	2,933	
Average Water Budget over Sustainability Period (2042-2068)				
Average	739	62	801	
Total	19,957	1,662	21,619	
Average Water Budget over GSP Period (2019-2021)				
Average	4,793	1,236	6,028	
Total	14,378	3,707	18,085	

FIGURES


Temescal Subbasin
Bedford-Coldwater Subbasin
Elsinore Valley Subbasin
Lake Mathews
TEMESCAL VALLEY
Cajalco Rd
Olsen Canyon
El Sobrante Landfill
Dawson Canyon
Park Canyon
Bedford Ridge
Bedford Peak
Estelle Mountain
2766 ft
Campbell Ranch Rd
Main St
Corona Fwy
Maple Spgs
Silverado Creek
Anderson Coldwater Canyon
Mayhew Canyon
Harding Canyon
Indian Canyon
Cow Canyon
Cleveland National Forest
Eagle Canyon
Main Street Canyon
East Fork Lade Canyon
Pine Canyon
Lake Matthews Dr
Multiview Dr
Lakeridge Dr
Idaleona Rd
Estelle Mountain Rd
Gavilan Springs Ranch Rd
Temescal Canyon Rd
Retreat Pkwy
Knabe St
Masters Dr
E Foothill Pkwy
Valencia Rd
E Upper Dr
Eagle Glen Golf Club
The Crossings at Corona
Cajalco Canyon
Eagle Canyon
Bedford Canyon
Dawson Canyon
Park Canyon
Mayhew Canyon
Indian Canyon
Cow Canyon
Harding Canyon
Anderson Coldwater Canyon
Pine Canyon
Silverado Creek
Maple Spgs
Bedford Ridge
Beford Peak
East Fork Lade Canyon
Cleveland National Forest
Main Street Canyon
Eagle Canyon
Hagador Canyon
Skyline Canyon
Lake Matthews
TEMESCAL VALLEY
Cajalco Rd
Olsen Canyon
El Sobrante Landfill
Dawson Canyon
Park Canyon
Bedford Ridge
Bedford Peak
Estelle Mountain
2766 ft
Campbell Ranch Rd
Main St
Corona Fwy
Maple Spgs
Silverado Creek
Anderson Coldwater Canyon
Mayhew Canyon
Harding Canyon
Indian Canyon
Cow Canyon
Cleveland National Forest
Eagle Canyon
Main Street Canyon
East Fork Lade Canyon
Pine Canyon
Lake Matthews Dr
Multiview Dr
Lakeridge Dr
Idaleona Rd
Estelle Mountain Rd
Gavilan Springs Ranch Rd
Temescal Canyon Rd
Retreat Pkwy
Knabe St
Masters Dr
E Foothill Pkwy
Valencia Rd
E Upper Dr
Eagle Glen Golf Club
The Crossings at Corona
Cajalco Canyon
Eagle Canyon
Bedford Canyon
Dawson Canyon
Park Canyon
Mayhew Canyon
Indian Canyon
Cow Canyon
Harding Canyon
Anderson Coldwater Canyon
Pine Canyon
Silverado Creek
Maple Spgs
Bedford Ridge
Beford Peak
East Fork Lade Canyon
Cleveland National Forest
Main Street Canyon
Eagle Canyon
Hagador Canyon
Skyline Canyon
N
Legend
Bedford-Coldwater Subbasin
Elsinore Valley Subbasin
Temescal Subbasin
0 0.5 1
Scale: Miles
November 2021
TODD GROUNDWATER
Figure 1
Location and Topography of
Bedford-Coldwater Basin



N

0 0.5 1

Scale: Miles

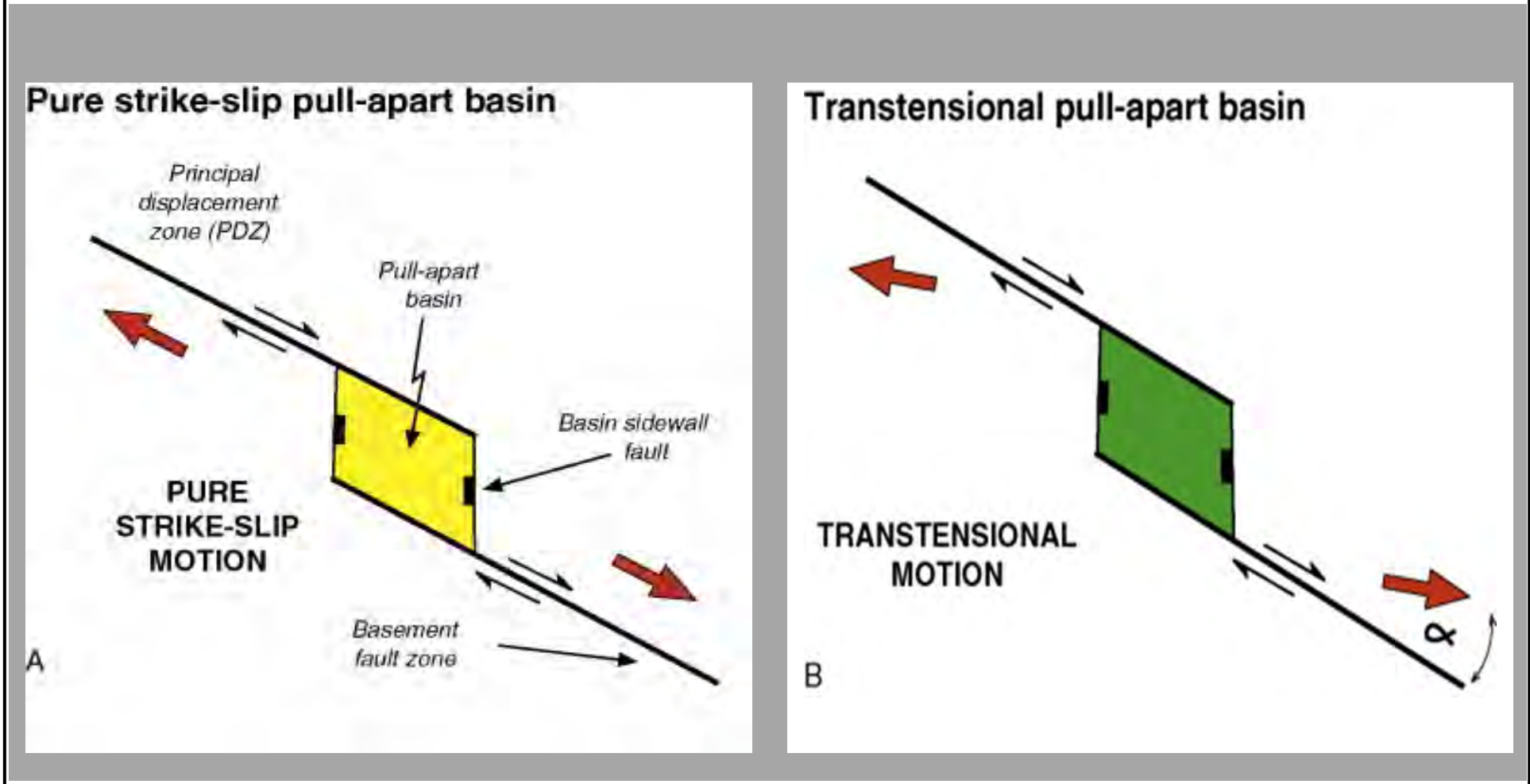
Legend

- Bedford-Coldwater Subbasin
- Elsinore Valley Subbasin
- Temescal Subbasin
- Temescal Wash
- Tributary Streams

November 2021

TODD GROUNDWATER

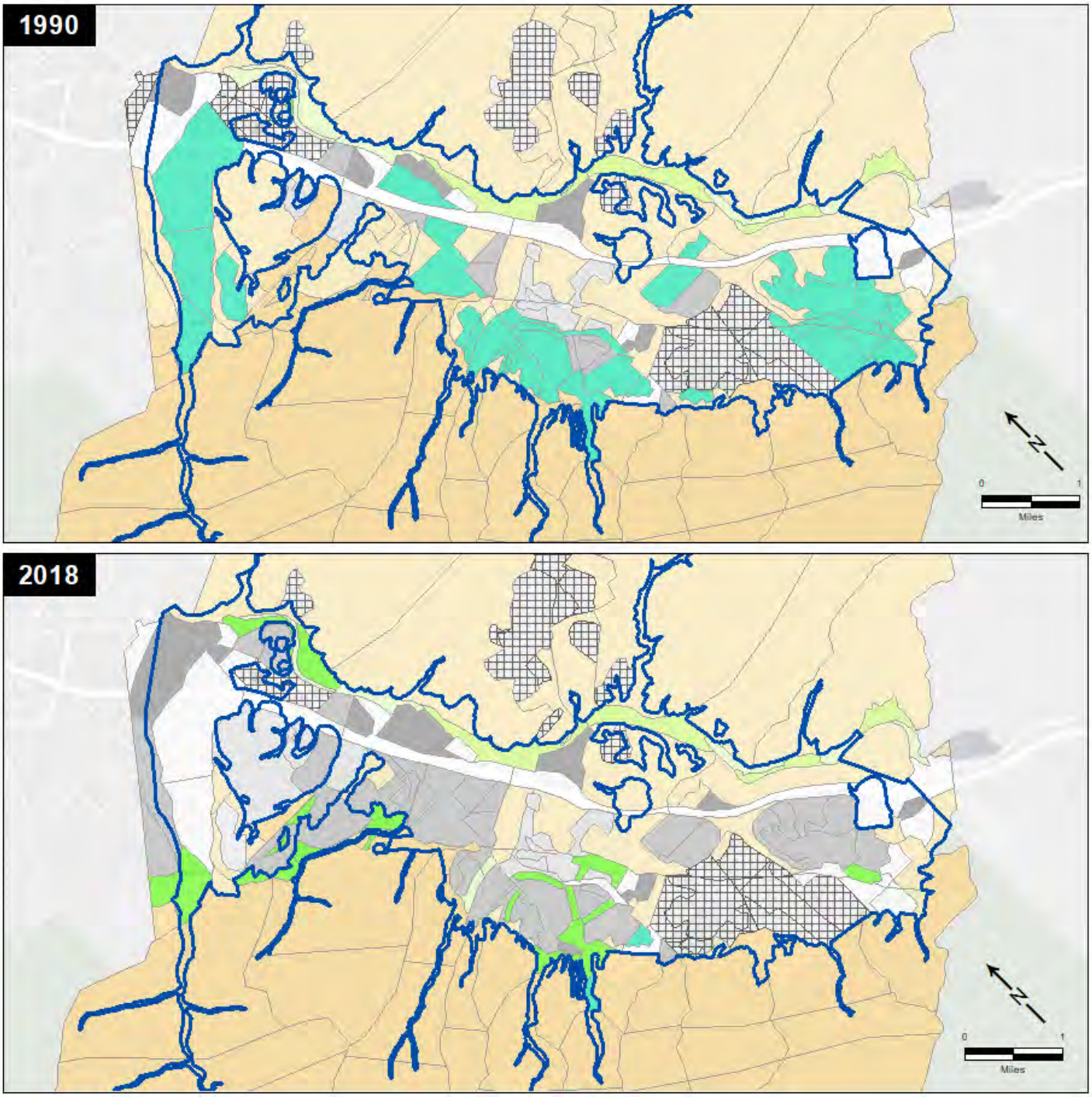
Figure 2
Local Watersheds that Drain into the Bedford-Coldwater Basin



Figures Source:

J. E. Wu, K. McClay, P. Whitehouse, T. Dooley, 2012, Regional Geology and Tectonics: Principles of Geologic Analysis

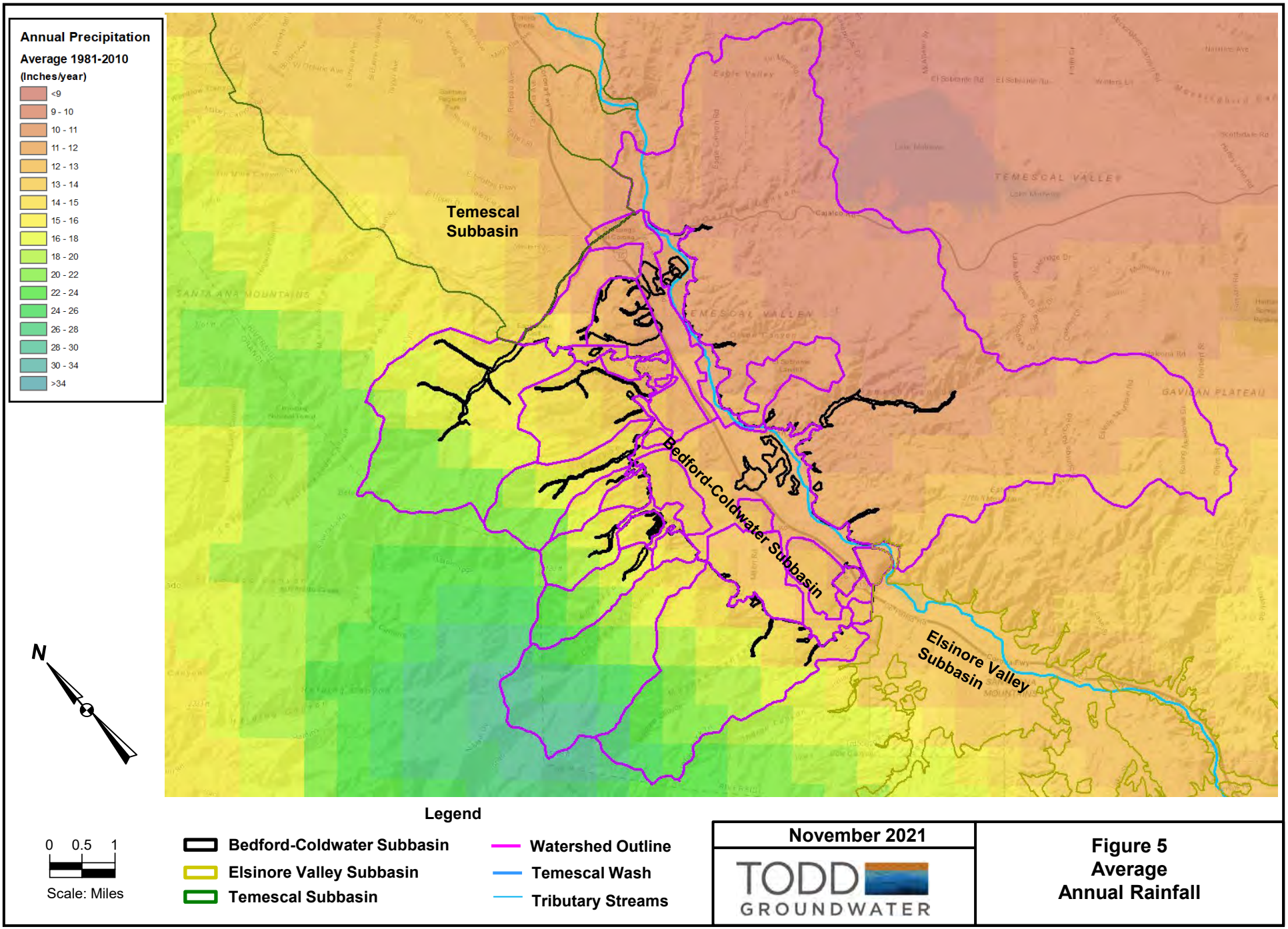
November 2021	Figure 3 Schematic Plan View Showing Faulting Associated with Pull-Apart Basins
TODD GROUNDWATER	

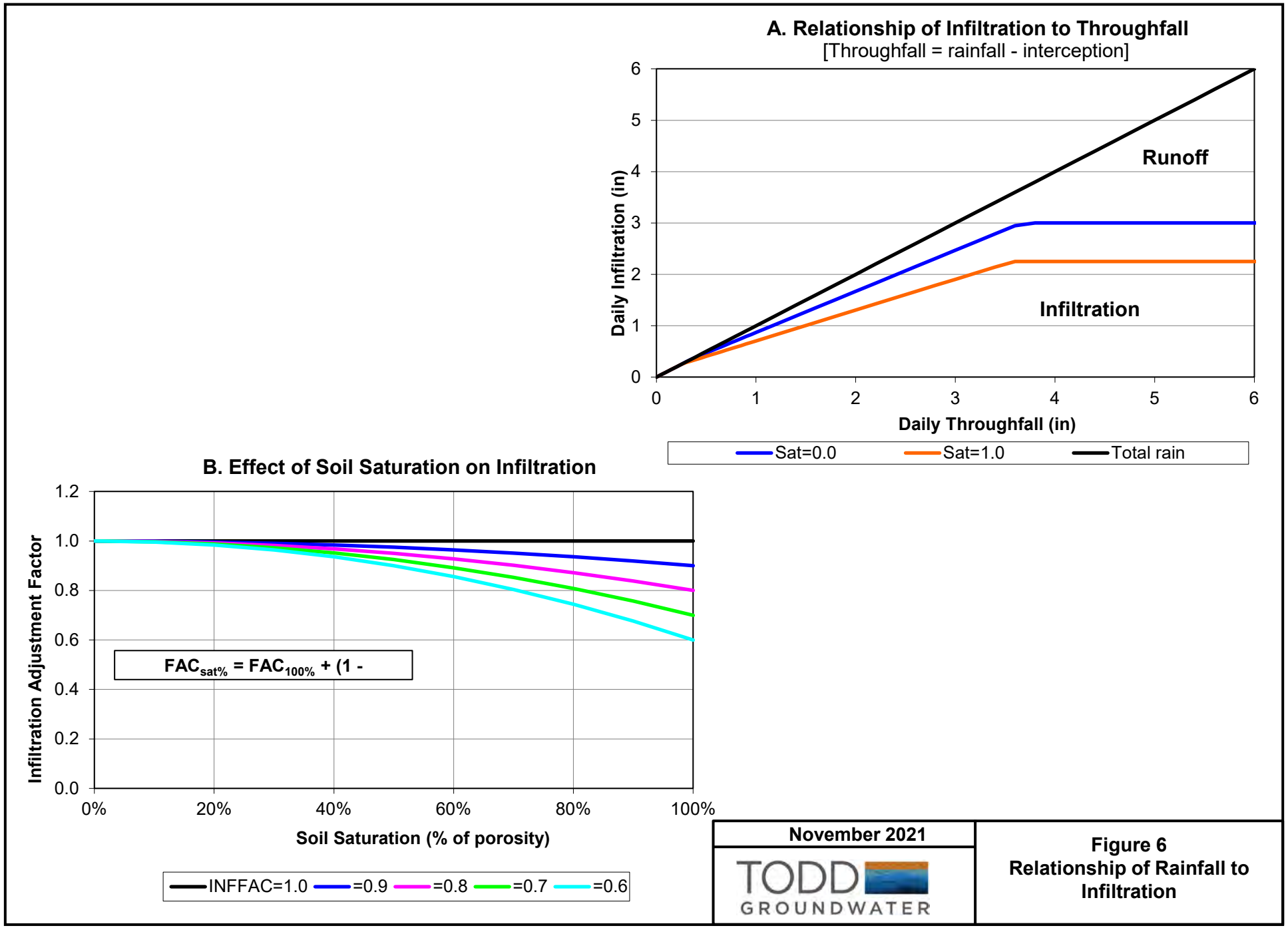


November 2021

TODD GROUNDWATER

Figure 4
1990 and 2018 Land Use for Recharge Polygons

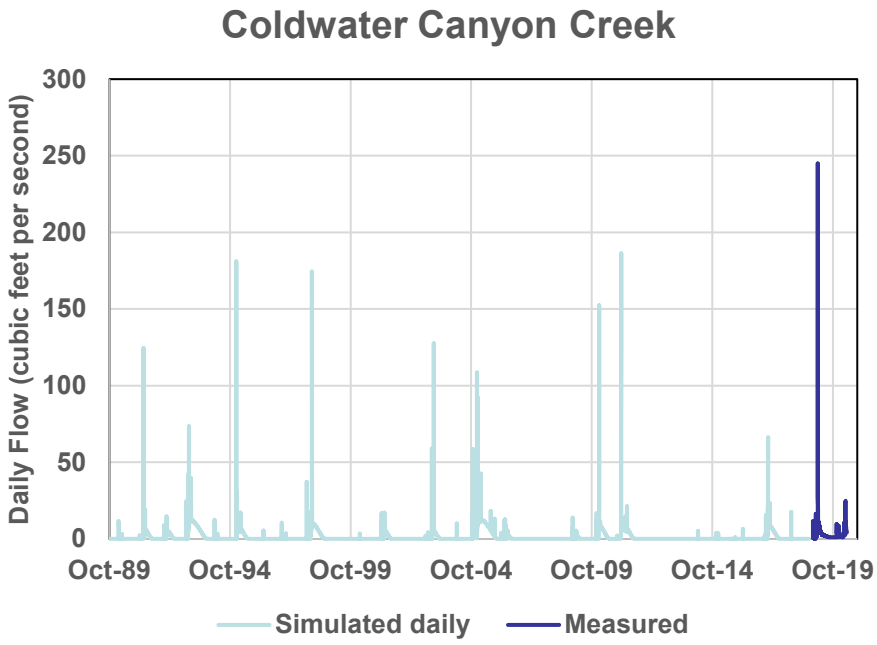

Annual Precipitation
Average 1981-2010
(Inches/year)
<9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
16 - 18
18 - 20
20 - 22
22 - 24
24 - 26
26 - 28
28 - 30
30 - 34
>34
Temescal Subbasin
Bedford-Coldwater Subbasin
Elsinore Valley Subbasin
N
0 0.5 1
Scale: Miles
Legend
Bedford-Coldwater Subbasin
Elsinore Valley Subbasin
Temescal Subbasin
Watershed Outline
Temescal Wash
Tributary Streams
November 2021
TODD GROUNDWATER
Figure 5
Average
Annual Rainfall

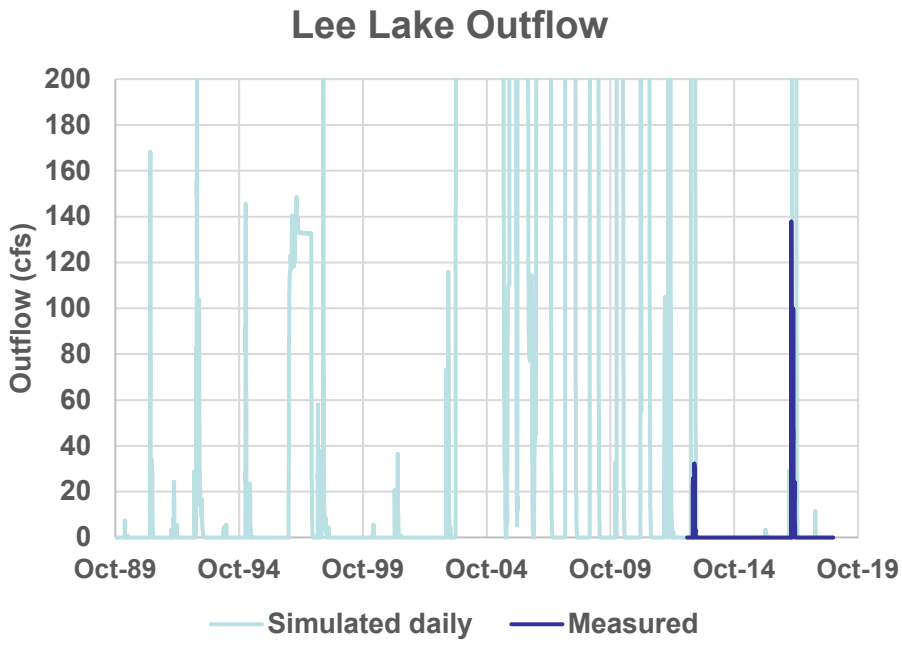


November 2021

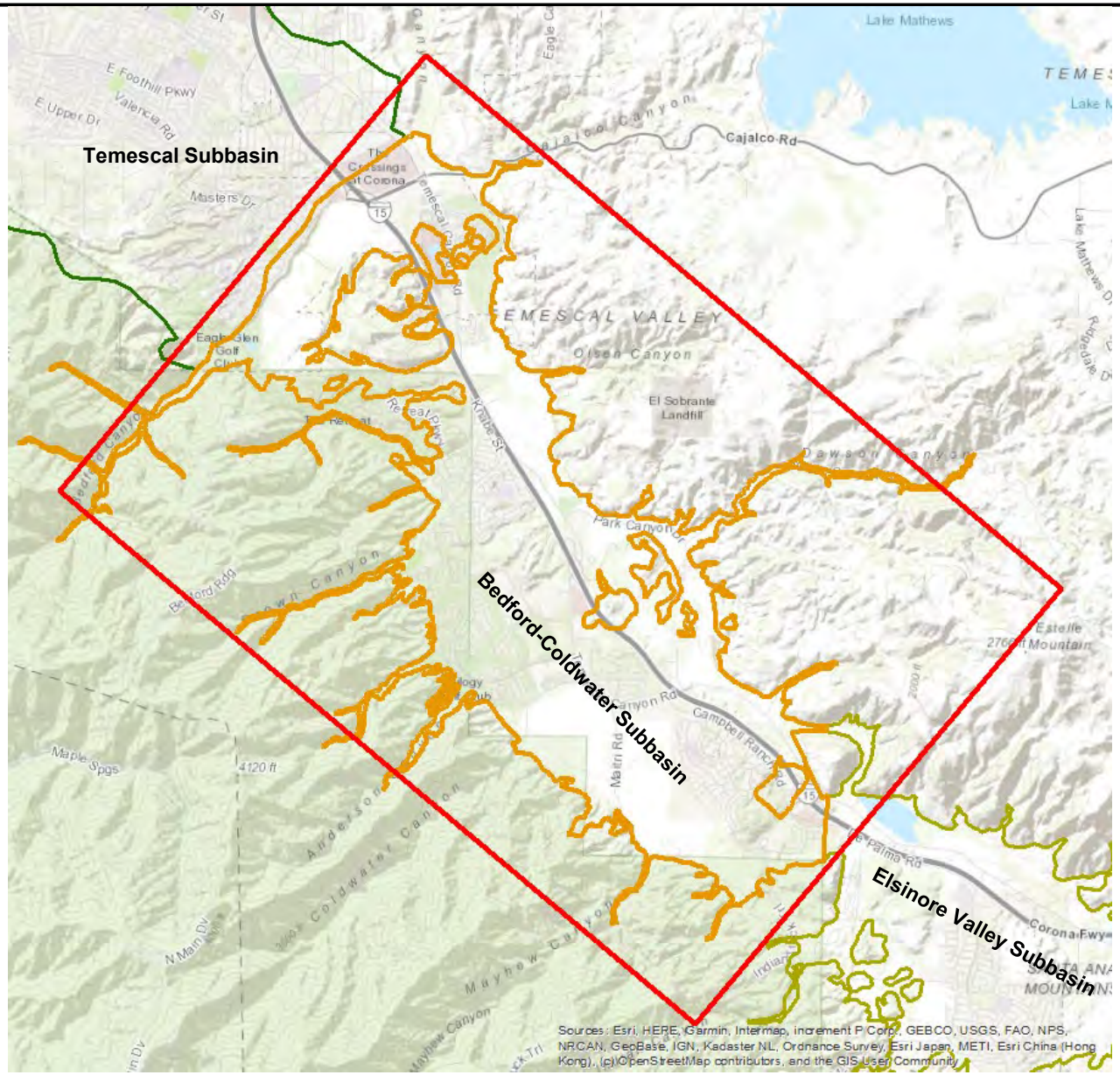
TODD GROUNDWATER

Figure 6
Relationship of Rainfall to Infiltration





November 2021	Figure 7 Rainfall to Runoff Calibration
TODD GROUNDWATER	



N

Legend

- MODFLOW Model Domain
- Elsinore Valley Subbasin
- Bedford-Coldwater Subbasin
- Temescal Subbasin

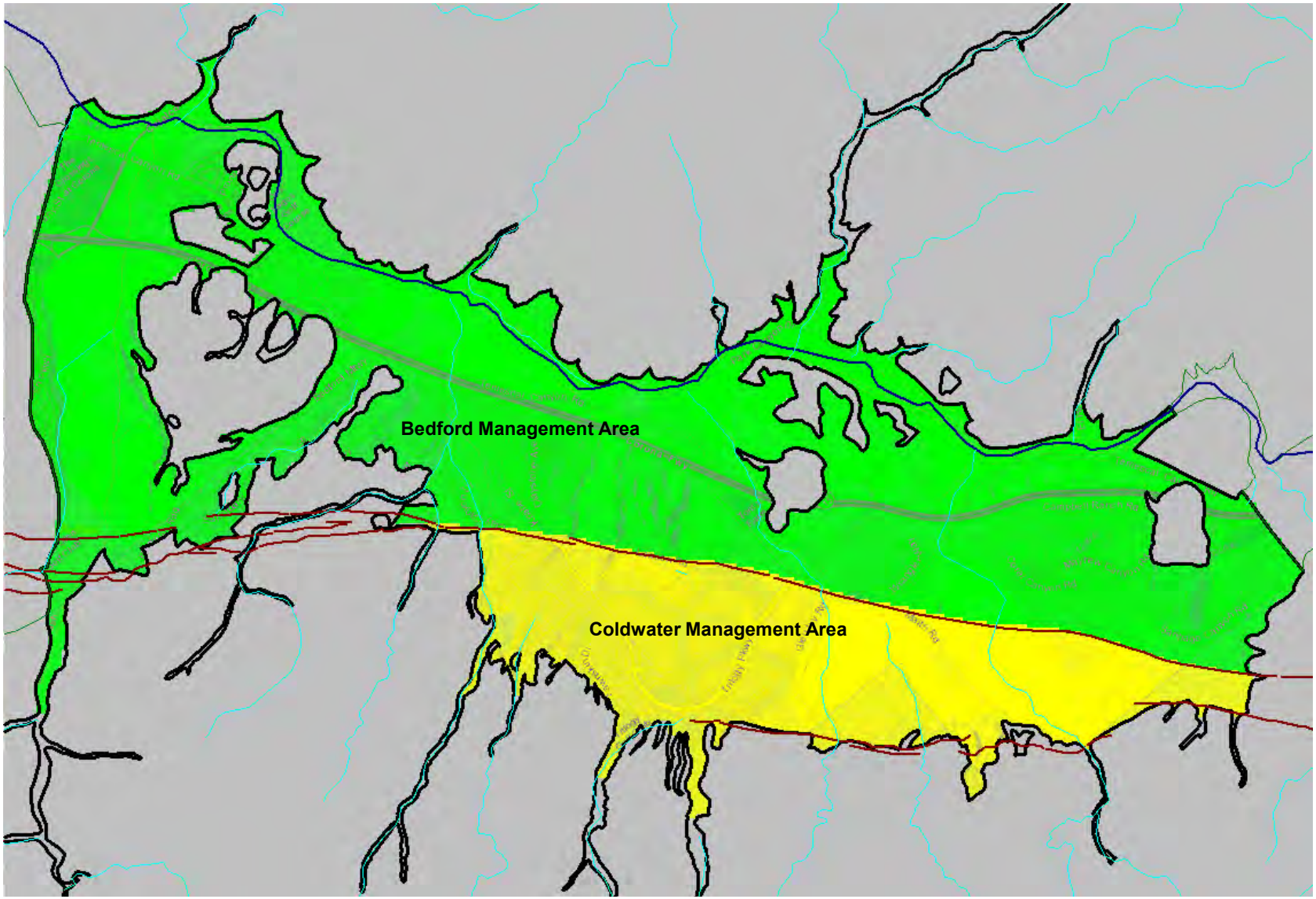
0 0.5 1

Scale: Miles

November 2021

TODD GROUNDWATER

Figure 8
Location of MODFLOW Model Domain



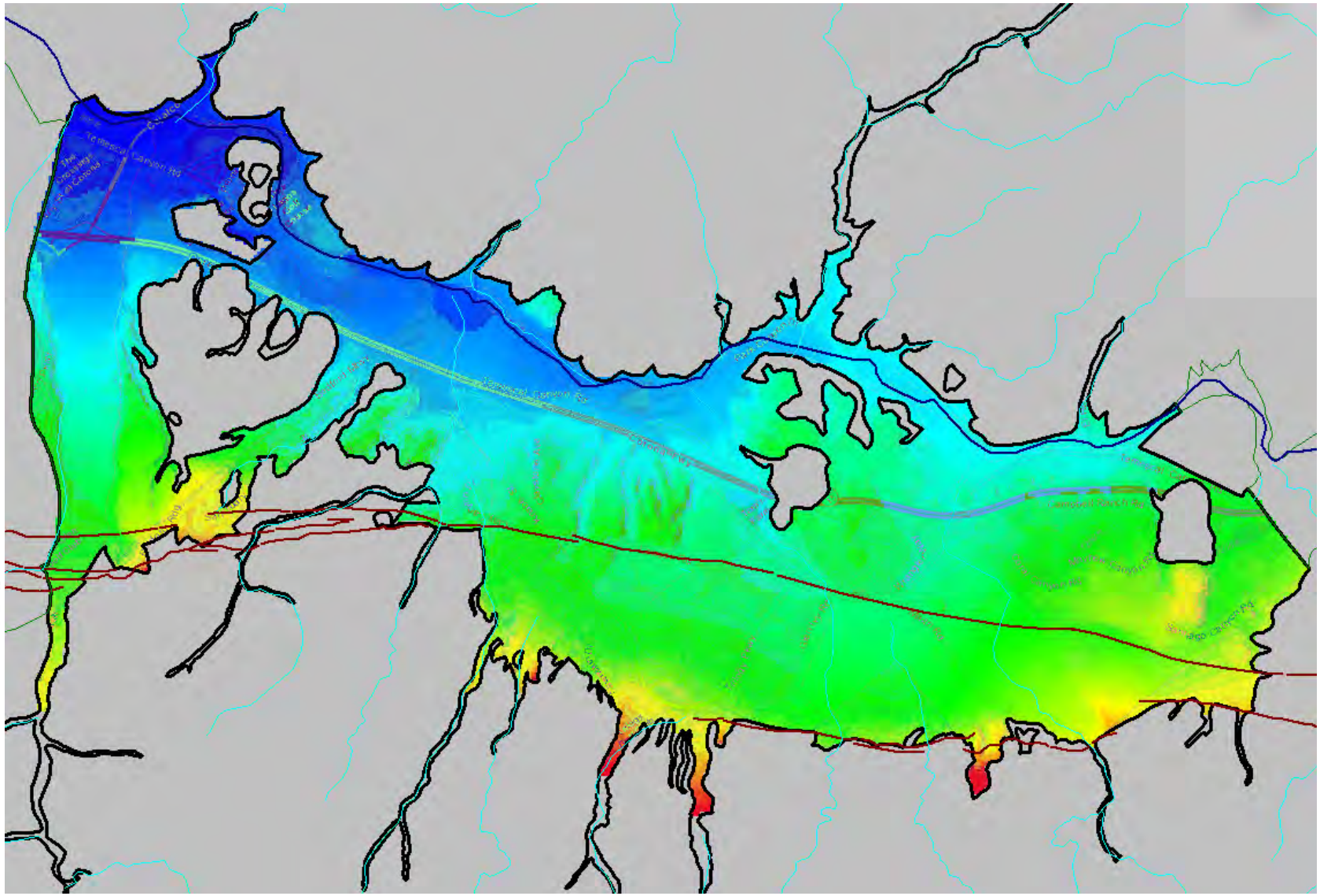
0 0.5 1

Scale: Miles

November 2021

TODD GROUNDWATER

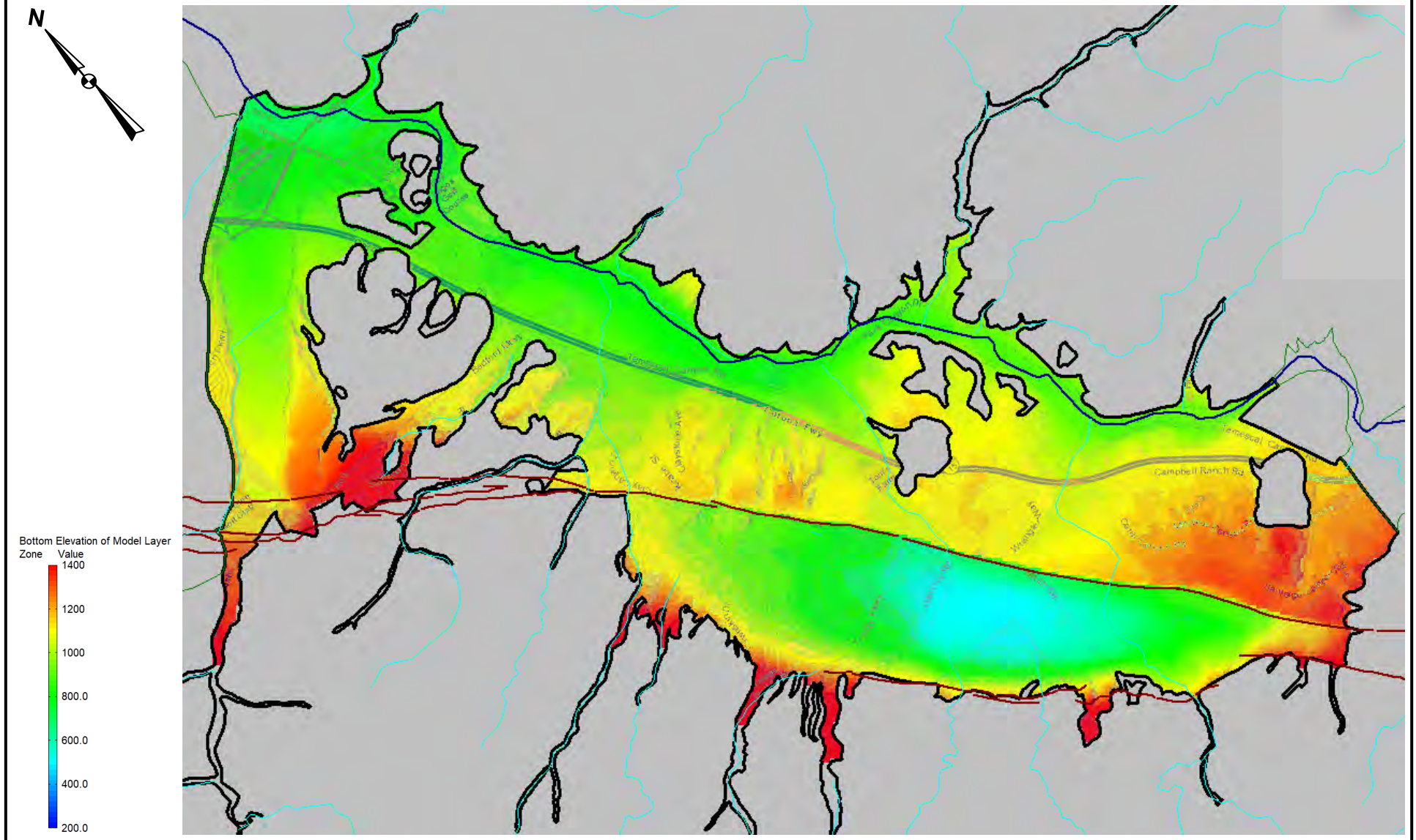
Figure 9
Location of Management Areas



November 2021

TODD GROUNDWATER

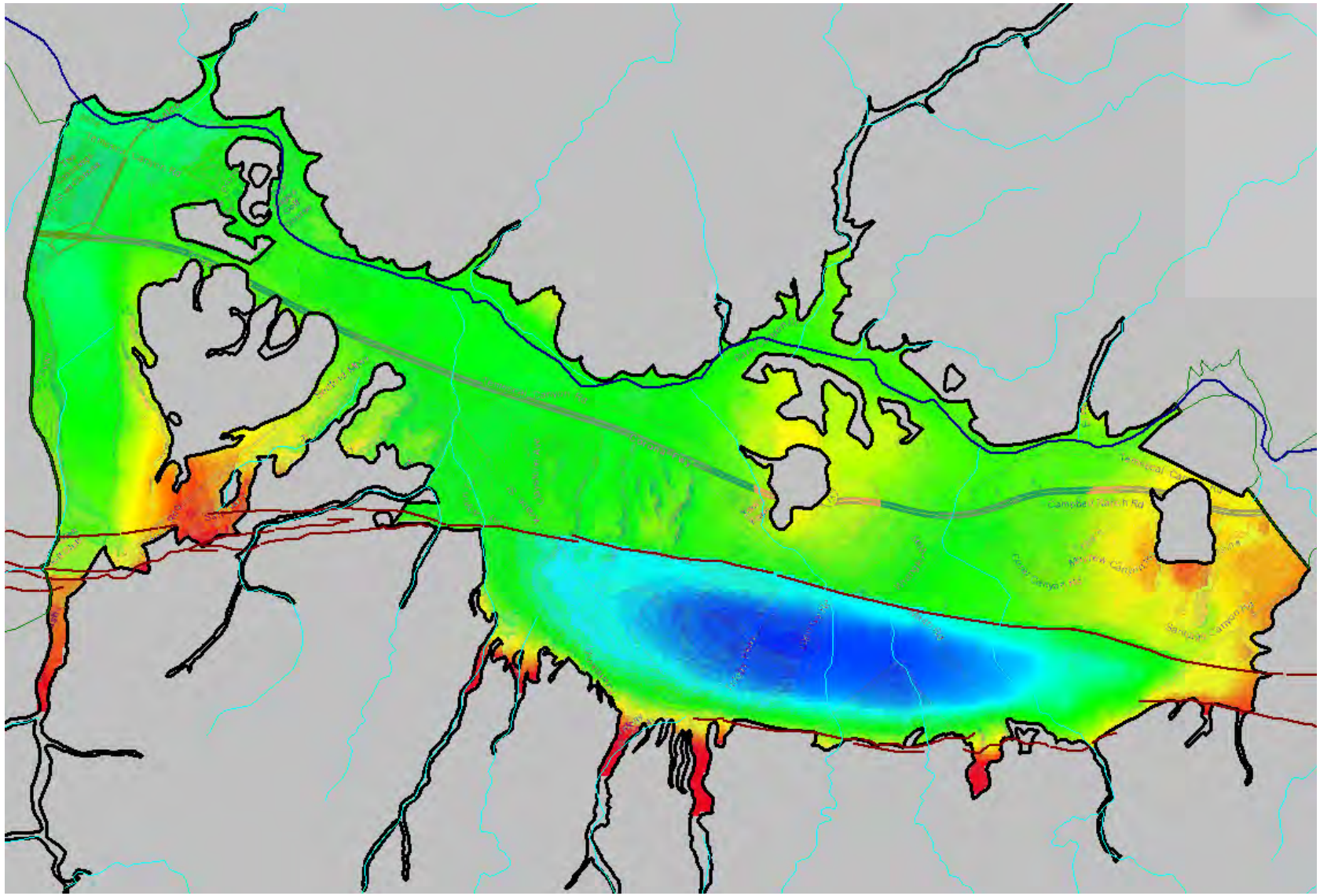
Figure 10
Topographic Elevation of the Top of Model Layer 1



November 2021

TODD GROUNDWATER

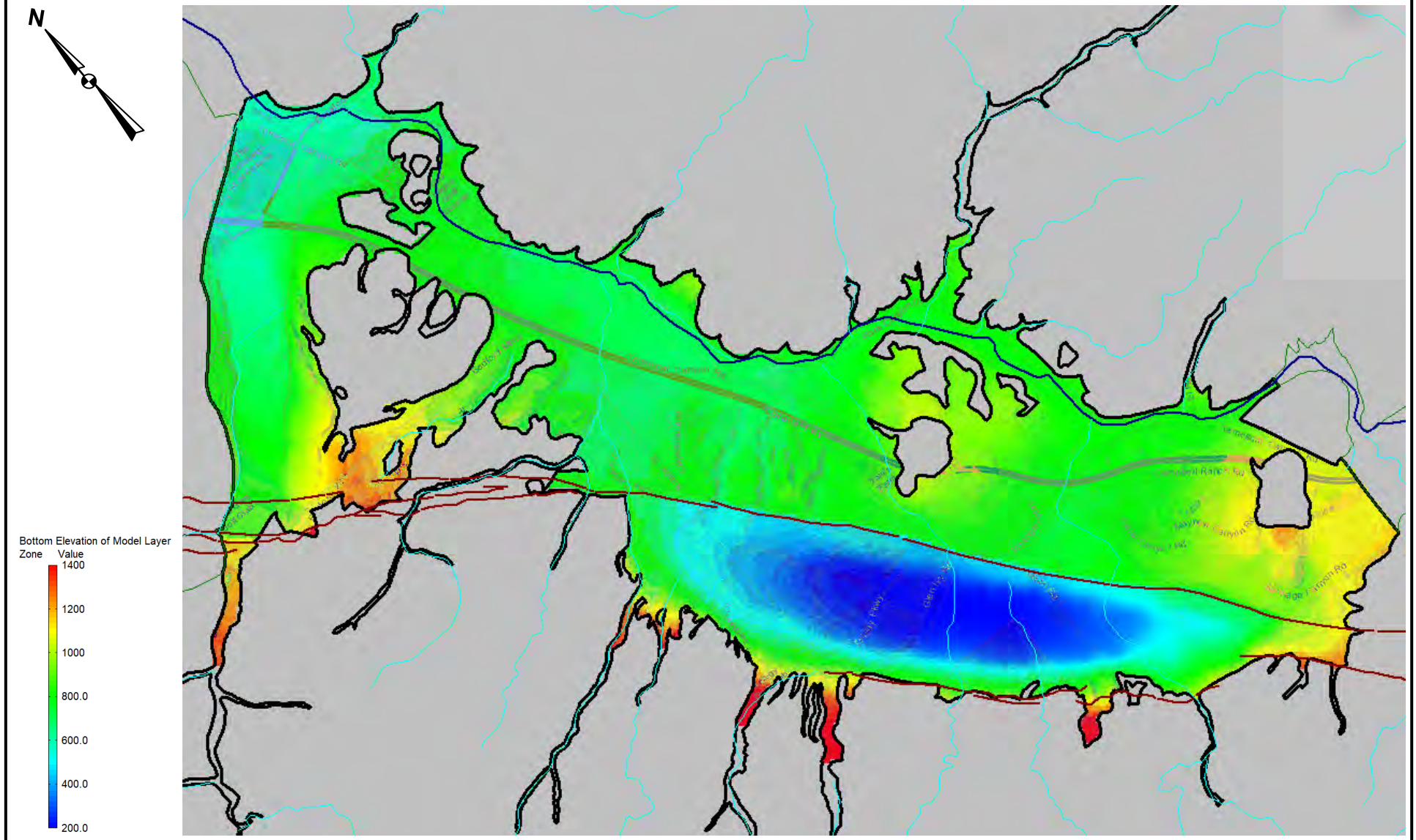
Figure 11
Bottom Elevation Distribution for Model Layer 1



November 2021

TODD GROUNDWATER

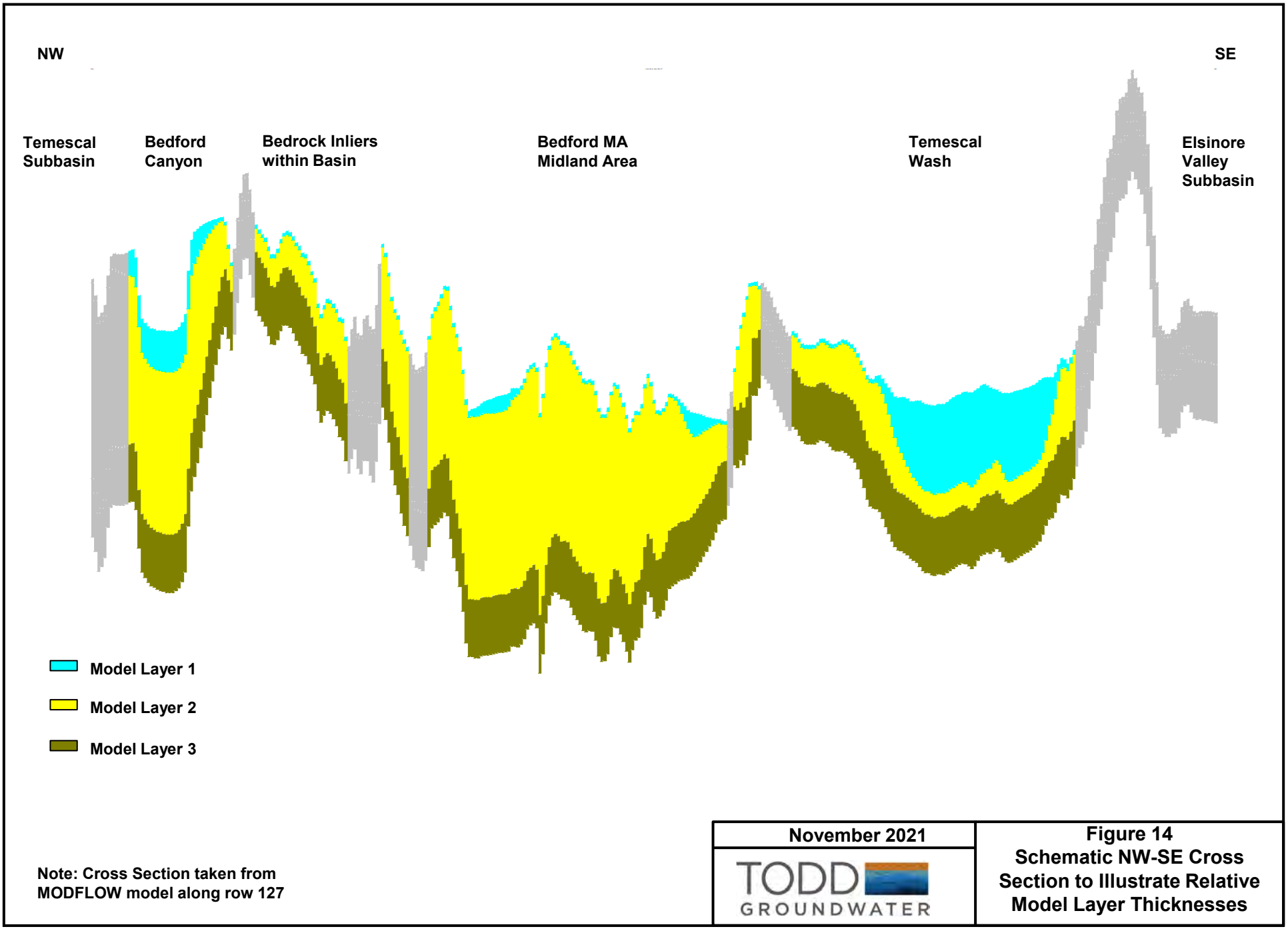
Figure 12
Bottom Elevation Distribution for Model Layer 2



November 2021

TODD GROUNDWATER

Figure 13
Bottom Elevation Distribution for Model Layer 3

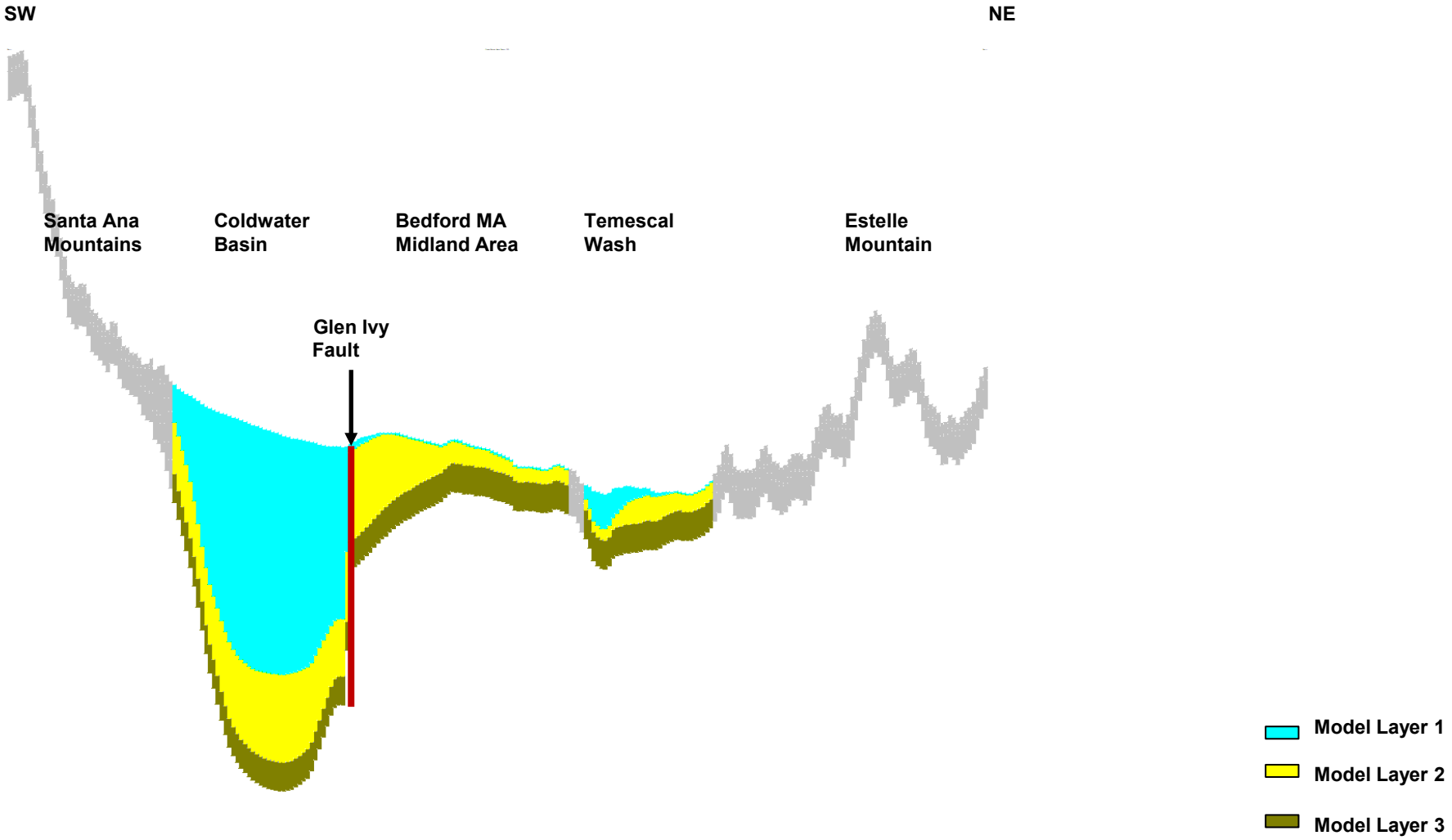


Note: Cross Section taken from MODFLOW model along row 127

November 2021

TODD GROUNDWATER

Figure 14
Schematic NW-SE Cross Section to Illustrate Relative Model Layer Thicknesses

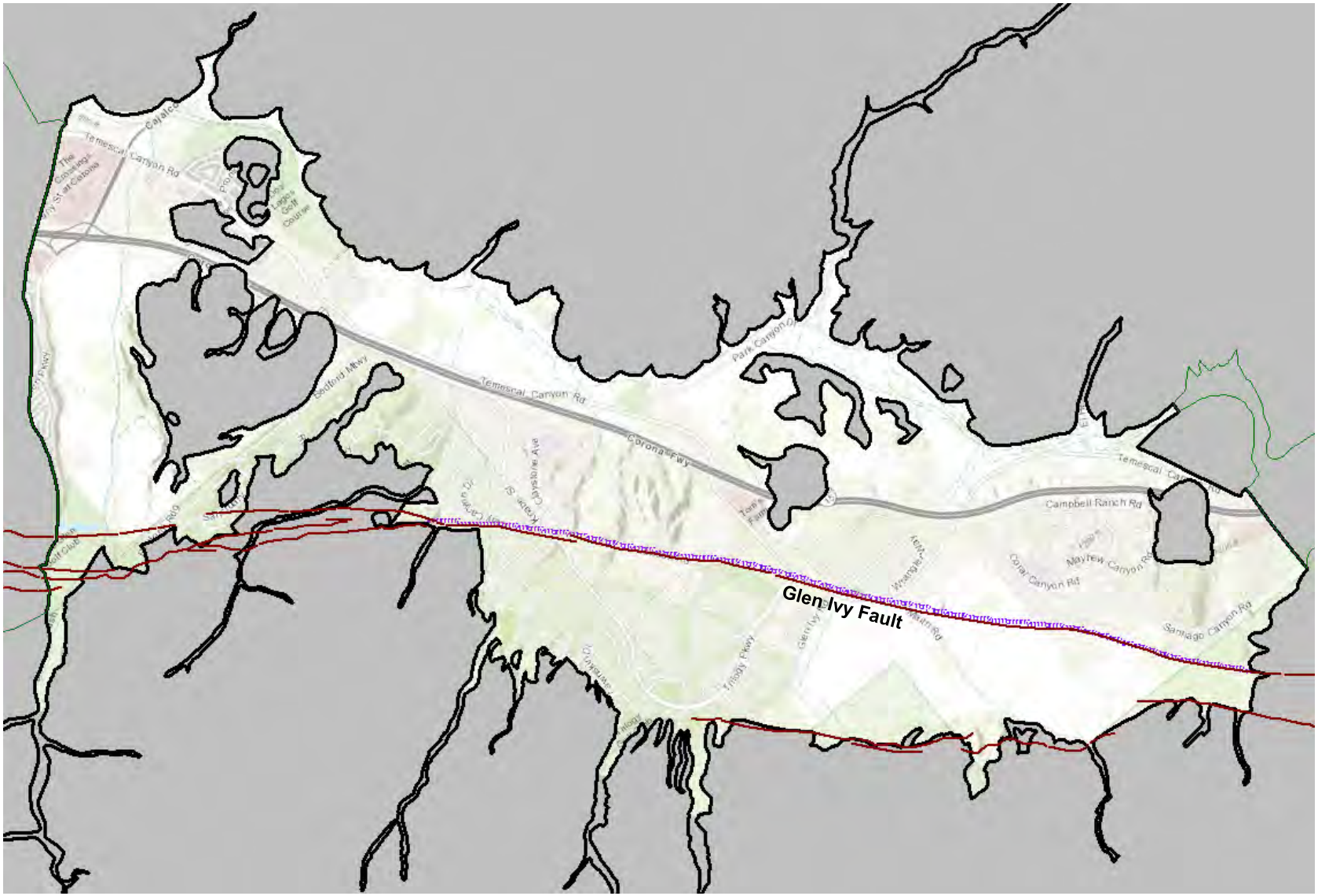


Note: Cross Section taken from MODFLOW model along column 230

November 2021

TODD GROUNDWATER

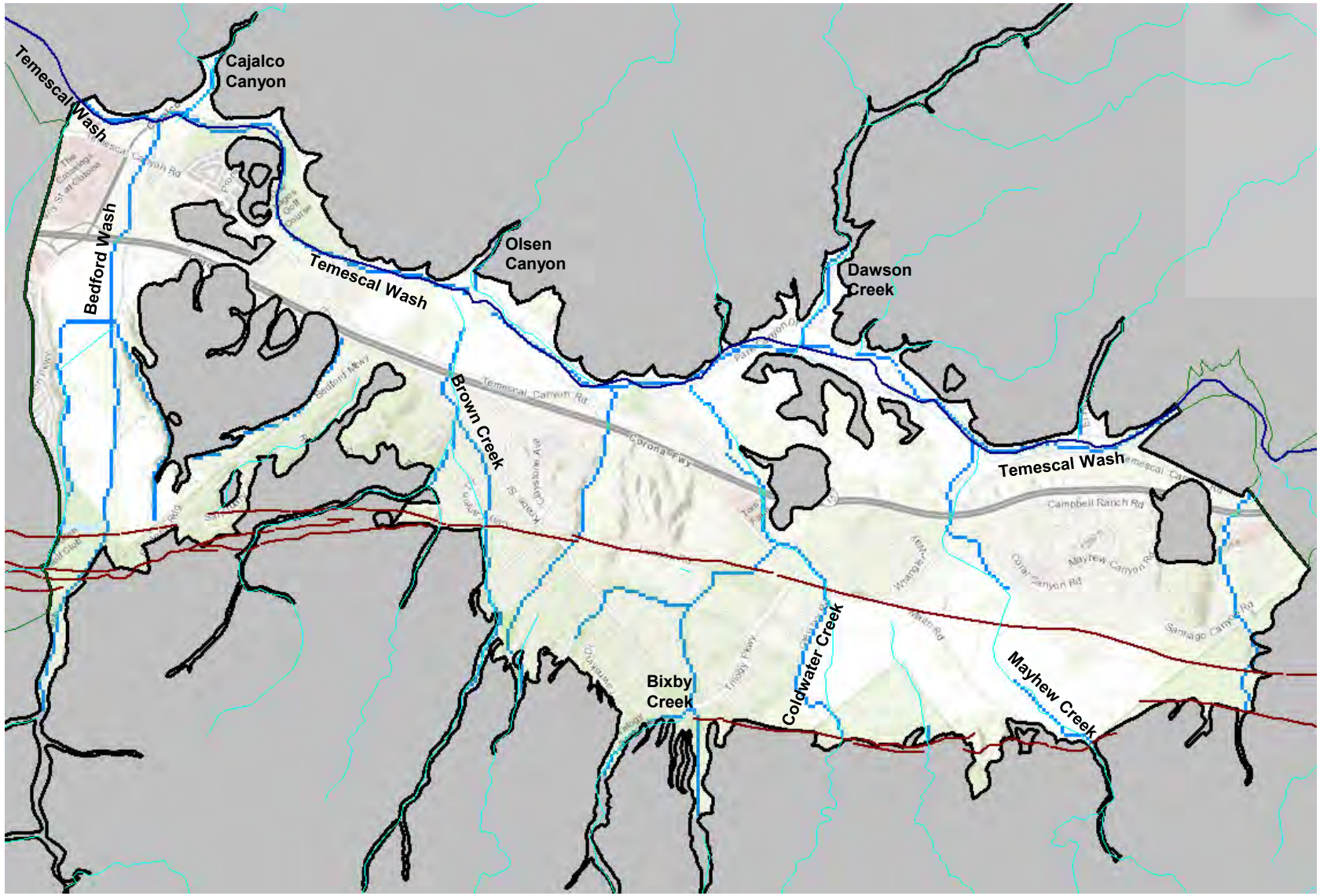
Figure 15
Schematic NE-SW Cross Section to Illustrate Relative Model Layer Thicknesses



November 2021

TODD GROUNDWATER

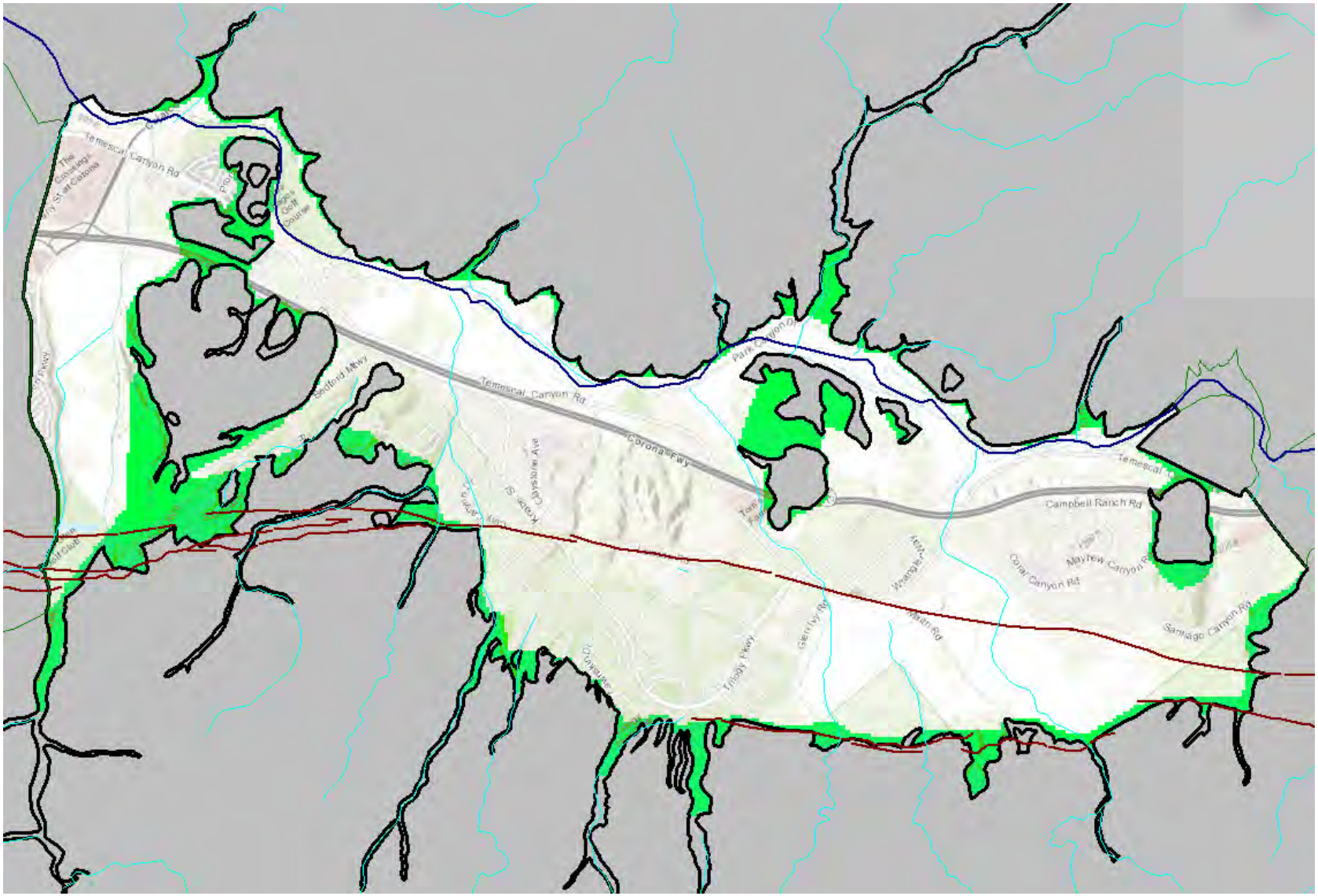
Figure 16
Location of Faults Included in MODFLOW model



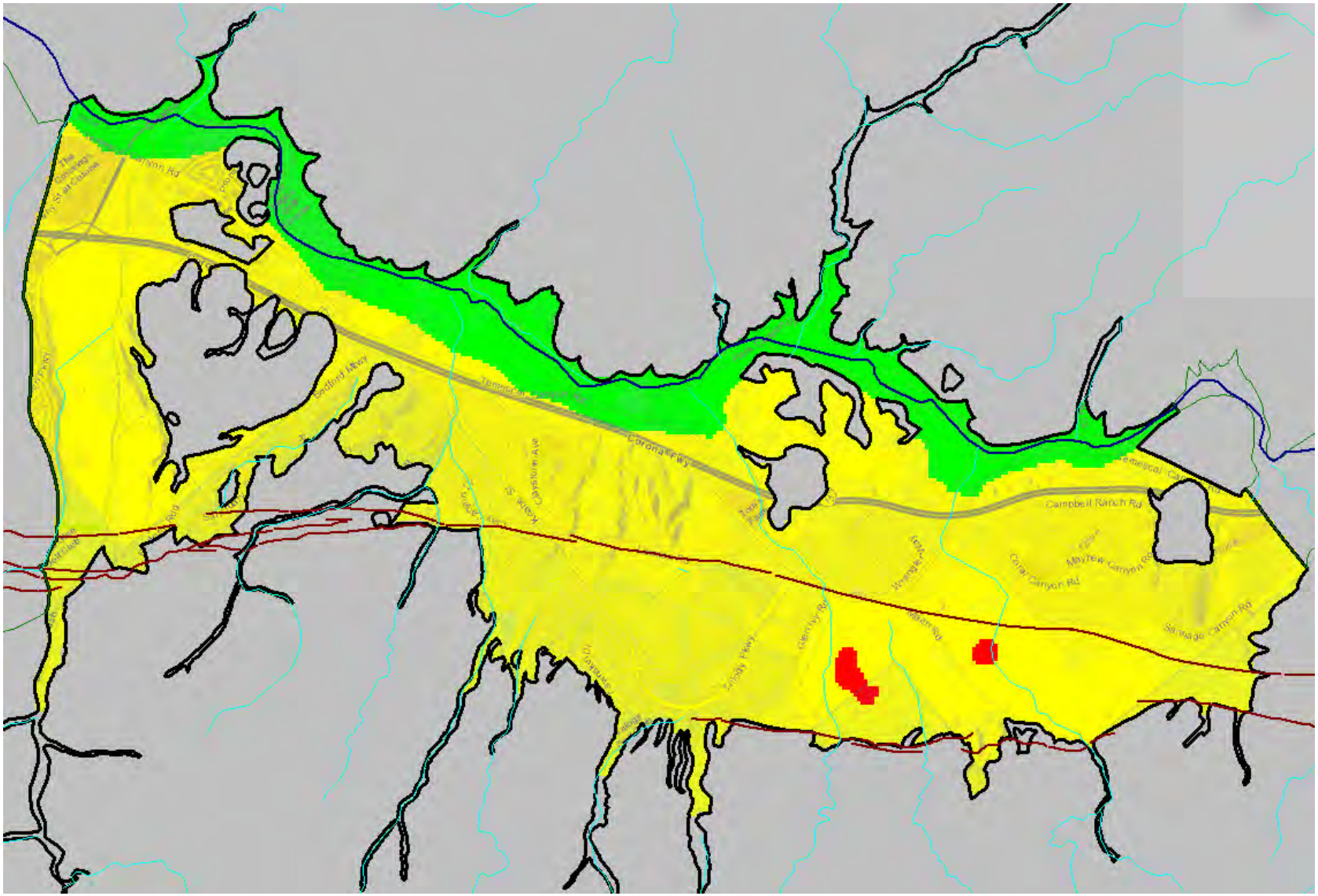
November 2021

TODD GROUNDWATER

Figure 17
Location of Streams



November 2021	Figure 18 Distribution of General Head Boundary Used for Mountain Front Recharge
TODD GROUNDWATER	



N

0 0.5 1

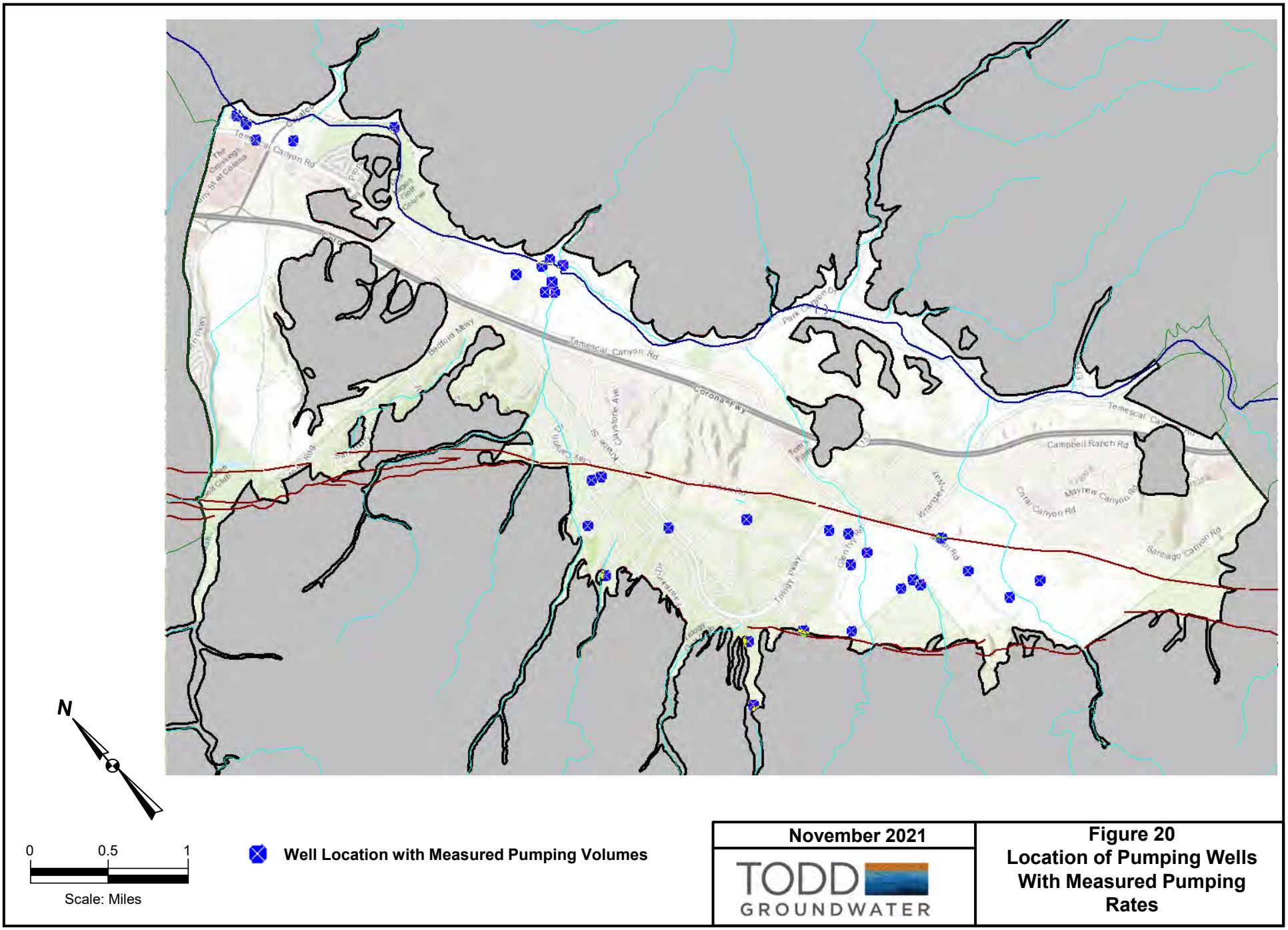
Scale: Miles

- ET Zone 1 – 7.5 ft extinction depth
- ET Zone 2 – 15 ft extinction depth
- ET Zone 3 – 3 ft extinction depth

November 2021

TODD GROUNDWATER

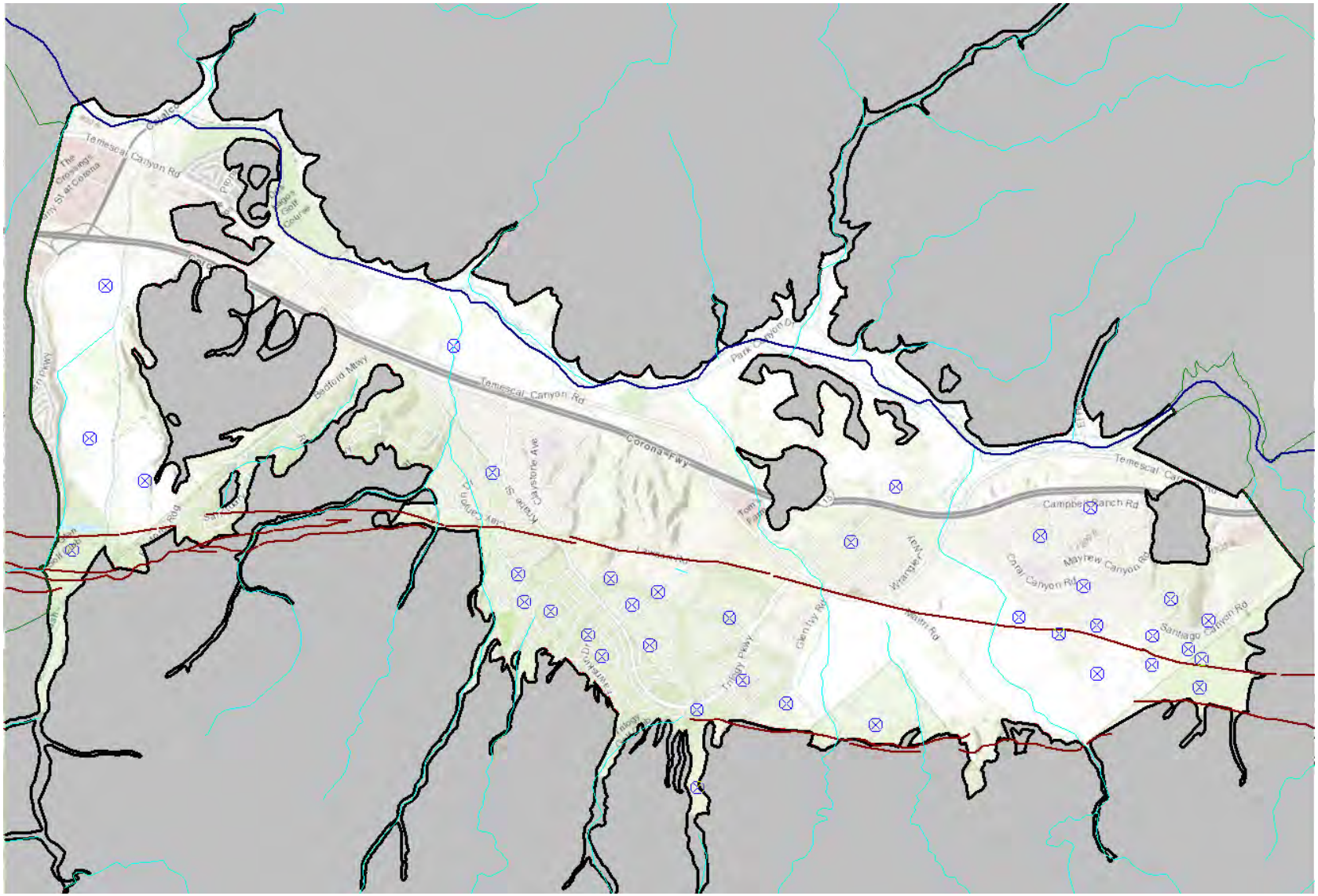
Figure 19
Distribution of Evapotranspiration (ET) Zones



November 2021

TODD GROUNDWATER

Figure 20
Location of Pumping Wells With Measured Pumping Rates



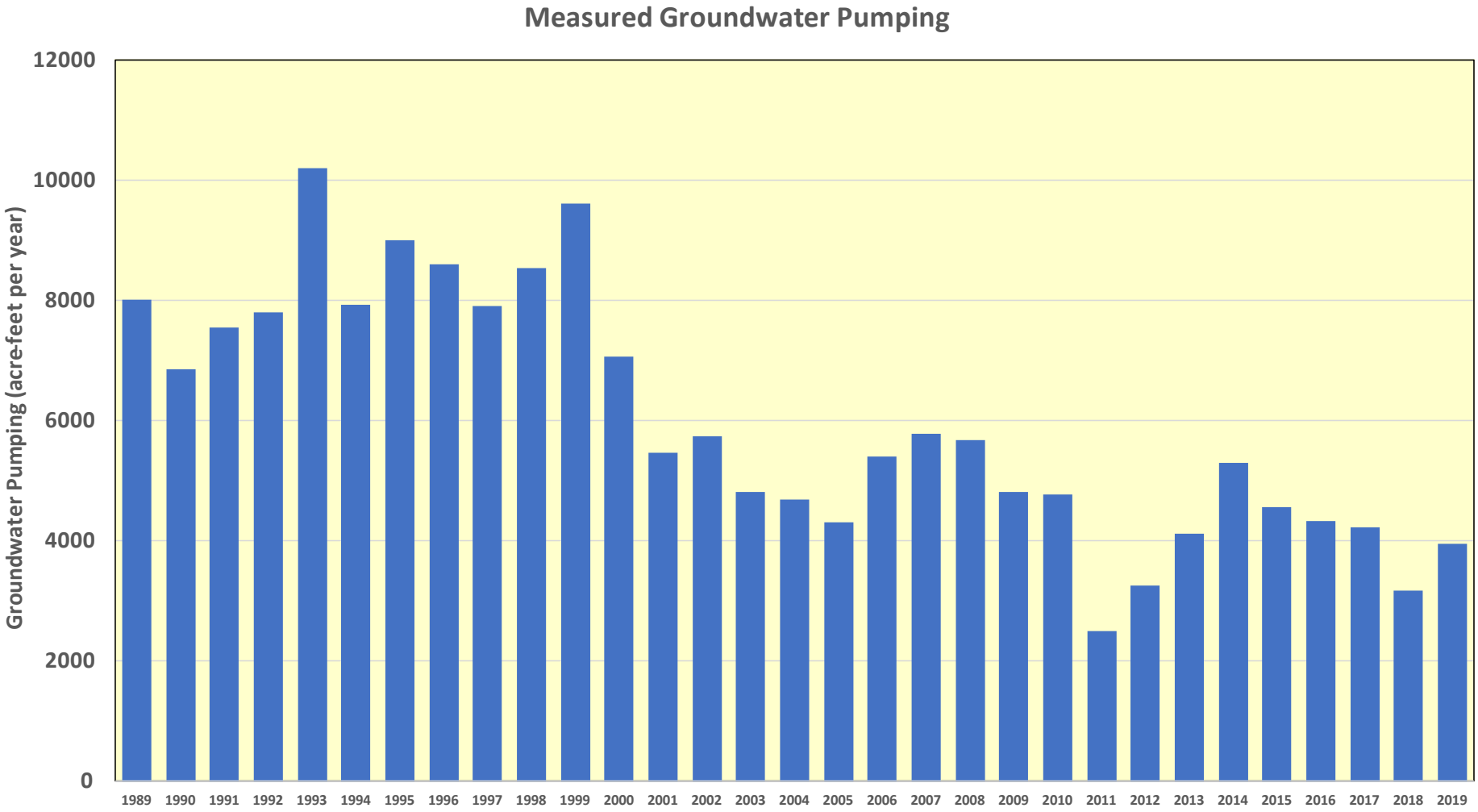
N

0 0.5 1

Scale: Miles

Location of Estimated Agricultural Pumping

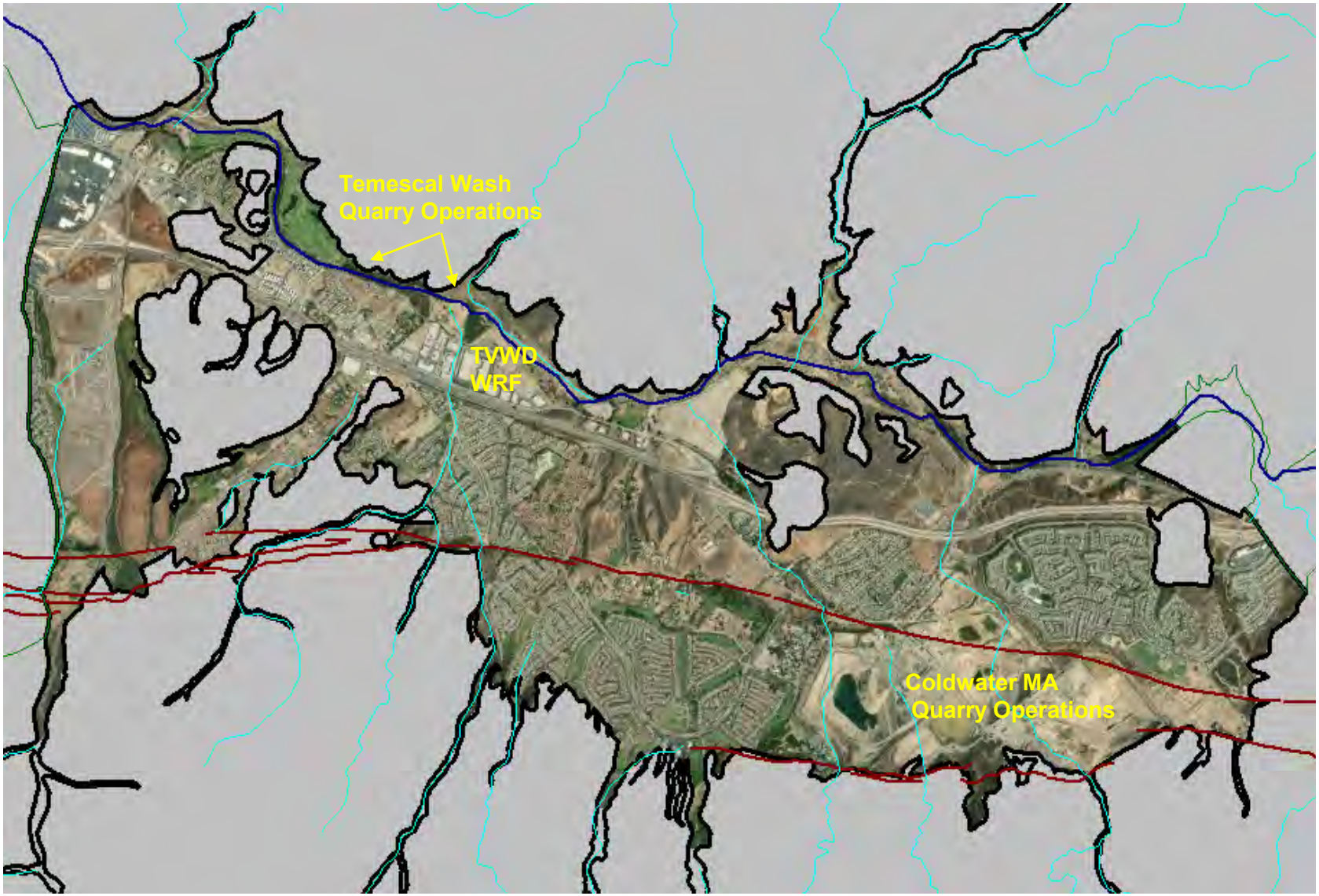
November 2021	Figure 21 Locations of Estimated Pumping for Historical Agriculture
TODD GROUNDWATER	



November 2021

TODD GROUNDWATER

Figure 22
Annual Groundwater Pumping in Bedford-Coldwater Basin



N

Constant Head Boundary

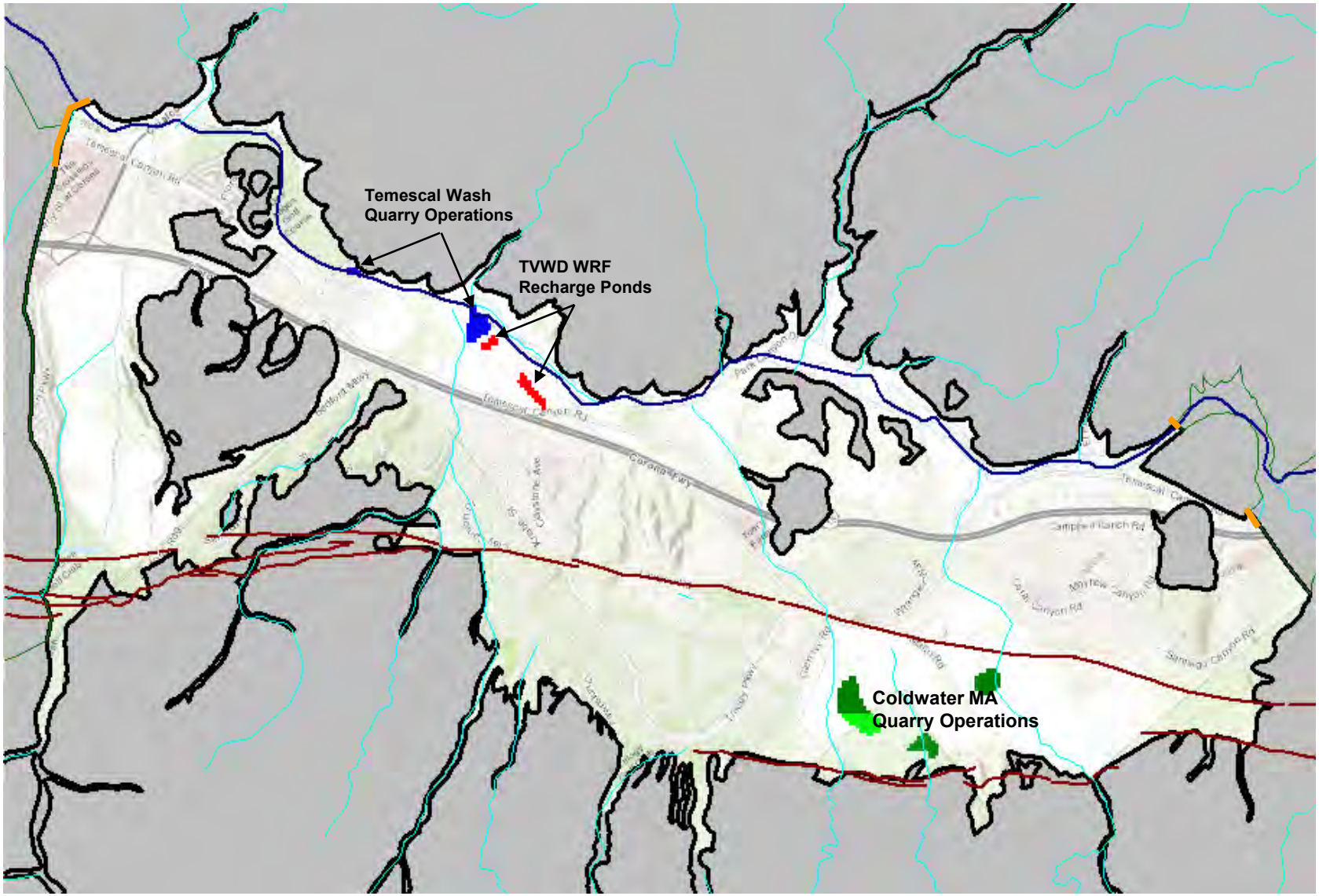
0 0.5 1

Scale: Miles

November 2021

TODD GROUNDWATER

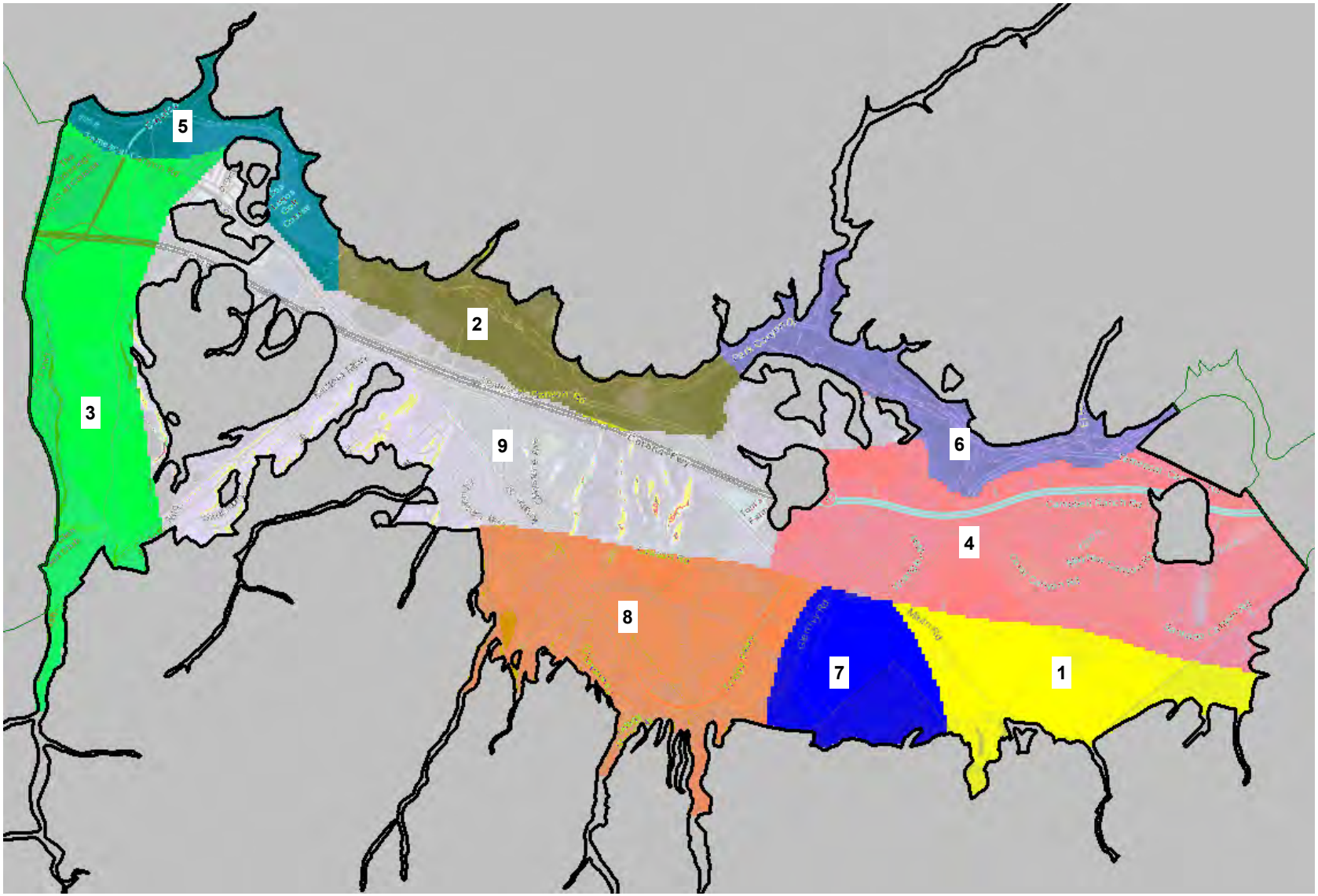
Figure 23
Location of Primary Quarry Areas and Wastewater Facilities



November 2021

TODD GROUNDWATER

Figure 24
Boundary Conditions Applied for Recharge Ponds, Quarries and Subsurface Flow



N

0 0.5 1

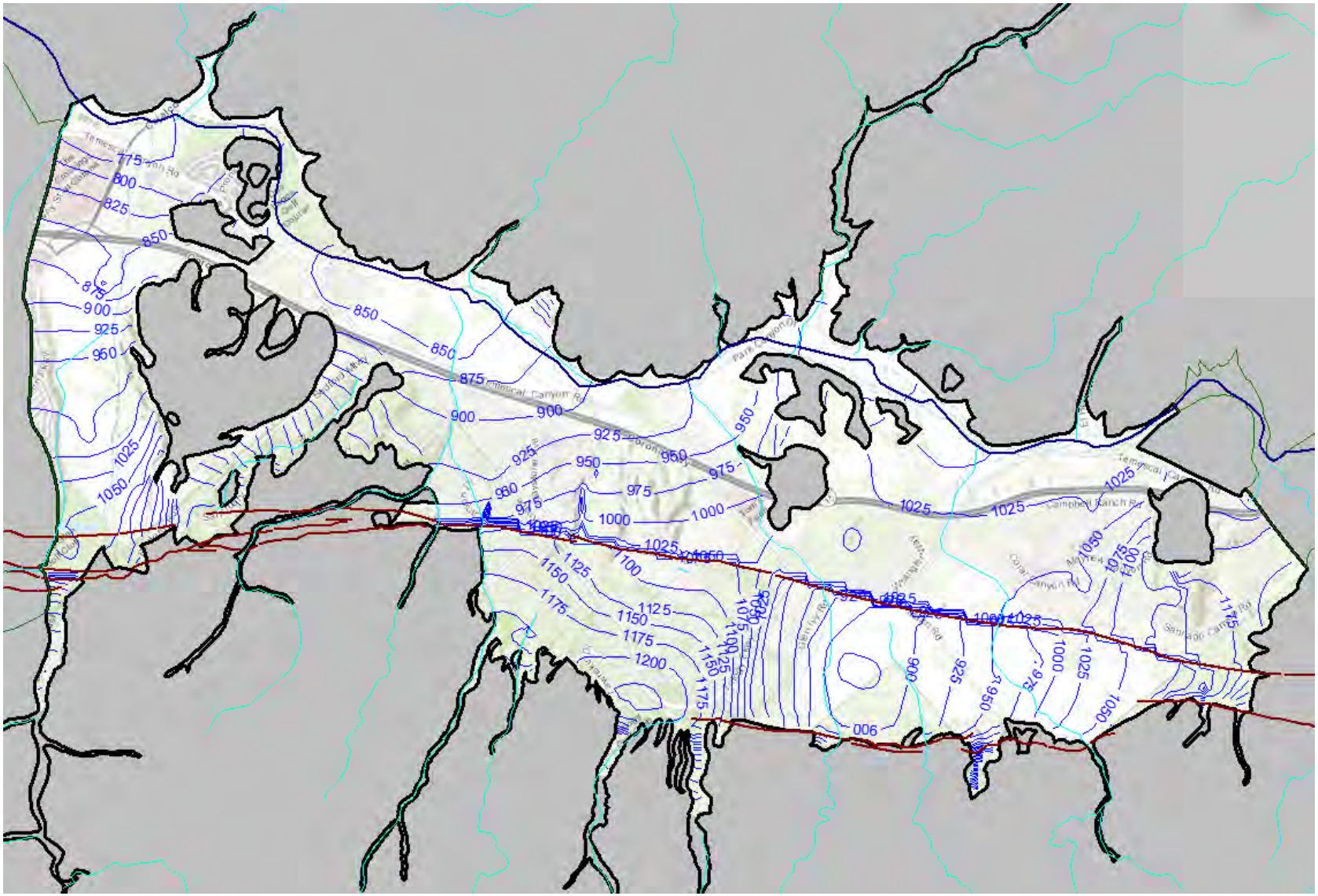
Scale: Miles

Note: Map Zone numbers relate to Aquifer Property Values on Table 3 in Report

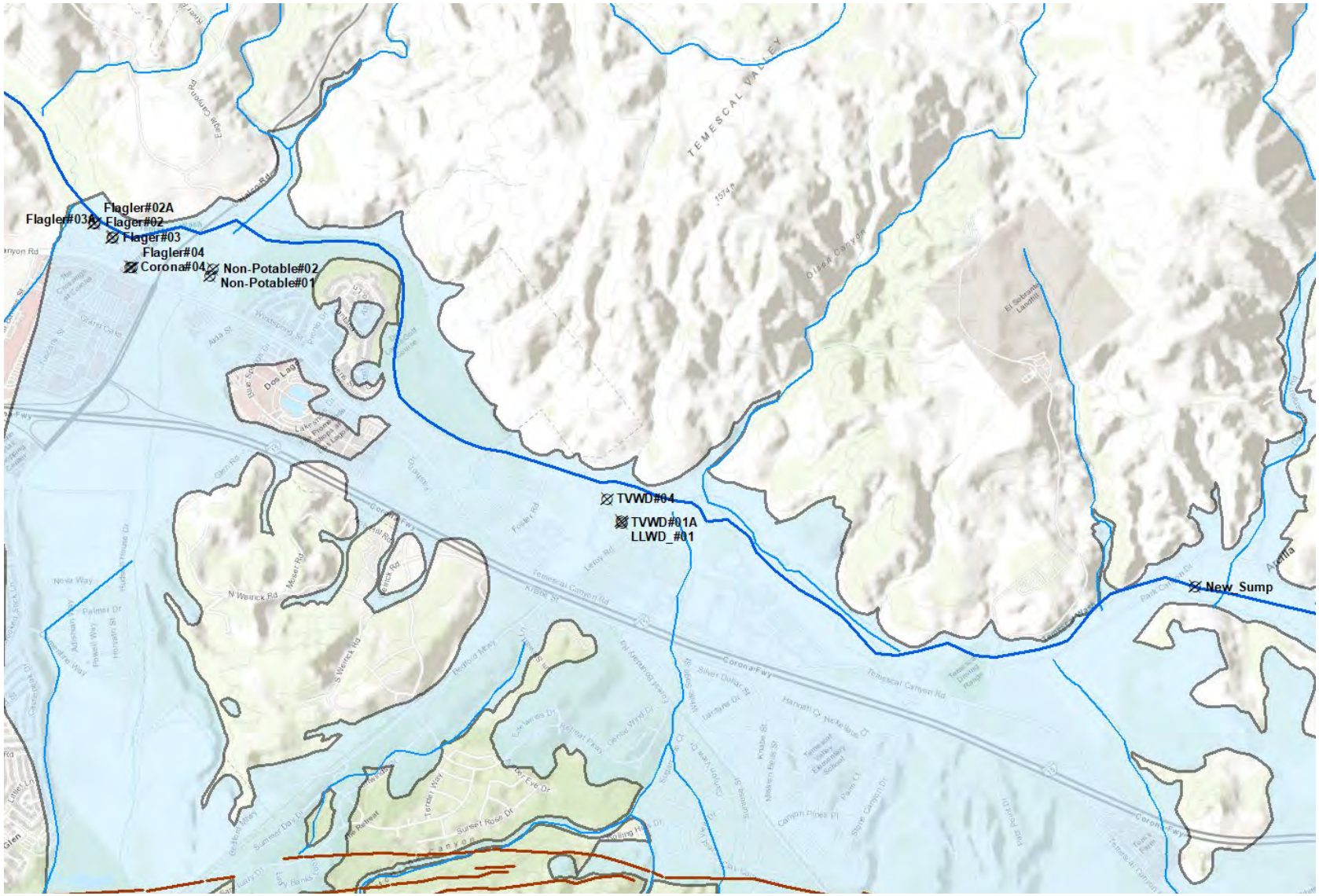
November 2021

TODD GROUNDWATER

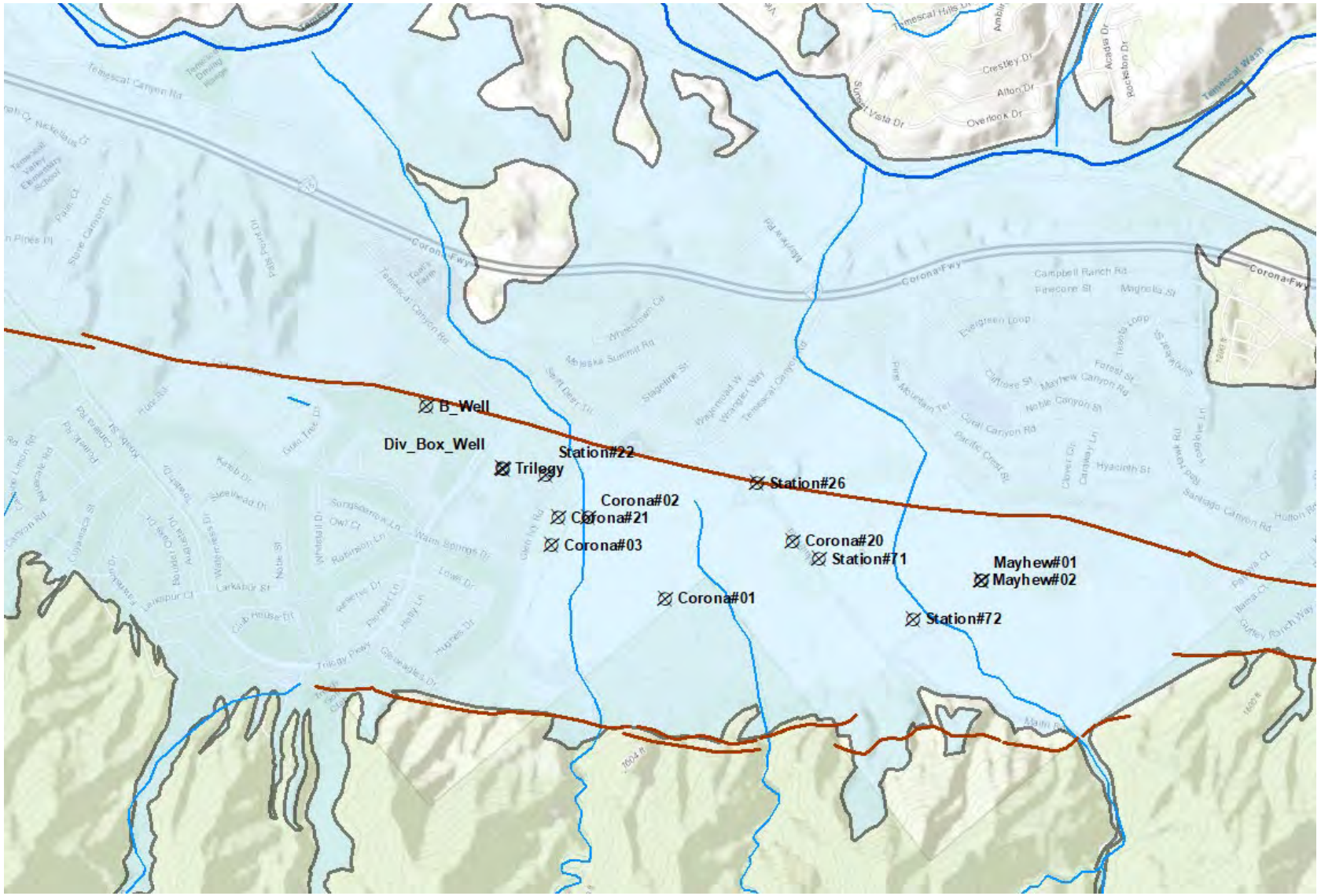
Figure 25
Distribution of Aquifer Property Zones for Layers 1, 2 and 3



November 2021	Figure 26 Initial Groundwater Conditions for Layer 2
TODD GROUNDWATER	



November 2021	Figure 27 Location of Monitoring Wells Used for Model Calibration in Bedford MA
TODD GROUNDWATER	



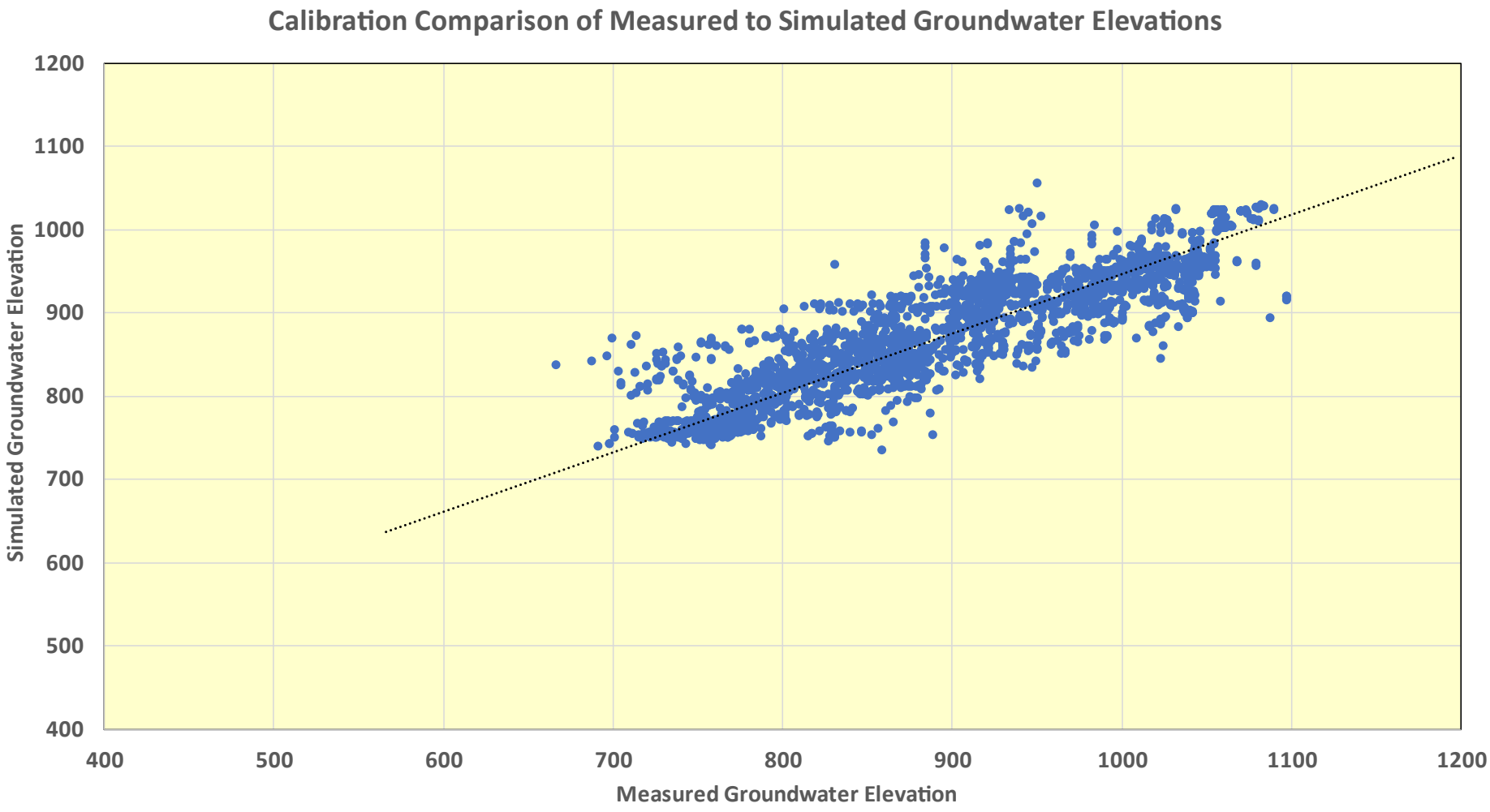
N

0 0.5 1

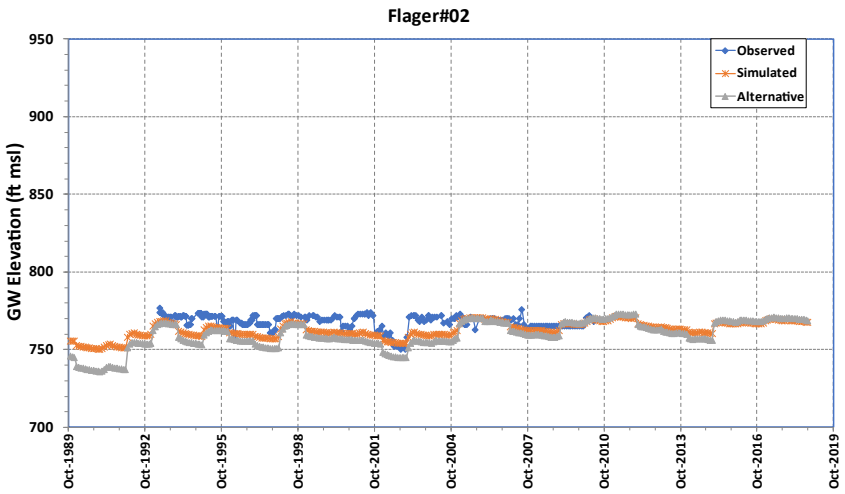
Scale: Miles

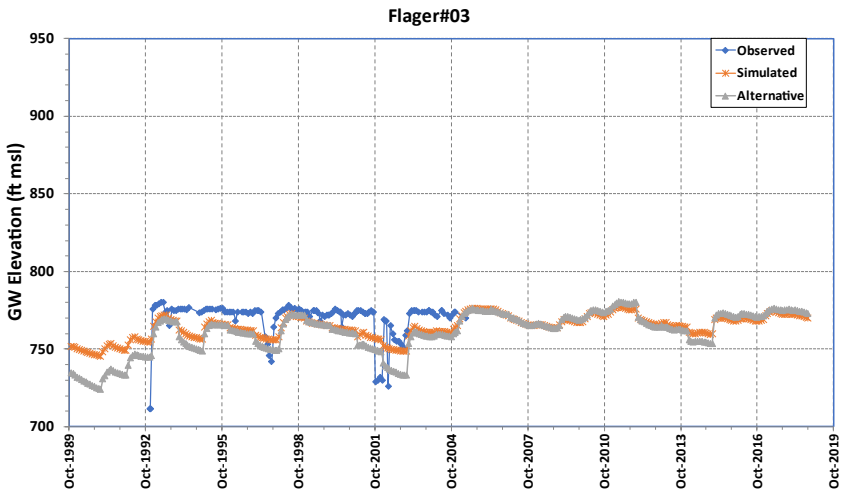
Corona#01

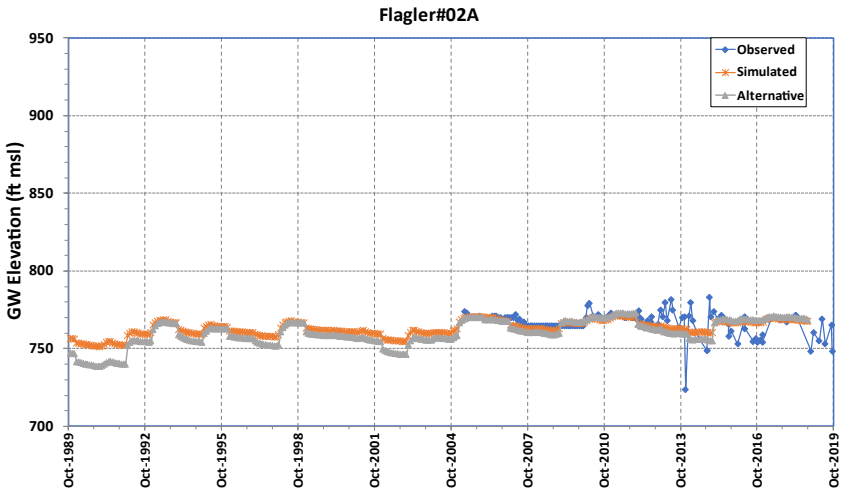
November 2021	Figure 28 Location of Monitoring Wells Used for Model Calibration in Coldwater MA
TODD GROUNDWATER	

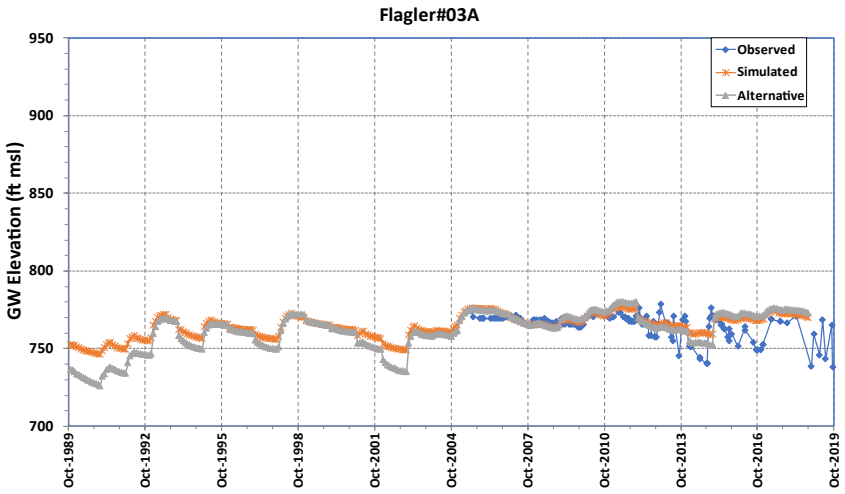


November 2021	Figure 29 Scatter Plot Comparing Simulated to Measured Groundwater Levels
TODD GROUNDWATER	





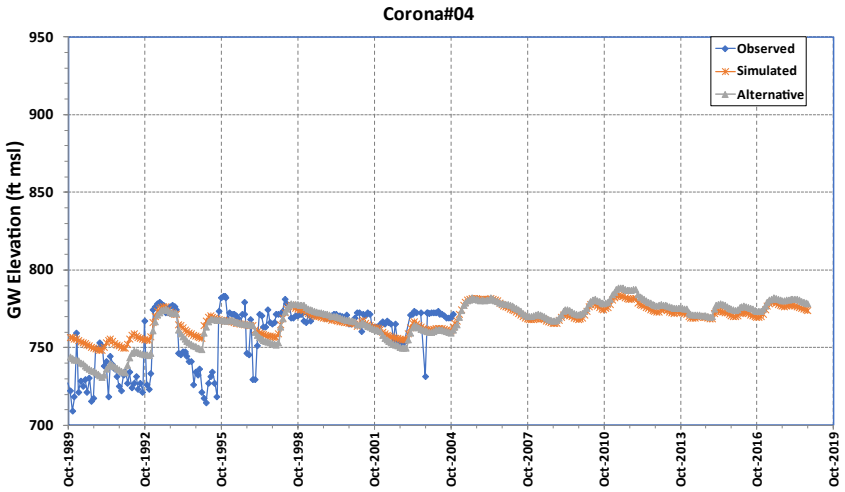


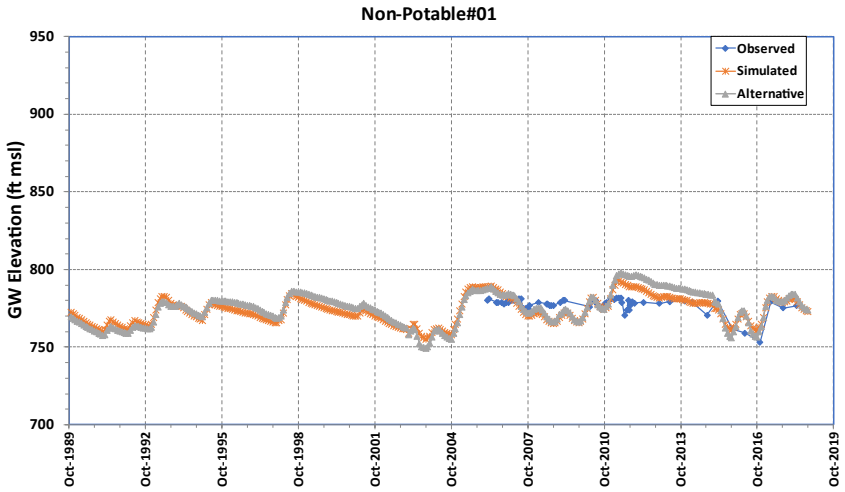


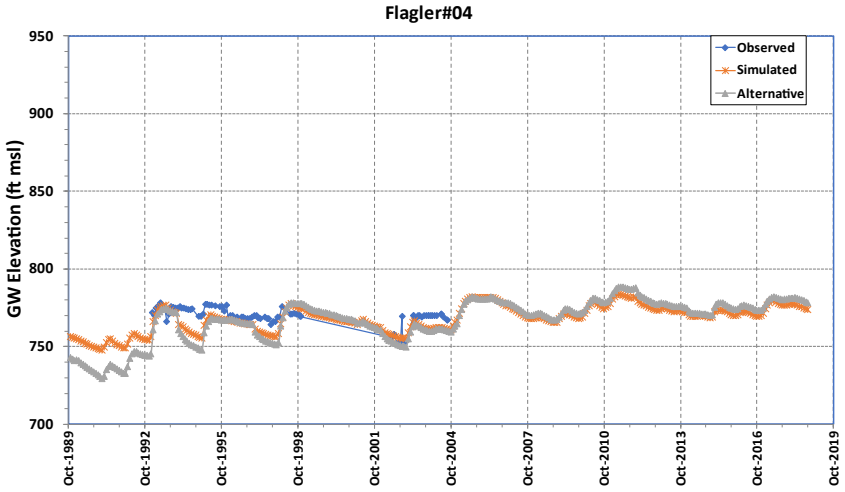
November 2021

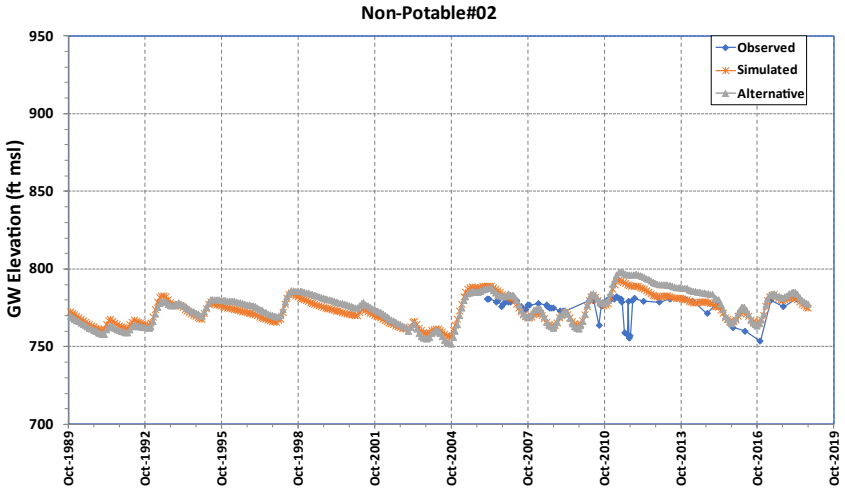
TODD GROUNDWATER

Figure 30
Calibration Hydrographs
Bedford MA
North Temescal Wash Area

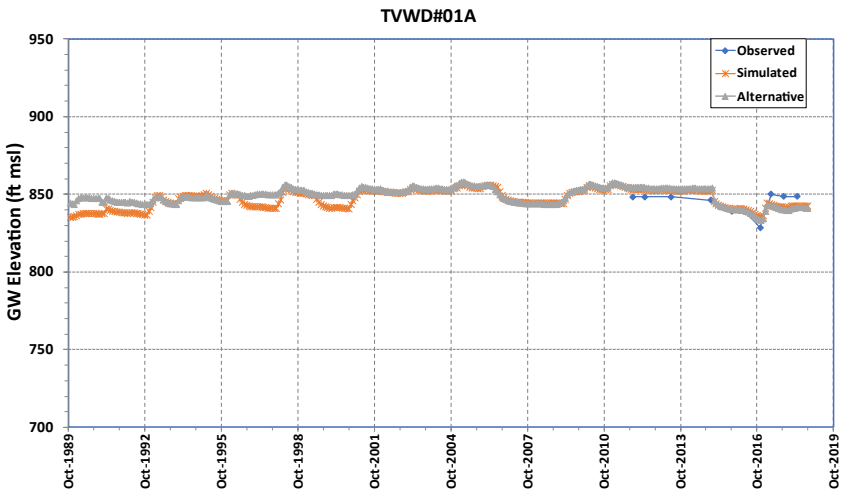


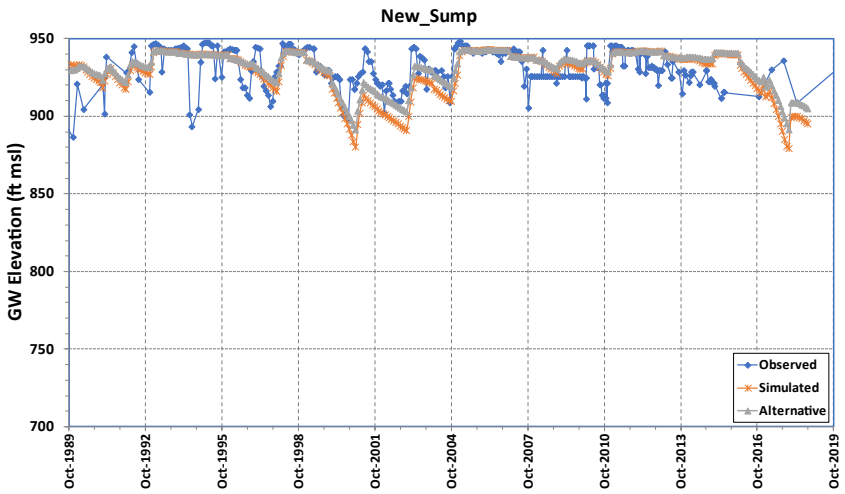


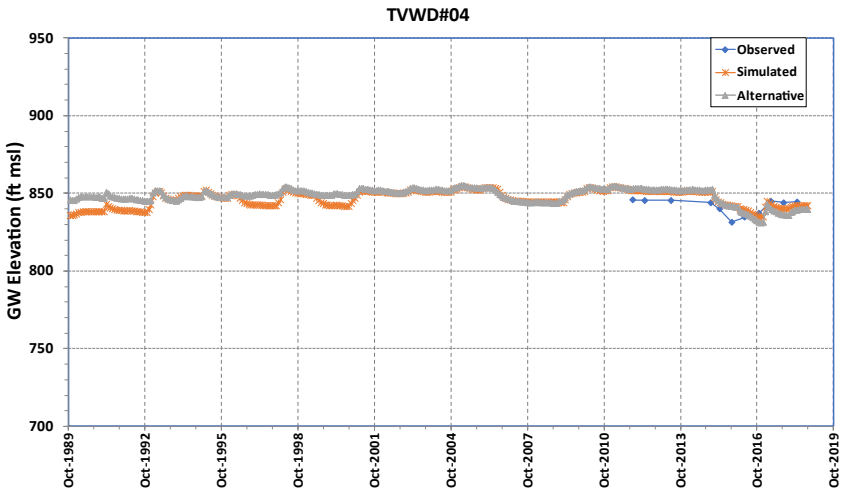


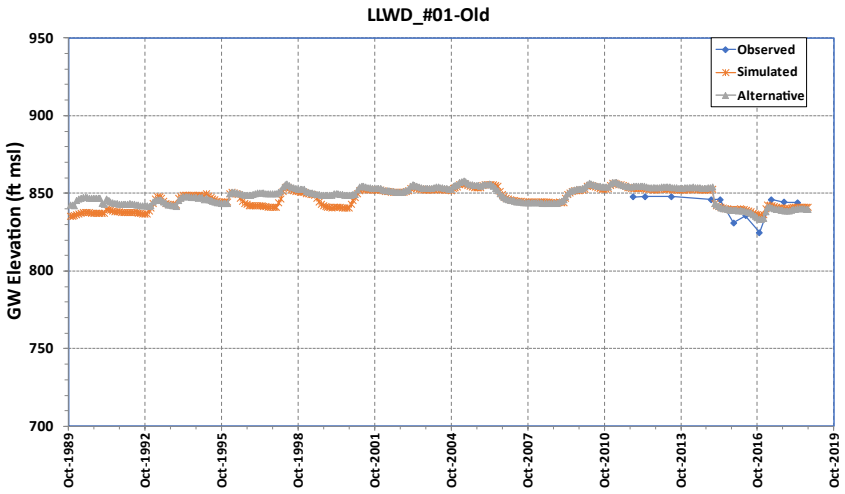


November 2021	Figure 31 Calibration Hydrographs Bedford MA North Temescal Wash Area
TODD GROUNDWATER	

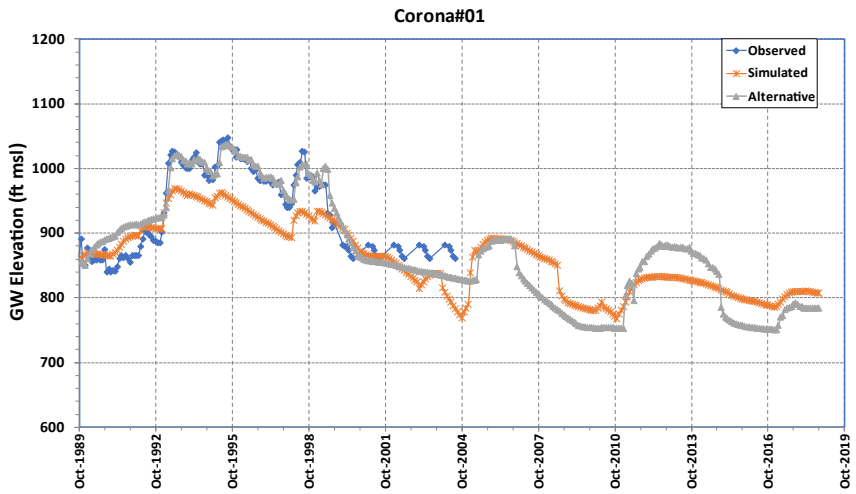


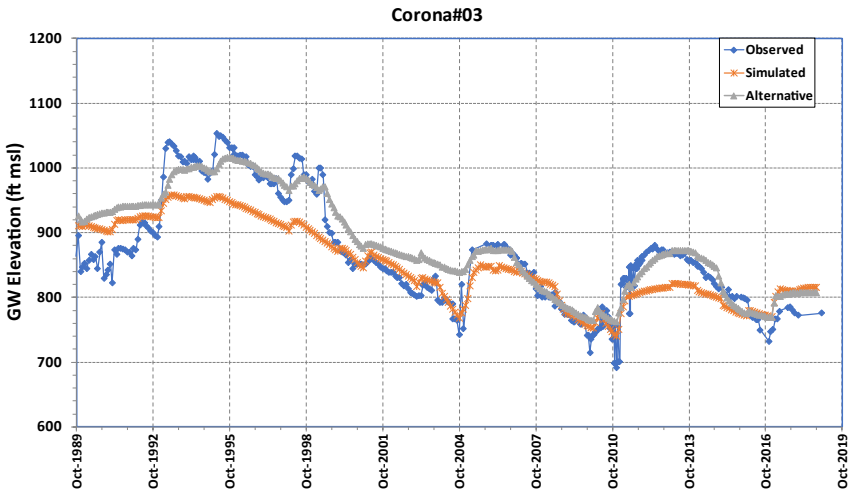


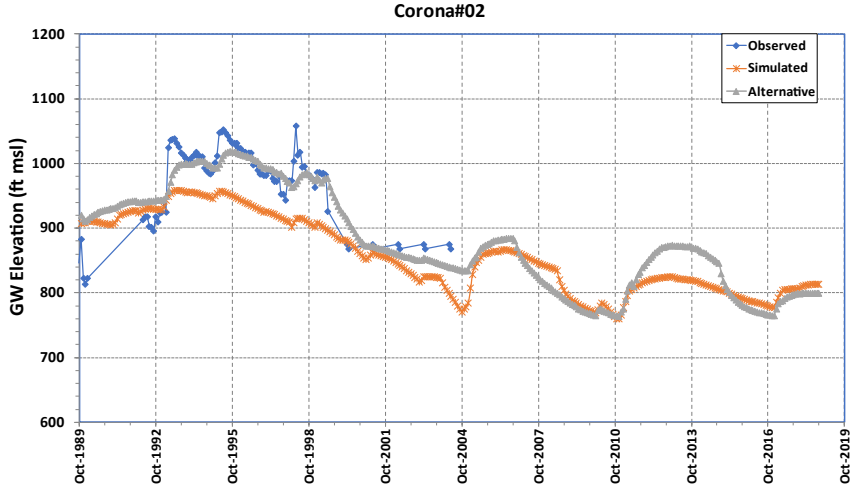


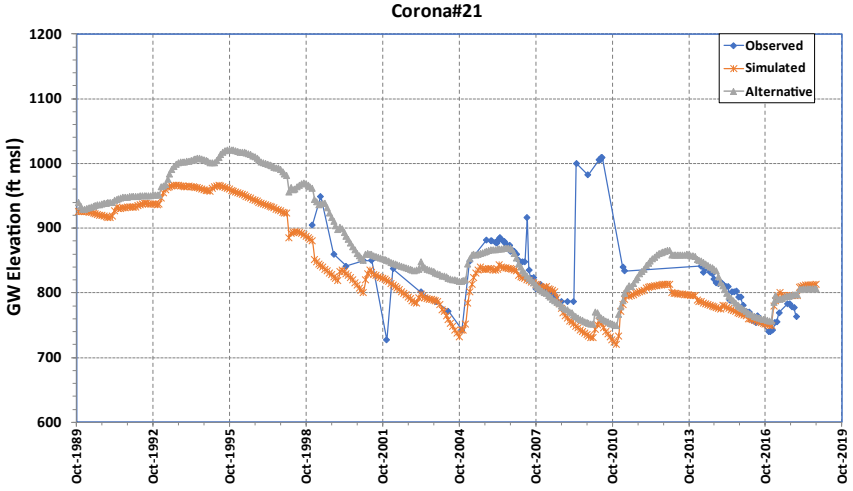


November 2021	Figure 32 Calibration Hydrographs Bedford MA Mid Temescal Wash Area
TODD GROUNDWATER	





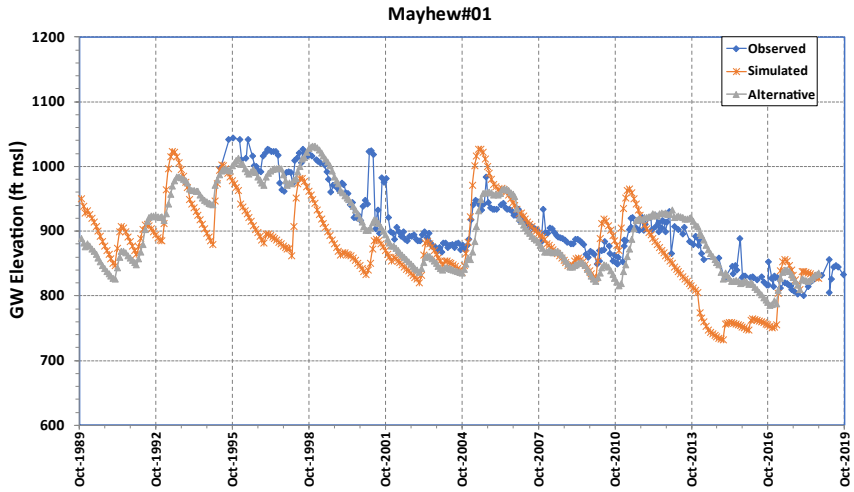


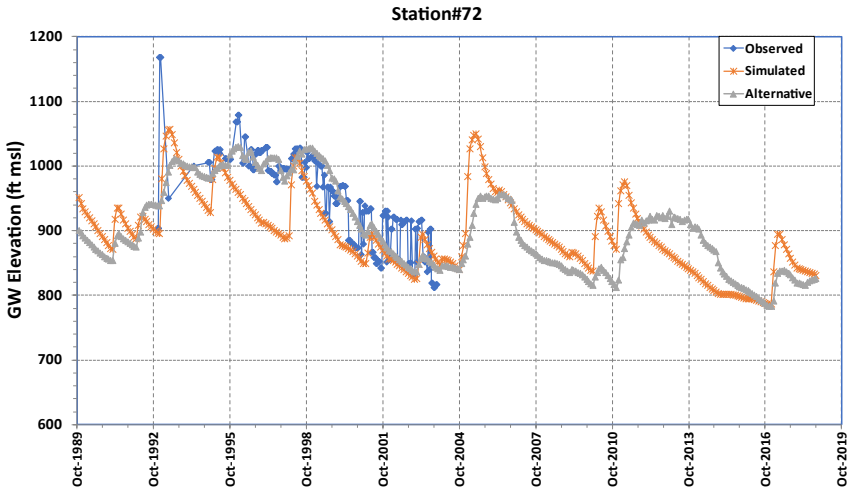


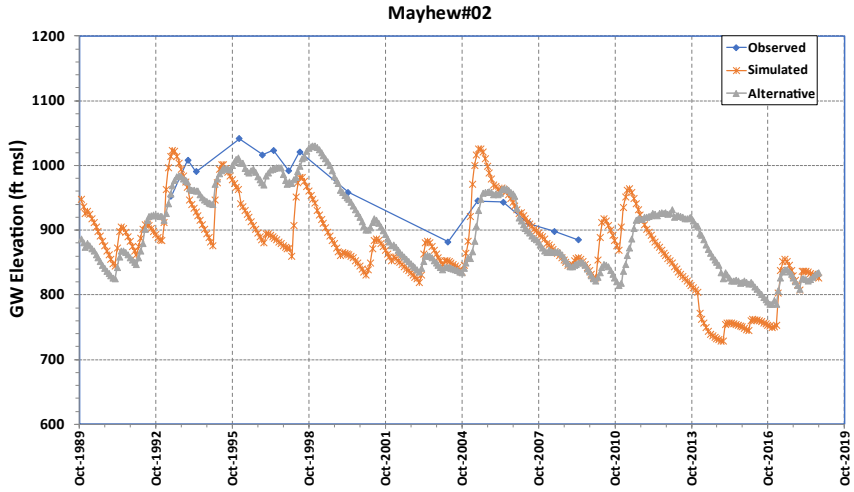
November 2021

TODD GROUNDWATER

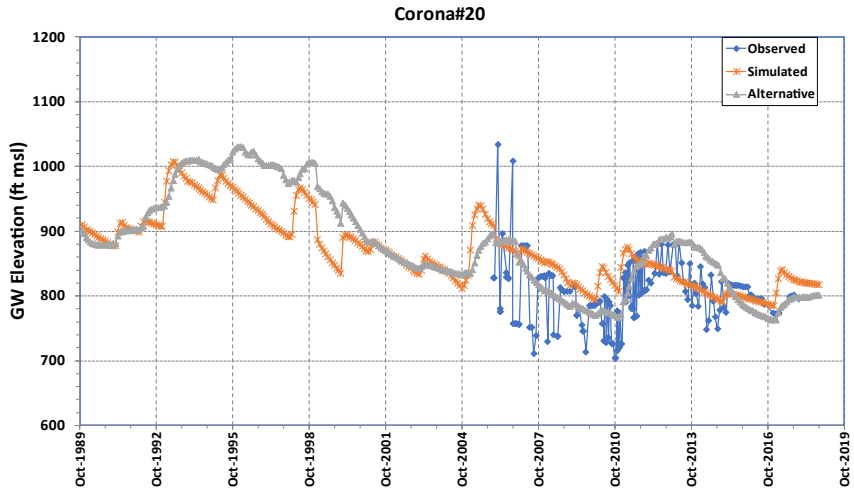
Figure 33
Calibration Hydrographs
Coldwater MA
Coldwater Quarry Area

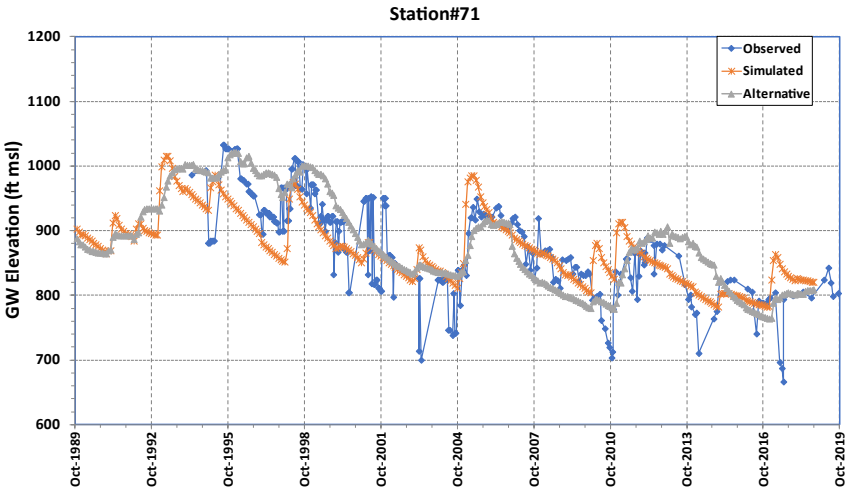


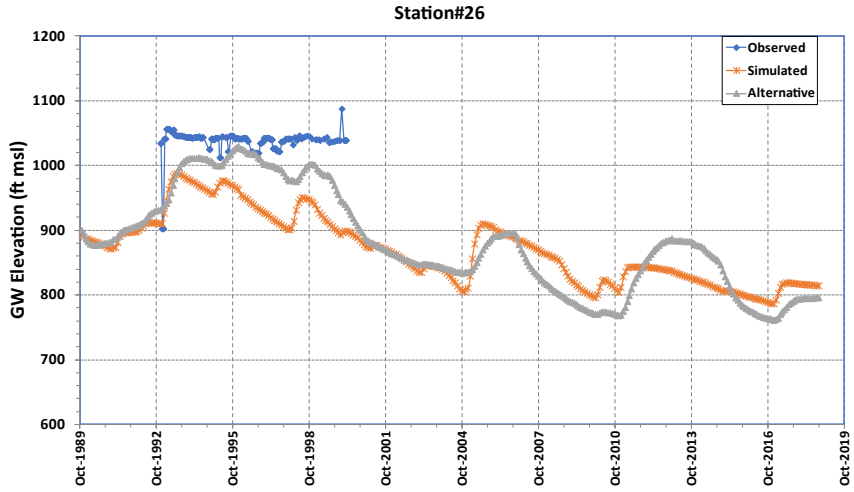




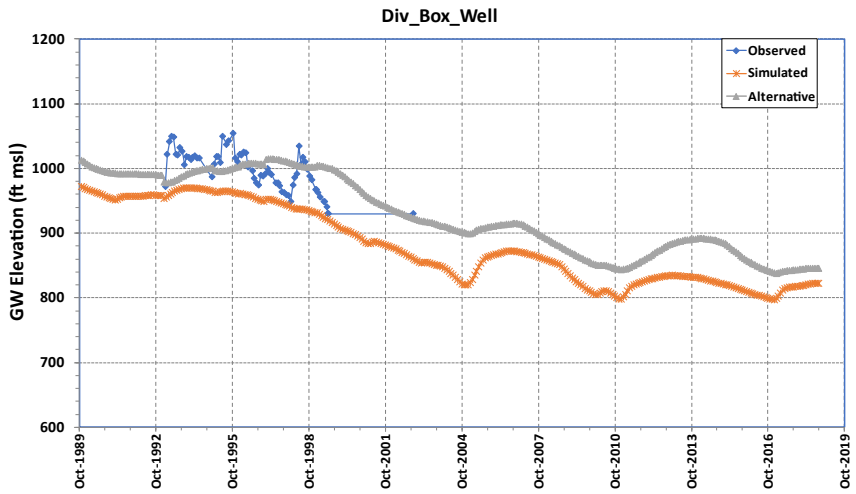
November 2021	Figure 34 Calibration Hydrographs Coldwater MA Mayhew Quarry Area
TODD GROUNDWATER	

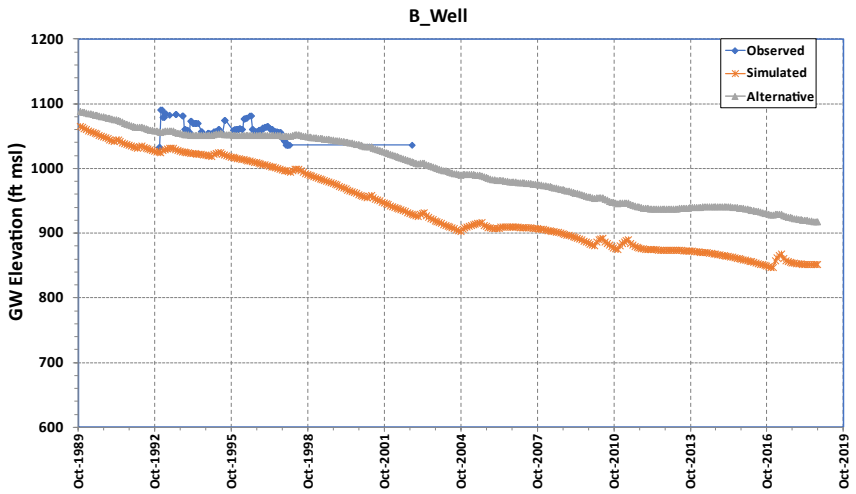


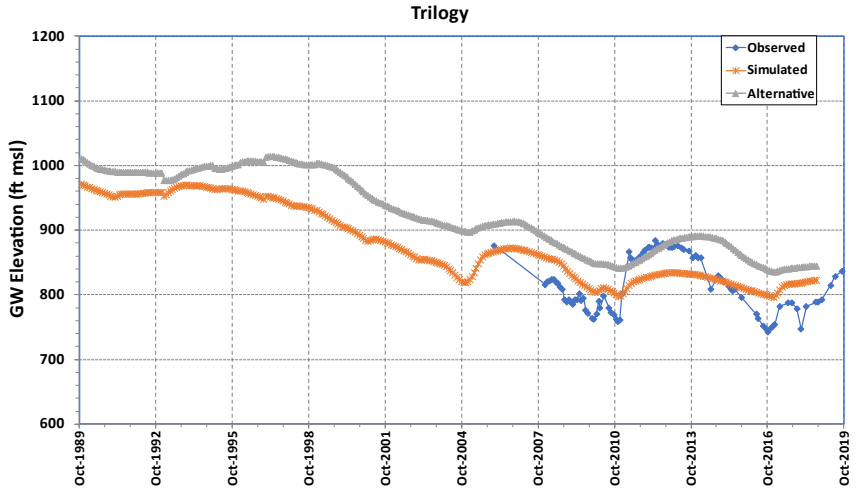


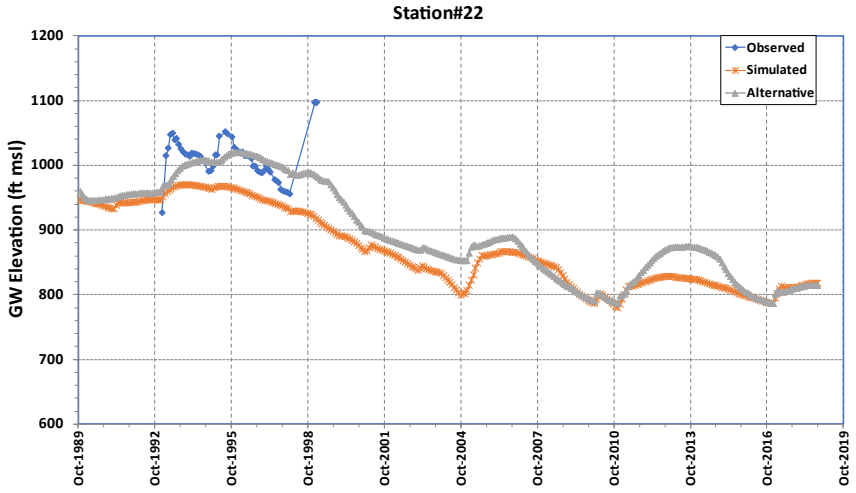


November 2021	Figure 35 Calibration Hydrographs Coldwater MA Other Quarry Areas
TODD GROUNDWATER	

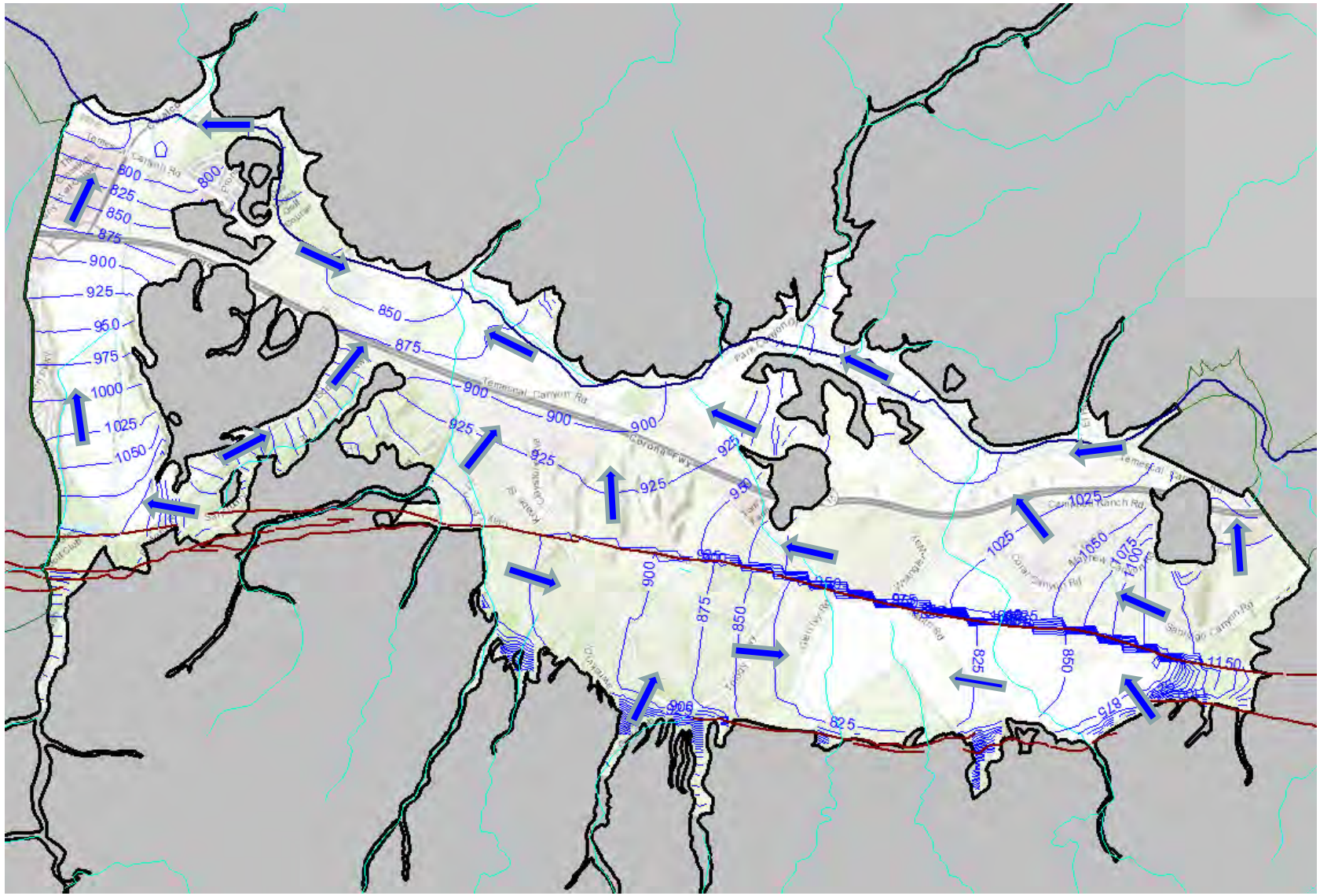








November 2021	Figure 36 Calibration Hydrographs Coldwater MA North of Quarry Area
TODD GROUNDWATER	



N

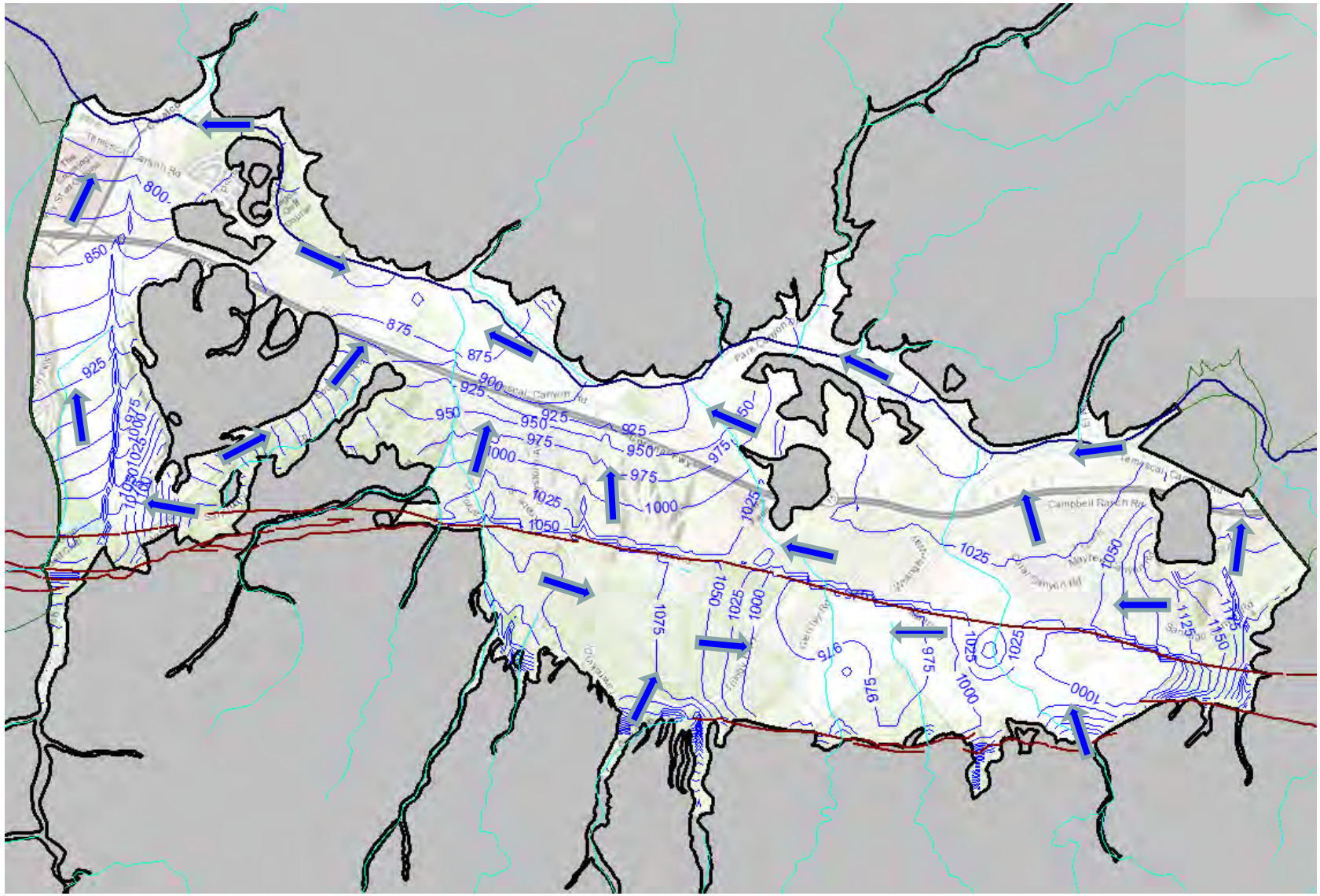
0 0.5 1

Scale: Miles

Inferred Groundwater Flow Direction

900 Simulated Groundwater Elevation

November 2021	Figure 37 Layer 1 Groundwater Elevations End of Simulation September 2018
TODD GROUNDWATER	



N

0 0.5 1

Scale: Miles

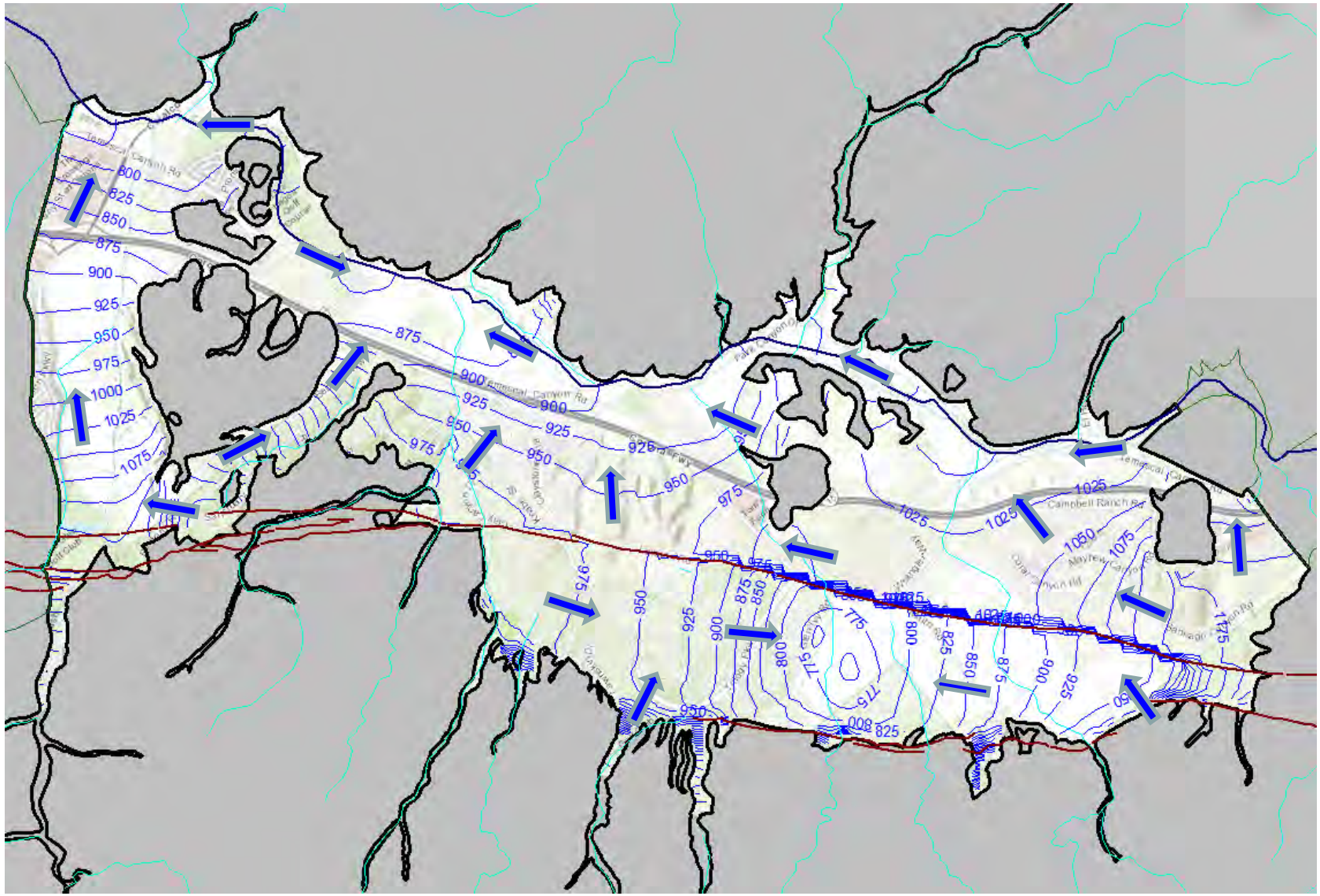
Inferred Groundwater Flow Direction

900 Simulated Groundwater Elevation

November 2021

TODD GROUNDWATER

Figure 38
Layer 1 Groundwater Elevations
Near Highest Levels
March 1995



N

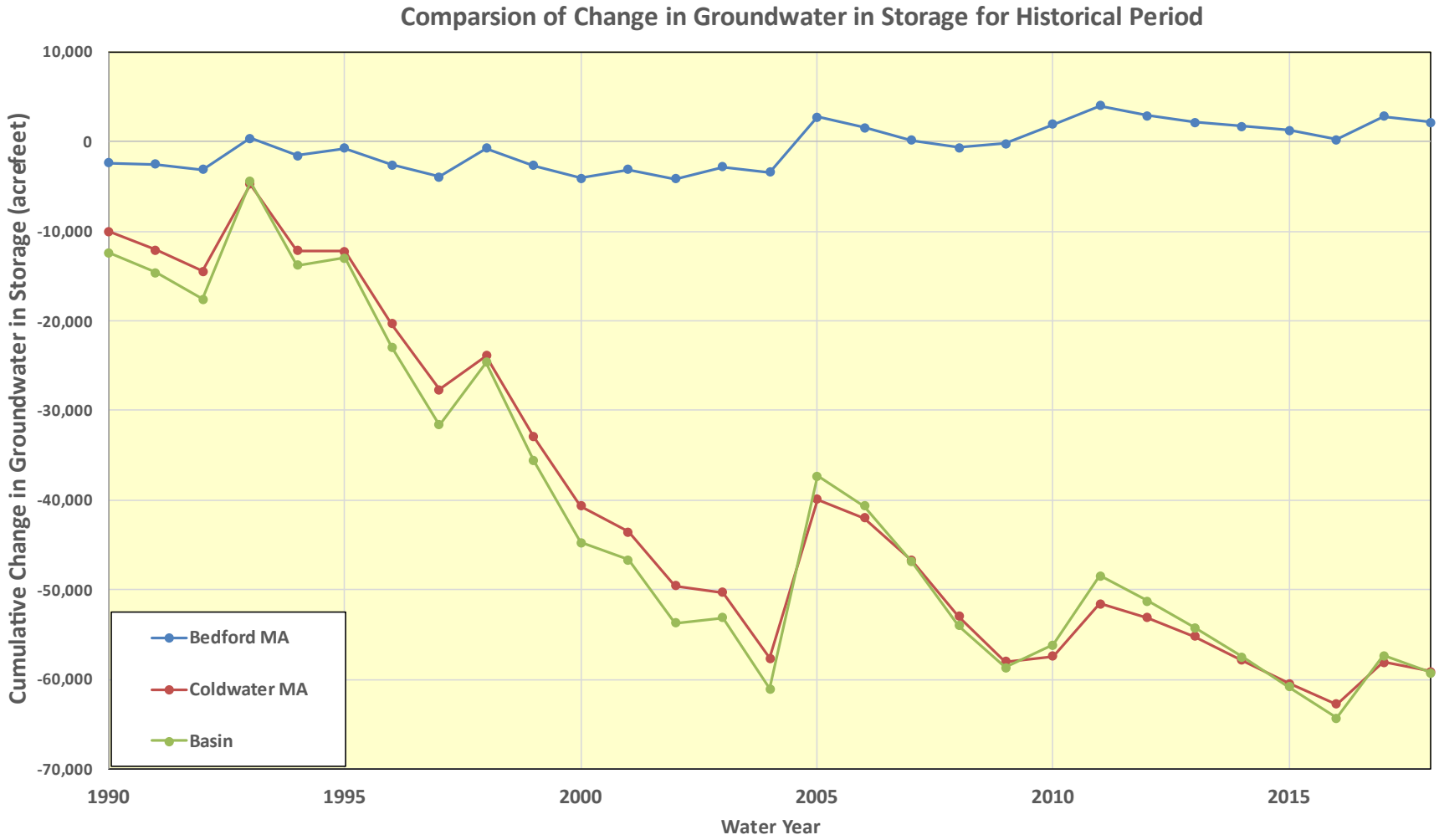
0 0.5 1

Scale: Miles

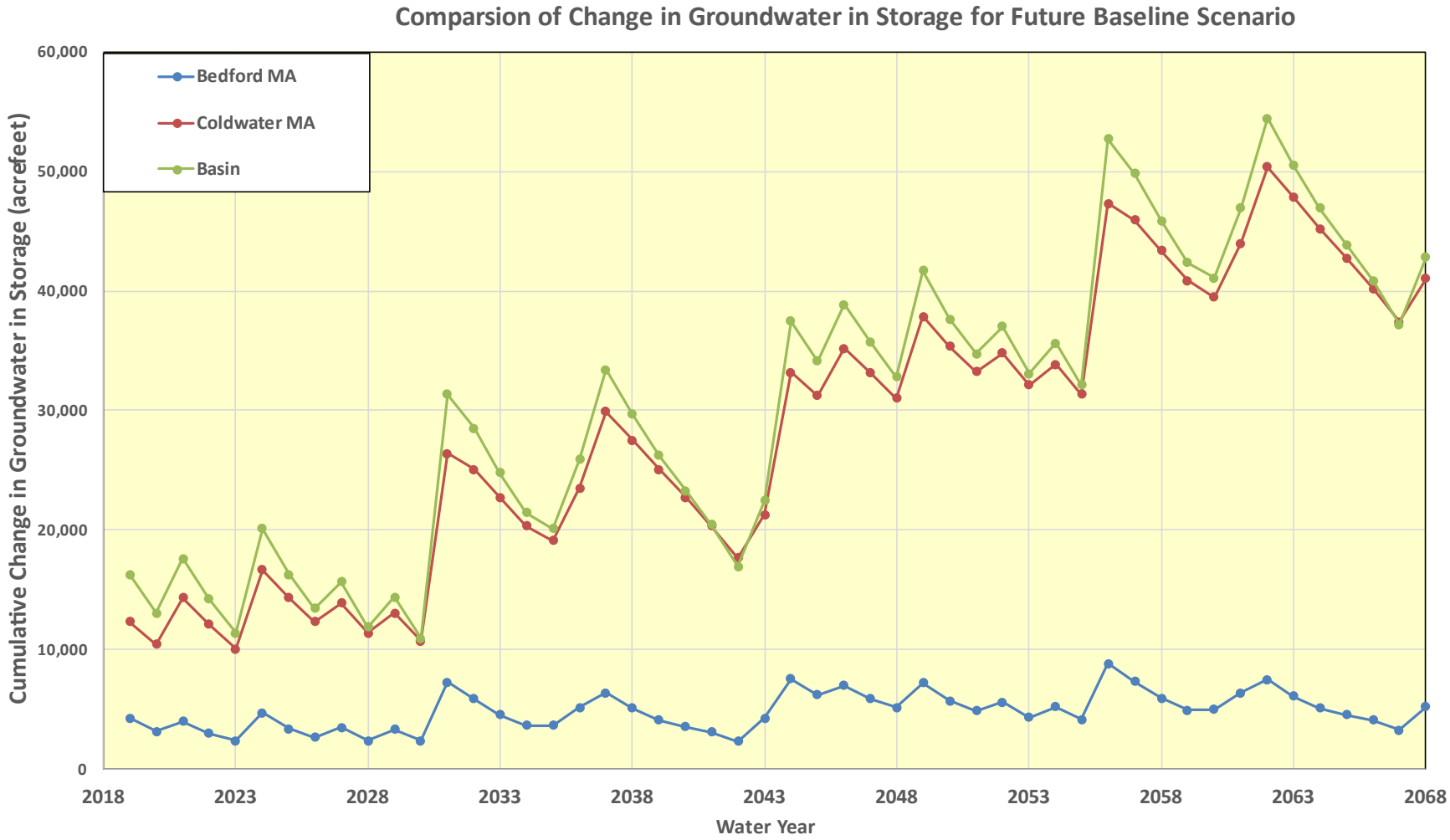
Inferred Groundwater Flow Direction

900 Simulated Groundwater Elevation

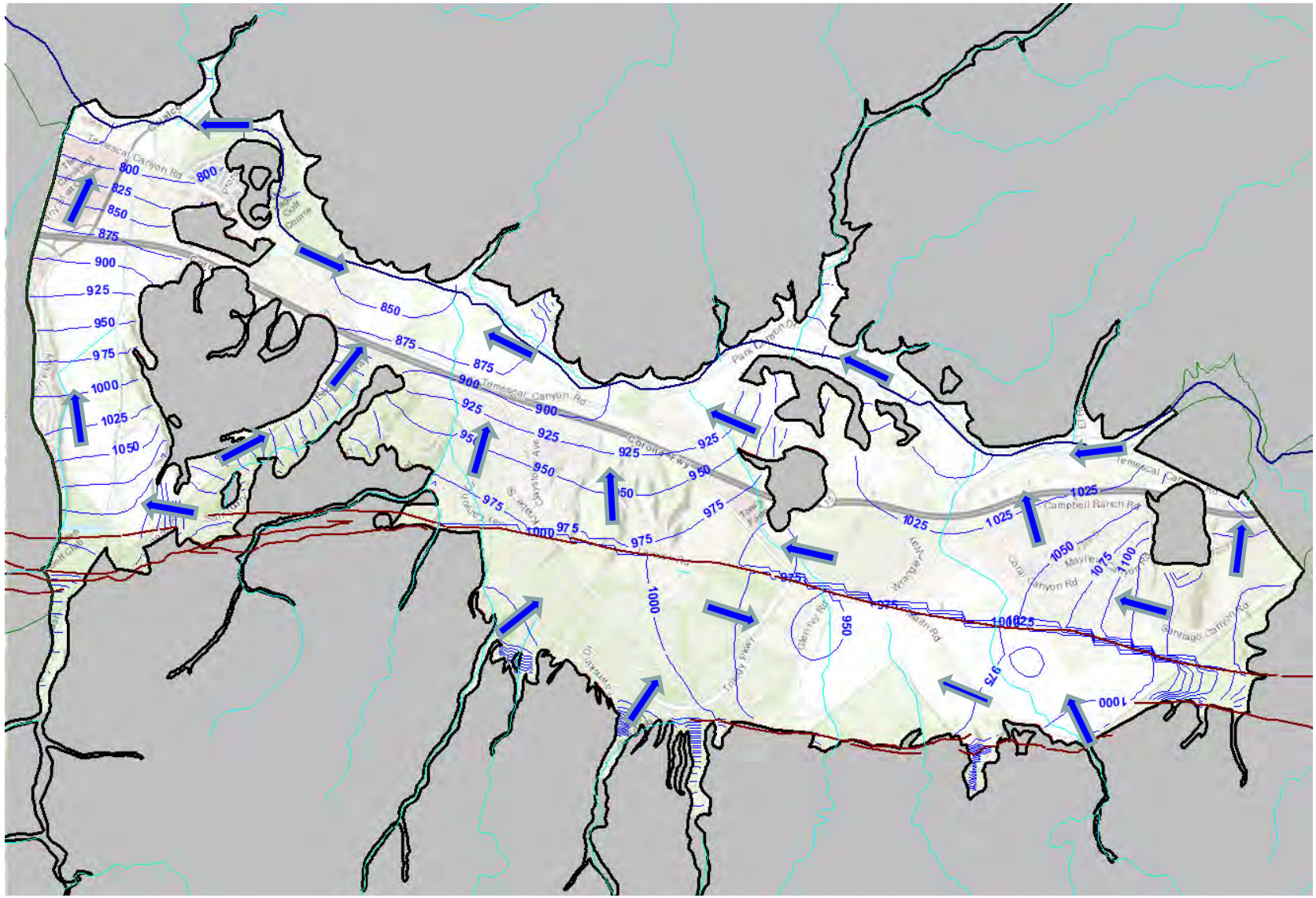
November 2021	Figure 39 Layer 1 Groundwater Elevations Near Lowest Levels October 2010
TODD GROUNDWATER	



November 2021	Figure 40 Simulated Change in Groundwater in Storage for Historical Simulation
TODD GROUNDWATER	



November 2021	Figure 41 Simulated Groundwater Storage Change for Future Baseline Scenario
TODD GROUNDWATER	



N

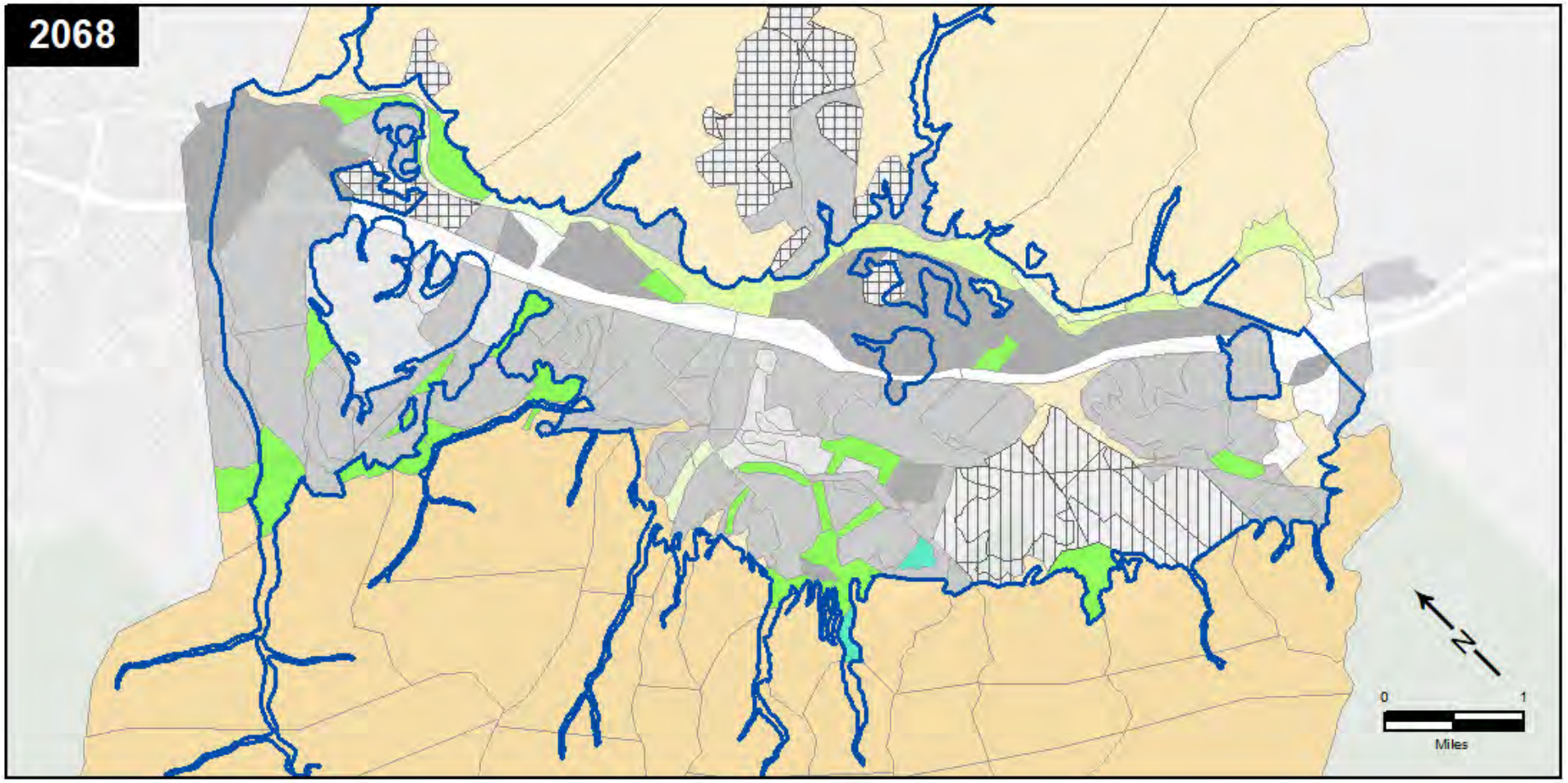
0 0.5 1

Scale: Miles

Inferred Groundwater Flow Direction

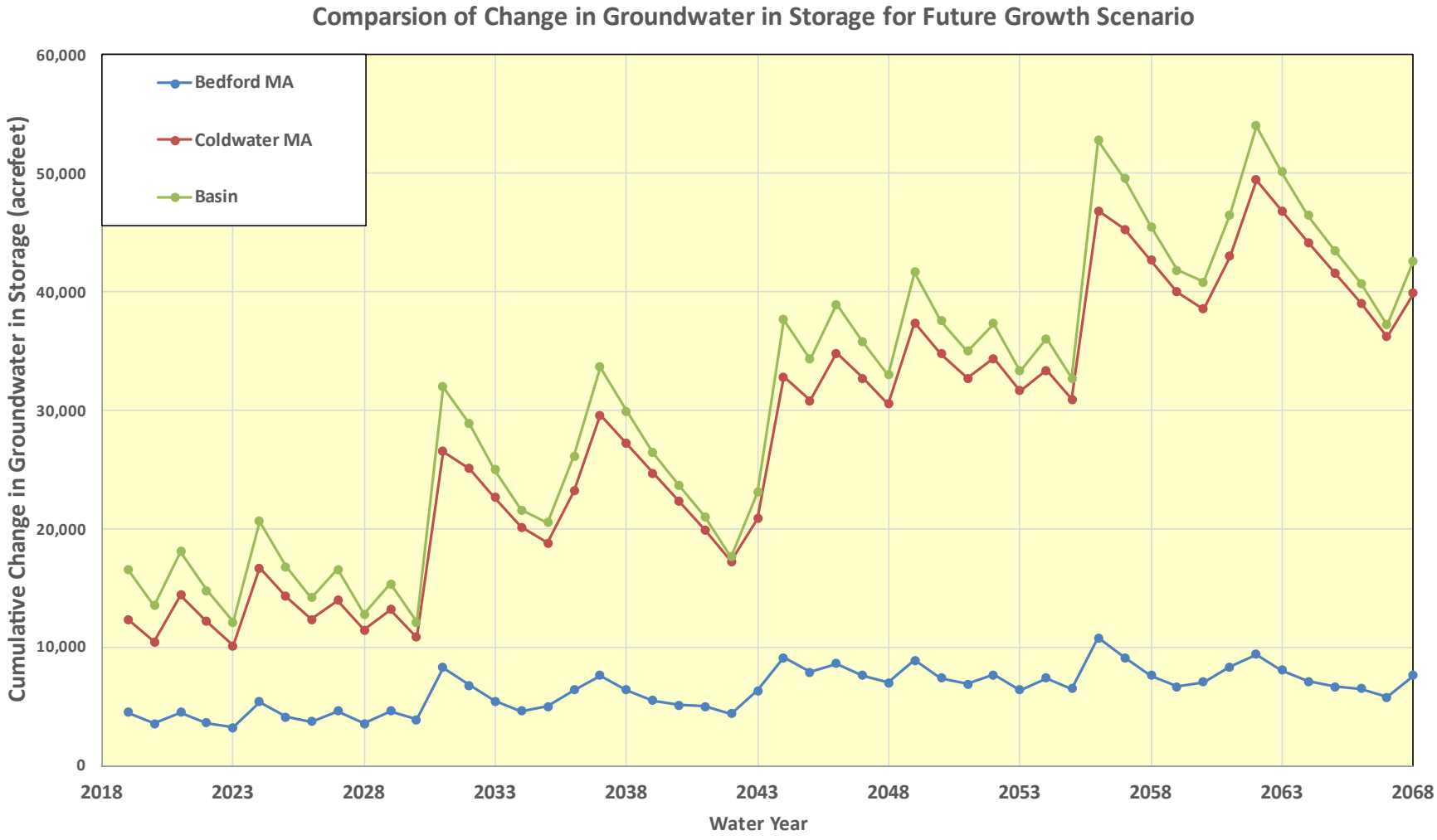
900 Simulated Groundwater Elevation

November 2021	Figure 42 Layer 1 Groundwater Elevations Future Baseline Scenario September 2068
TODD GROUNDWATER	

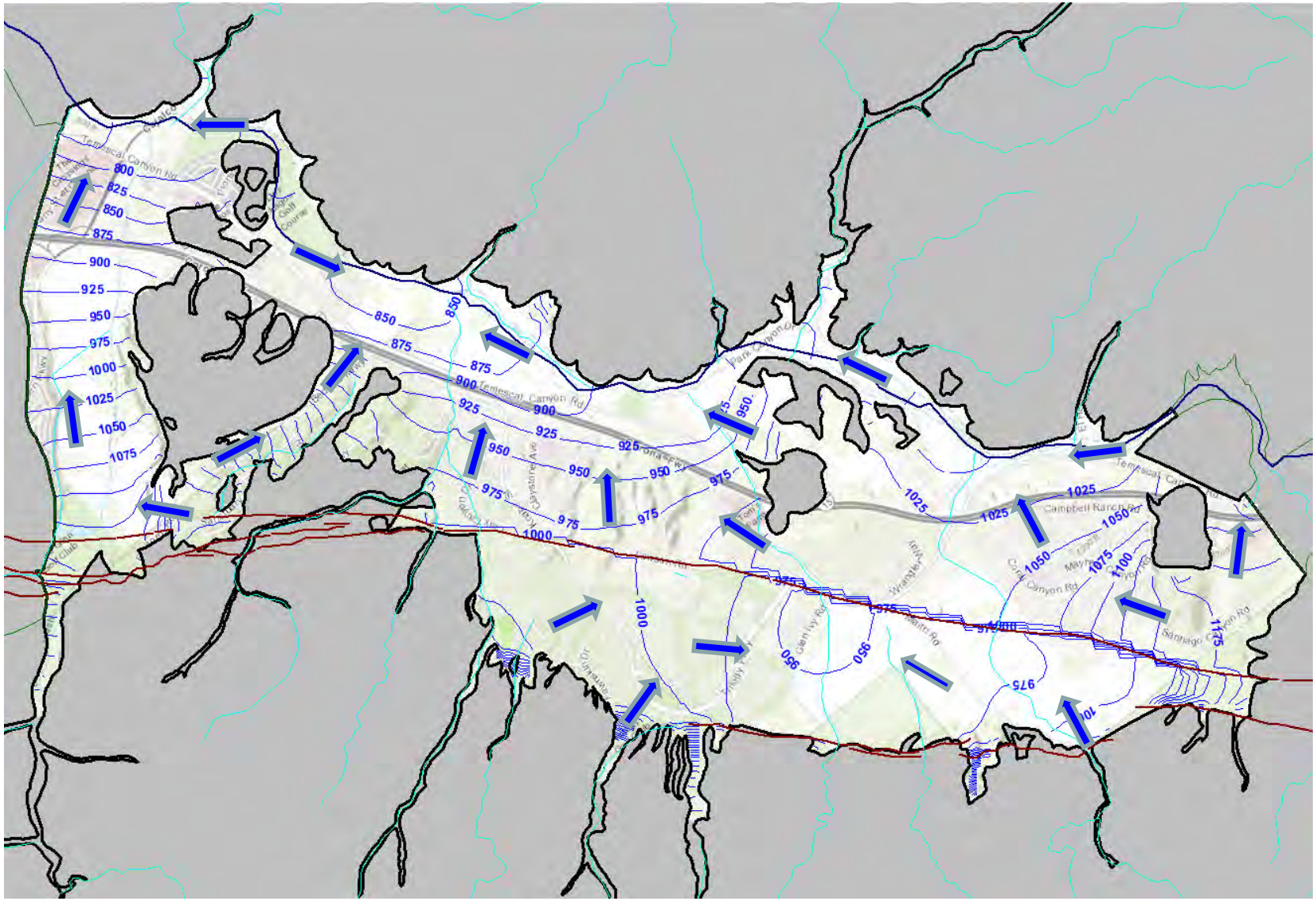


Citrus
Dense Riparian
Sparse Riparian
Grassland
Shrubs / Trees
Commercial
Industrial
Quarries
Stormwater Basins
Turf
Residential
Low Density Residential
Vacant

November 2021	Figure 43 2018 Land Use for Recharge Polygons for Future Growth Scenario
TODD GROUNDWATER	



November 2021	Figure 44 Simulated Groundwater Storage Change for Growth-Climate Change Scenario
TODD GROUNDWATER	



November 2021	Figure 45 Layer 1 Groundwater Elevations Future Growth Scenario September 2068
TODD GROUNDWATER	

APPENDIX H

Baseline Water Quality Sampling Results

Baseline Water Quality Data - February 2021

WELL NAME	Units	Type of Limit[1]	Limit Concentration[1]	Corona Well 21 Coldwater	Mayhew Well 2 Coldwater	New Sump Bedford	Corona Non-Potable Well 1 Bedford	Station 71 Bedford	TVWD Well 4 Bedford	Flagler 2A Well Bedford	TVWD TP-1 Bedford
11-chloroeicosafluoro 3oxaundecane-1-sulfonic Acid	ng/L			<1.7	<1.7	<1.7	<1.7	<1.7	<1.8	<1.7	<1.7
4,8-dioxa-3H-perfluorononanoic Acid (ADONA)	ng/L			<1.7	<1.7	<1.7	<1.7	<1.7	<1.8	<1.7	<1.7
9-chlorohexadecafluoro-3-oxanone-1-sulfonic Acid	ng/L			<1.7	<1.7	<1.7	<1.7	<1.7	<1.8	<1.7	<1.7
Arsenic	ug/L	MCL-CA	10 ug/L	<2	<2	<2	<2	<2	<2	2.1	<2.0
Bicarbonate	mg/L as CaCO3			190	150	270	240	150	280	280	230
Boron	ug/L	NL	1000 ug/L	<100	<100	260	250	<100	320	160	260
Calcium	mg/L	none		86	66	120	120	74	130	160	120
Carbonate	mg/L as CaCO3			<5	<5	<5	<5	<5	<5	<5.0	<5.0
Chloride	mg/L	SMCL	500 mg/L	30	43	180	170	49	180	140	170
Dissolved Oxygen	mg/L	none		7.9	6.7	1.2	6.1	5.7	5.7	6.4	4.0
E_ coli	MPN/100ml			<1	<1	<1	<1	<1	<1	<1.0	<1.0
Fluoride	mg/L	MCL-CA	2 mg/L	0.46	0.29	0.42	0.44	0.26	0.48	0.21	0.51
Heterotrophic Plate Count	CFU/mL			6	17		1	25	1900	6.0	14
Hexafluoropropylene oxide dimer acid (HFPO-DA)	ng/L			<1.7	<1.7	<1.7	<1.7	<1.7	<1.8	<1.7	<1.7
Hydroxide	mg/L as CaCO3			<5	<5	<5	<5	<5	<5	<5.0	<5.0
Iron	ug/L	SMCL	300 ug/L	140	<100	<100	<100	<100	<100	<100	<100
Magnesium	mg/L	none		16	15	30	32	18	30	50	35
Manganese	ug/L	SMCL	50 ug/L	20	<20	<20	<20	24	38	<20	<20
N-EtFOSAA	ng/L			<1.7	<1.7	<1.7	<1.7	<1.7	<1.8	<1.7	<1.7
Nitrate as N	mg/L	MCL-CA	10 mg/L	1.9	2.5	0.82	2.6	2.1	1.3	7.4	2.0
N-MeFOSAA	ng/L			<1.7	<1.7	<1.7	<1.7	<1.7	<1.8	<1.7	<1.7
Perfluorobutanesulfonic Acid (PFBS)	ng/L	NL	500 ng/L	0.81	2.2	26	27	2.4	29	15	27
Perfluorodecanoic Acid (PFDA)	ng/L			0.19	<1.7	0.72	0.21	0.32	3.2	<1.7	0.36
Perfluorododecanoic Acid (PFDoDA)	ng/L			<1.7	<1.7	<1.7	<1.7	<1.7	<1.8	<1.7	<1.7
Perfluoroheptanoic Acid (PFHpA)	ng/L			0.19	1	1.5	3.3	2.9	4.2	4.4	2.2
Perfluorohexanesulfonic Acid (PFHxS)	ng/L			<1.7	1.8	7.2	5	2.8	9.8	3.3	8.9
Perfluorohexanoic Acid (PFHxA)	ng/L			0.89	2.5	4.1	8.3	5.6	9.3	10	4.1
Perfluorononanoic Acid (PFNA)	ng/L			<1.7	0.21	3.8	2.3	0.87	2.3	0.65	1.2
Perfluorooctanesulfonic Acid (PFOS)	ng/L	RL	40 ng/L	<1.7	0.91	11	11	4.1	14	4.0	11
Perfluorooctanoic Acid (PFOA)	ng/L	RL	10 ng/L	0.34	2.9	11	14	7.8	25	11	18
Perfluorotetradecanoic Acid (PFTeDA)	ng/L			<1.7	<1.7	<1.7	<1.7	<1.7	<1.8	<1.7	<1.7
Perfluorotridecanoic Acid (PFTrDA)	ng/L			<1.7	<1.7	<1.7	<1.7	<1.7	<1.8	<1.7	<1.7
Perfluoroundecanoic Acid (PFUnA)	ng/L			<1.7	<1.7	<1.7	<1.7	<1.7	<1.8	<1.7	<1.7
pH (at Site, grab)	pH Units			7.4	7.2	6.8	7	7.3	7.3	7.1	7.0
Potassium	mg/L	none		1.6	1.8	3.8	3.3	1.8	3.3	3.7	6.1
Sodium	mg/L	US-HAL	200 mg/L	38	48	140	120	43	140	83	150
Specific Conductance	umhos/cm	SMCL	1600 UMHOS/CM	710	570	1200	1400	610	1300	1300	1300
Sulfate	mg/L	SMCL	500 mg/L	120	110	190	230	120	200	270	270
Temperature (at Site, grab)	°C			20	17	23	18	19	22	19	22
Total Alkalinity	mg/L as CaCO3	none		190	150	270	240	150	280	280	230
Total Coliform	MPN/100ml			<1	<1	46	<1	<1	<1	<1.0	<1.0
Total Dissolved Solids	mg/L	SMCL	1000 mg/L	440	410	820	910	430	850	930	900
Total Organic Carbon	mg/L			<0.3	0.31	1.6	0.59	0.61	1.2	0.30	1.0
Turbidity-at site	NTU			1.8	0.28	0.34	1.2	0.25	0.75	0.57	0.52

Notes:

[1]: Limits on constituent concentrations in water come from multiple sources, as indicated below (https://oehha.ca.gov/water/notification-levels-chemicals-drinking-water):

NL: California drinking water Notification Levels
SMCL: California Secondary Maximum Contiment Level,
AL: Agricultural Limit
MCL: California Secondary Maximum Contiment Level
US-HAL: Federal Health Advisory Limit
RL: California Response Level

APPENDIX I

Management Areas Designated in the Bedford Coldwater Subbasin to be Included in the Groundwater Sustainability Plan

INTRODUCTION

This memorandum summarizes the Management Areas (MAs) designated in the Bedford Coldwater Subbasin (Subbasin) to be included in the Groundwater Sustainability Plan (GSP) developed for the Bedford Coldwater Groundwater Sustainability Agency (BCGSA). As defined in the GSP Regulations, the purpose of MAs is to facilitate implementation of the GSP. The objective of this memorandum is to summarize the rational for creating each MA within the Bedford Coldwater Subbasin.

Management Areas will be described in Section 5 of the GSP, along with sustainability goals, characterization of undesirable results, and minimum thresholds and measurable objectives for each sustainability indicator. These indicators will be described for each MA. Consistent with the GSP Regulations, MAs will be presented in terms of:

- Reason for creation of each MA
- Descriptions, maps, and other information required by GSP Regulations to describe conditions in each MA
- Level of monitoring and analysis appropriate for each MA
- Explanation of how management of MAs will not cause undesirable results outside the MA

The purpose of dividing a basin into Management Areas is to facilitate implementation of the GSP in instances where a basin has distinctly different areas with unique management needs. As defined in the GSP Regulations, a MA is an area within a basin for which the GSP may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors. Although a MA may have different minimum thresholds and be operated according to different measurable objectives than the basin as a whole, undesirable results must still be defined consistently throughout the Subbasin. The operation of each MA must also be managed in a way so as not to cause undesirable results outside of that MA.

The Bedford Coldwater Subbasin is a subbasin of the Elsinore Basin and covers approximately 11 square miles in western Riverside County. The Subbasin covers a portion of the Santa Ana River watershed. The main tributaries to the Santa Ana River include Temescal Creek, which flows through the Subbasin from the southeast to the northwest, and the Bedford Wash, which flows to the northeast along the northern boundary of the Subbasin. The Subbasin is located within the Elsinore-Temecula trough, a low-lying structural block between the Santa Ana Mountains to the west and the Perris Plain on the east. The Subbasin is separated from the Temescal Subbasin to the northwest by a groundwater divide near Bedford Wash. A jurisdictional boundary separates the Subbasin with the Elsinore Valley Subbasin to the south. The Subbasin is thin in some areas, which impedes groundwater flow especially at the northern and southern boundaries.

The Glen Ivy fault separates the Bedford area from the Coldwater area, resulting in differing geology, water use, water quality, and sources of water between the two areas. These differences serve as the basis for defining two management areas in the Subbasin for the purpose of facilitating implementation of the GSP.

The Bedford Coldwater Subbasin is divided into two MAs, Bedford and Coldwater, as defined in the following sections. The MAs will be used in the water budget analysis (presented in Section 5 of the GSP)

and in numerical modeling. The MAs will be used to help define the sustainability criteria (undesirable results, minimum thresholds, management objectives) described in Section 6.

DEFINITION OF BEDFORD MANAGEMENT AREA

The Bedford MA is the area east of the Glen Ivy fault to the Estelle Mountain, as shown in Figure 1. The fault offsets the aquifer units in the Bedford MA from the units in the Coldwater MA by up to approximately 250 feet (Todd, 2019), with the west side of the fault (Coldwater MA) down dropped relative to the east side of the fault (Bedford MA). Alluvial sediments are up to 500 feet thick in the Bedford MA, and up to 800 feet deep in the Coldwater MA (Todd and AKM, 2008). Land uses are primarily urban residential and commercial/industrial in the Bedford MA. The only groundwater pumpers in the Bedford MA are the three member agencies of the BCGSA.

The 2017 Upper Temescal Valley Salt and Nutrient Management Plan (SNMP) separates the Bedford area from the Coldwater area and combines it with the Upper Temescal Valley groundwater management zone (GMZ; WEI, 2017).

DEFINITION OF COLDWATER MANAGEMENT AREA

The Coldwater MA is the area located within a down-dropped block between the Glen Ivy fault and the Santa Ana Mountains. Alluvial sediments are more than 800 feet thick in the Coldwater MA (Todd and AKM, 2008). In addition to a greater depth to bedrock, a factor distinguishing the Coldwater MA from the Bedford MA is that most of the groundwater pumping in the Subbasin occurs within this area. The City of Corona and Elsinore Valley Municipal Water District established a production agreement in 2008 to ensure the sustainable use of groundwater in the Coldwater area (EVMWD, 2008). Glen Ivy Hot Springs also has one well in the area that serves an estimated 750 people.

The Coldwater area is a separate groundwater management zone in the 2017 Upper Temescal Valley SNMP due to its distinct geologic structure and deep aquifer units (WEI, 2014).

REFERENCES

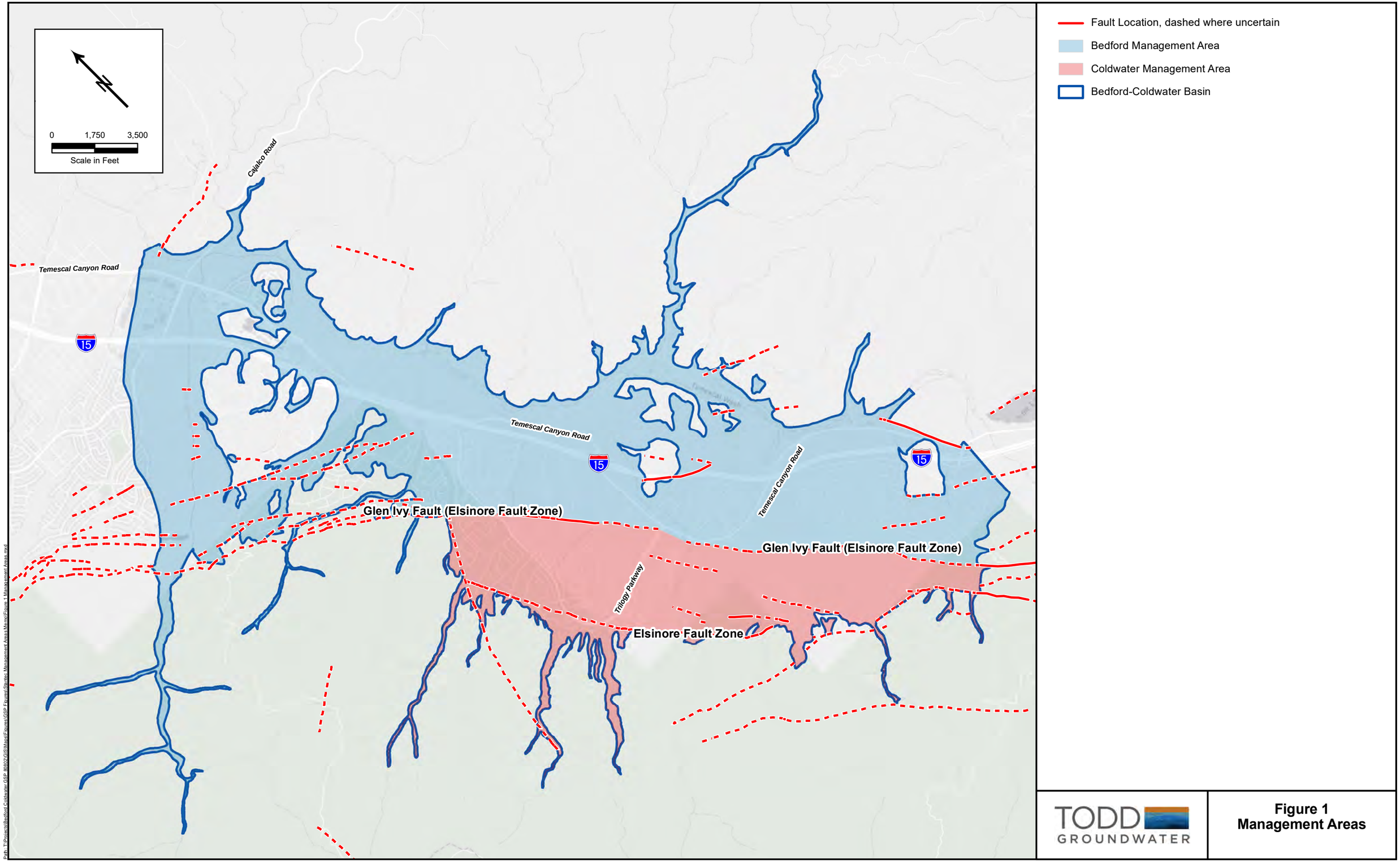
Corona and Elsinore Valley Municipal Water District (EVMWD), 2008. Agreement Concerning Water Production from Coldwater. December.

Todd Groundwater (Todd), 2019. Bedford-Coldwater Basin Existing Data Transmittal. February 9.

Todd Engineers and AKM Consulting Engineers (Todd and AKM), 2008. AB3030 Groundwater Management Plan. Prepared for the City of Corona. June.

Wildermuth Environmental, Inc. (WEI), 2014. Rationale for Creating the Upper Temescal Valley Groundwater Management Zone. Letter to EVMWD and Eastern Municipal Water District. September 8.

WEI, 2017. Salt and Nutrient Management Plan for the Upper Temescal Valley. Final September.



TODD GROUNDWATER

Figure 1
Management Areas

APPENDIX J

Detailed Annual Surface and Groundwater Budgets

Bedford-Coldwater Basin Surface Water Budget, Model Calibration Period (1990 to 2018)

Water Year	BEDFORD MANAGEMENT AREA (acre-feet per year)								COLDWATER MANAGEMENT AREA (acre-feet per year)			
	Outflow from Elsinore Subbasin to Bedford MA	Inflow from Coldwater MA	TVWD WRF Discharge into Wash	City of Corona WRF3 Discharge to Wash	Tributary and Local Runoff	Stream Percolation to Groundwater	Seepage from Groundwater to Streams	Surface Outflow to Temescal Basin	Tributary and Local Runoff	Stream Percolation to Groundwater	Inflow from Groundwater to Streams	Outflow to Bedford MA
1990	24,043	308	0	0	260	863	731	24,479	284	331	355	308
1991	5,398	2,308	7	0	4,043	2,248	559	10,066	6,175	4,055	188	2,308
1992	3,142	495	48	0	1,524	1,344	409	4,274	3,526	3,141	111	495
1993	63,144	8,156	134	0	24,997	3,920	1,495	94,005	24,042	15,979	93	8,156
1994	6,915	138	273	0	446	1,042	950	7,680	401	324	61	138
1995	8,510	2,462	402	0	7,184	2,422	1,080	17,215	9,416	6,998	43	2,462
1996	2,565	108	406	0	343	494	563	3,491	157	68	19	108
1997	1,392	132	414	0	435	206	233	2,401	270	139	1	132
1998	13,755	4,252	534	0	14,078	3,159	832	30,293	15,077	10,831	5	4,252
1999	4,682	87	840	0	503	341	413	6,184	88	1	0	87
2000	695	93	1,034	0	657	146	117	2,450	474	381	0	93
2001	3,940	668	690	0	2,890	1,731	193	6,651	4,063	3,396	2	668
2002	1,671	95	709	0	435	72	94	2,933	96	1	0	95
2003	6,056	2,067	844	0	3,968	1,655	152	11,433	5,597	3,532	2	2,067
2004	2,928	122	893	0	769	153	83	4,642	285	163	0	122
2005	49,649	13,308	1,029	0	32,278	4,947	2,377	93,695	32,138	18,840	10	13,308
2006	24,731	329	1,068	19	1,512	2,135	2,170	27,693	2,059	1,735	4	329
2007	12,768	22	1,335	50	480	1,031	1,114	14,737	35	14	0	22
2008	8,843	27	1,317	80	370	682	666	10,621	40	13	0	27
2009	6,339	164	1,455	111	947	1,205	637	8,447	1,539	1,377	2	164
2010	14,242	4,676	1,424	172	9,419	2,888	949	27,995	10,297	5,625	4	4,676
2011	23,939	6,872	1,397	194	12,566	3,069	1,580	43,480	14,107	7,239	4	6,872
2012	2,989	163	1,405	109	322	1,172	1,187	5,003	164	1	0	163
2013	1,873	87	0	205	-18	931	831	2,048	88	1	0	87
2014	0	140	0	150	159	664	568	352	267	127	0	140
2015	0	182	0	130	344	577	450	529	362	180	0	182
2016	0	111	0	137	159	403	257	261	273	162	0	111
2017	10,667	4,552	0	148	7,583	2,847	660	20,763	10,608	6,058	2	4,552
2018	2,082	95	0	162	205	727	433	2,250	299	205	0	95

Bedford Management Area Detailed Annual Water Budget, Model Calibration Period (1990 to 2018)

	Water Year and Type[1]																												
	1990 D	1991 AN	1992 AN	1993 W	1994 BN	1995 W	1996 D	1997 D	1998 W	1999 D	2000 D	2001 N	2002 D	2003 AN	2004 W	2005 W	2006 BN	2007 D	2008 D	2009 BN	2010 AN	2011 W	2012 BN	2013 D	2014 D	2015 BN	2016 D	2017 W	2018 D
Inflows (AFY)																													
Subsurface inflow	1,493	1,514	1,054	423	637	427	563	849	354	342	499	556	977	654	562	124	87	143	313	148	80	75	94	165	399	192	92	80	72
Percolation from streams	863	2,248	1,344	3,920	1,042	2,422	494	206	3,159	341	146	1,731	72	1,655	153	4,947	2,135	1,031	682	1,205	2,888	3,069	1,172	931	664	577	403	2,847	727
Bedrock inflow	980	981	979	977	978	1,185	1,194	1,046	897	833	629	592	693	547	393	848	1,119	1,080	1,019	969	706	765	894	897	894	686	297	341	382
Dispersed recharge: non-irrigated land	46	126	102	2,629	63	894	82	123	1,800	127	156	381	13	579	165	4,227	424	-23	17	395	1,621	2,154	249	135	198	332	166	1,581	51
Dispersed recharge: irrigated land	556	1,050	801	2,072	477	1,082	459	493	1,296	390	504	773	340	691	400	1,961	654	282	227	473	736	905	365	305	390	438	387	742	347
Pipe leaks	91	94	96	100	104	110	114	117	124	130	125	120	122	131	142	149	154	153	153	155	154	150	155	164	174	184	191	198	187
Reclaimed water percolation	0	0	0	0	0	20	40	62	107	210	309	373	473	691	891	1,029	854	801	525	291	285	0	487	1,575	1,646	1,462	386	3,438	2,862
Quarry recharge	74	7	18	418	314	121	111	11	36	1	14	85	56	29	37	1	38	0	0	72	14	30	18	22	25	178	252	404	353
Total Inflow	4,103	6,020	4,395	10,538	3,614	6,260	3,057	2,907	7,772	2,375	2,381	4,611	2,746	4,978	2,743	13,287	5,466	3,466	2,936	3,707	6,483	7,148	3,434	4,194	4,390	4,049	2,174	9,631	4,980
Outflows (AFY)																													
Subsurface outflow	-57	-59	-46	-370	-117	-105	-48	-33	-287	-117	-33	-30	-24	-41	-20	-553	-743	-166	-20	-150	-457	-762	-270	11	46	-171	-207	-463	-357
Wells - M&I and domestic	-2,570	-2,935	-2,251	-2,252	-1,874	-1,486	-1,896	-1,662	-373	-1,055	-1,336	-1,400	-1,824	-833	-1,046	-188	-306	-995	-1,149	-643	-390	-59	-779	-1,079	-1,346	-947	-966	-1,876	-2,173
Wells - agricultural	-1,739	-1,121	-965	-978	-1,065	-863	-658	-945	-1,089	-806	-750	-640	-388	-808	-394	-714	-648	-172	13	-152	-279	-176	147	47	38	-255	-225	251	729
Groundwater discharge to streams	-731	-559	-409	-1,495	-950	-1,080	-563	-233	-832	-413	-117	-193	-94	-152	-83	-2,377	-2,170	-1,114	-666	-637	-949	-1,580	-1,187	-831	-568	-450	-257	-660	-433
Riparian evapotranspiration	-394	-369	-306	-768	-531	-609	-427	-267	-545	-369	-195	-294	-268	-341	-311	-1,037	-773	-497	-350	-418	-626	-919	-759	-625	-564	-429	-292	-585	-359
Quarry outflow	-973	-1,153	-1,012	-1,214	-1,006	-1,297	-1,252	-1,112	-1,471	-1,558	-1,373	-1,108	-1,145	-1,447	-1,490	-2,279	-1,982	-1,972	-1,542	-1,290	-1,654	-1,583	-1,689	-2,455	-2,438	-2,241	-1,232	-3,736	-3,062
Total Outflow	-6,464	-6,196	-4,988	-7,076	-5,544	-5,441	-4,845	-4,252	-4,597	-4,318	-3,804	-3,664	-3,743	-3,622	-3,344	-7,149	-6,622	-4,917	-3,714	-3,291	-4,355	-5,080	-4,537	-4,932	-4,831	-4,493	-3,178	-7,069	-5,655
Storage Change (AFY)																													
Total Inflows minus Total Outflows	-2,361	-176	-593	3,462	-1,930	819	-1,787	-1,345	3,174	-1,944	-1,423	947	-998	1,356	-601	6,138	-1,157	-1,451	-778	416	2,128	2,069	-1,103	-738	-440	-444	-1,005	2,562	-675

Notes:

[1]: Water year types are described in Section 5 - Water Budget, and shown on Figure 5-1. Water year types are summarized above as follows D = Dry, Below Normal = BN, N = Normal, AN = Above Normal, W = Wet.

Coldwater Management Area Detailed Annual Water Budget, Model Calibration Period (1990 to 2018)

	Water Year and Type[1]																												
	1990 D	1991 AN	1992 AN	1993 W	1994 BN	1995 W	1996 D	1997 D	1998 W	1999 D	2000 D	2001 N	2002 D	2003 AN	2004 W	2005 W	2006 BN	2007 D	2008 D	2009 BN	2010 AN	2011 W	2012 BN	2013 D	2014 D	2015 BN	2016 D	2017 W	2018 D
Inflows (AFY)																													
Subsurface inflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	77	40	18	24	51	83	106	85	85	95	107	117	136	123
Percolation from streams	331	4,055	3,141	15,979	324	6,998	68	139	10,831	1	381	3,396	1	3,532	163	18,840	1,735	14	13	1,377	5,625	7,239	1	1	127	180	162	6,058	205
Bedrock inflow	676	678	675	665	667	788	818	675	570	522	419	397	468	410	338	542	736	725	661	619	508	476	558	562	536	408	166	165	277
Dispersed recharge: non-irrigated land	10	30	59	978	-8	376	-34	-38	723	-14	32	265	-5	325	72	1,976	260	0	10	297	805	1,022	78	43	95	121	78	785	52
Dispersed recharge: irrigated land	305	635	496	1,202	303	685	298	291	766	209	309	402	226	520	228	1,105	339	147	134	283	446	535	201	161	207	249	213	436	193
Pipe leaks	19	20	21	22	22	21	21	21	22	23	29	35	37	40	40	41	42	42	41	40	39	38	39	41	44	46	48	50	47
Quarry runoff recharge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Inflow	1,341	5,418	4,393	18,845	1,308	8,868	1,171	1,088	12,912	740	1,169	4,494	728	4,826	850	22,582	3,152	945	883	2,667	7,506	9,416	961	892	1,104	1,111	784	7,631	896
Outflows (AFY)																													
Subsurface outflow	-320	-296	-277	-217	-238	-182	-179	-164	-101	-100	-84	-59	-49	-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-4,148	-4,447	-5,368	-8,150	-6,285	-7,887	-6,968	-6,289	-8,104	-8,344	-5,711	-4,012	-3,911	-3,744	-3,634	-4,110	-5,089	-4,791	-4,520	-4,179	-4,122	-2,391	-2,372	-2,989	-3,927	-3,113	-2,961	-2,078	-973
Wells - agricultural	-2,164	-1,627	-995	-343	-2,166	-721	-2,088	-1,996	-811	-1,312	-1,746	-1,300	-680	-329	-239	-62	65	-211	-172	-182	-128	-536	-120	40	144	-245	-92	-343	-395
Groundwater discharge to streams	-355	-188	-111	-93	-61	-43	-19	-1	-5	0	0	-2	0	-2	0	-10	-4	0	0	-2	-4	-4	0	0	0	0	0	-2	0
Riparian evapotranspiration	-52	-76	-37	-323	-6	-77	-2	-1	-129	0	-306	-427	-472	-531	-496	-617	-204	-685	-463	-450	-601	-337	0	0	0	-387	-14	-503	-557
Quarry operations	-4,303	-861	0	0	0	0	0	0	0	0	-1,010	-1,605	-1,606	-977	-3,824	-57	-7	0	-1,983	-2,869	-2,089	-292	0	0	0	0	0	0	0
Total Outflow	-11,342	-7,495	-6,787	-9,126	-8,756	-8,909	-9,255	-8,451	-9,151	-9,756	-8,857	-7,404	-6,718	-5,592	-8,193	-4,857	-5,238	-5,687	-7,139	-7,681	-6,943	-3,560	-2,492	-2,950	-3,783	-3,745	-3,067	-2,926	-1,924
Storage Change (AFY)																													
Total Inflows minus Total Outflows	-10,000	-2,077	-2,395	9,719	-7,448	-42	-8,084	-7,363	3,761	-9,017	-7,688	-2,909	-5,990	-766	-7,344	17,724	-2,087	-4,741	-6,256	-5,015	562	5,856	-1,531	-2,058	-2,679	-2,633	-2,282	4,705	-1,028

Notes:

[1]: Water year types are described in Section 5 - Water Budget, and shown on Figure 5-1. Water year types are summarized above as follows D = Dry, Below Normal = BN, N = Normal, AN = Above Normal, W = Wet.

Bedford Management Area Detailed Annual Water Budget, Baseline Period

| | Water Year | | |

Coldwater Management Area Detailed Annual Water Budget, Baseline Period

| | Water Year | | |

Bedford Management Area Detailed Annual Water Budget, Growth And Climate Change 50-year Period

| | Water Year | | |

Coldwater Management Area Detailed Annual Water Budget, Growth And Climate Change 50-year Period

| | Water Year | | |

APPENDIX K

Bedford-Coldwater GSP Data Management System Description

May 19, 2021

TECHNICAL MEMORANDUM

To: Victor Harris, H&H Water Resources
From: Maureen Reilly, PE and Chad Taylor, PG, CHG
Re: Data Management System (DMS) Documentation, Bedford-Coldwater Groundwater Sustainability Plan

1. EXECUTIVE SUMMARY

The Bedford Coldwater Groundwater Basin Agency (BCGSA) was formed by the City of Corona (Corona), Elsinore Valley Municipal Water District (EVMWD), and Temescal Valley Water District (TVWD) through a Joint Powers Authority (JPA) to fulfill the role and legal obligations of a Groundwater Sustainable Agency (GSA) for the Bedford-Coldwater Subbasin (Basin) of the Elsinore Valley Groundwater Basin in accordance with the Sustainable Groundwater Management Act (SGMA). Foremost among the responsibilities is to develop, adopt, and implement a Groundwater Sustainability Plan (GSP) for the Basin.

As part of GSP development, the BCGSA has compiled data from various sources that are relevant to groundwater, geology, and water supply the Basin. These data focus on information that have been required and useful for the preparation of the GSP. The purpose of this Technical Memorandum (TM) is to document the Data Management System (DMS) developed as part of the GSP.

Corona, EVMWD, and TVWD have been collecting and compiling groundwater data including water levels, water quality, and water use for the GSP. As part of the GSP, the DMS has been redesigned to be practicable, usable, intuitive, and cost effective. The data (and data from the BCGSA and other sources) are being compiled in an Access database, geographic information system (GIS) geodatabase, and Excel workbooks. This DMS has been prepared to facilitate queries and other means of quickly checking and summarizing data and extracting relevant information for GSP preparation. This memo outlines the type of data available in the DMS and details how the data are stored. More information on available data is documented in the technical memorandum, “Bedford-Coldwater Basin Existing Data Transmittal” (Todd 2019).

2. DMS TYPES AND SOURCES

Data collected and compiled for the GSP have been stored in a variety of formats based on the type of data collected. Spatial information such as ArcGIS files, aerial imagery, and or other map sources, are stored in a Geodatabase. Tabular data are stored in subject-specific

relational databases. Additional datasets are stored in files best suited for analysis. To be specific, climate data are stored in an Excel workbook to allow for cumulative departure calculations, scanned well documents are stored as images to preserve the detail on the hardcopy forms, and online datasets updated by other agencies are included by reference. Discussed below are the data formats and the type of data available within that format.

3. GEODATABASE

Spatial data are stored in a geodatabase, which allows spatial files to be easily accessed and transferred with all appropriate spatial information. Within the BC Geodatabase, consistent and feature dataset structures have been constructed to group associated data sets and maintain coordinate system assignments.

3.1 Jurisdiction Boundaries

The basin boundaries for the Bedford-Coldwater Basin, management areas, and neighboring basins are available as spatial coverages in the geodatabase. State, local, and federal boundaries within and surrounding the Bedford-Coldwater Basin were compiled from state and federal sources. These boundaries include all water districts and other local agencies near the basin as well as federally owned land. These boundaries are included in the *JurisdictionalAreas* feature dataset in the project geodatabase.

3.2 Surface Water Body Location and Watershed Mapping

Mapping data for surface water features have been provided from publicly available sources. These mapped data include locations of aqueducts, reservoirs, rivers, streams, drainages, lakes, and ponds. These data are presented in the project geodatabase in feature classes named *HydrologyArcs,* and *HydrologyPolygons*. DWR defined watershed coverages are also stored in the ArcHydro geodatabase names *Watershed*.

3.3 Mapping of Natural Communities Commonly Associated with Groundwater

GSP Regulations require identification of Groundwater Dependent Ecosystems (GDEs), which are defined as ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. A statewide database and mapping tool, developed by DWR, provides geographic information on Natural Communities Commonly Associated with Groundwater (NCAAG). While these do not necessarily represent GDEs, the dataset is a starting point in identifying GDEs. The mapping data for watersheds surrounding the Basin are included in the project geodatabase in the *Hydrology* feature dataset in feature classes named *GDE_NCCAGWetlands* and *GDE_NCCAGVegetation*.

3.4 Ground Surface Elevation Data

Ground surface elevation data are available from the USGS in the form of National Elevation Dataset (NED) GIS grid files (rasters) and raster and vector topographic map datasets. Both

datasets have been compiled for the area surrounding and including the Basin. The 10-meter resolution NED data have been combined into a single raster.

3.5 Aerial Photographs

Aerial photographs of the area surrounding the Basin have been downloaded from the USGS National Aerial Imagery Program (NAIP) for 2004, 2005, 2006, 2009, 2010, 2012, 2014, and 2016. Selected historical aerial imagery of the Temescal Wash area from Google Earth and privately held aerial imagery archives have also been acquired. These aerial photographs are rectified GIS raster datasets whenever possible. Rectified GIS datasets are included in the project geodatabase, unrectified aerial imagery is stored separately.

3.6 Soil Maps

Soil information for the Basin and surrounding areas have been downloaded from the Natural Resources Conservation Service (NRCS 2018). Soil data are mapped and maintained by NRCS in a standardized format that is compatible with tools that NRCS makes freely available to the public. The soils data for the area surrounding the basin have been maintained in the standard NRCS formats to facilitate future use. These raw data are available for preparation of a various soil data presentations and analyses. The hydrologic soil group data from these datasets have been also mapped using the NRCS *Soil Data Development Toolbox.* These data are in the *Soils* feature dataset in the project geodatabase.

3.7 Land Use Maps

Land use map data have been collected from DWR, the California Department of Conservation Farmland Mapping and Monitoring Program (FMMP), and Riverside County. The available land use maps are indicated below:

- DWR: 2014 statewide land use mapping specifically developed for SGMA and GSPs.
- FMMP: 1984, 1986, 1988, 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014, and 2016
- Riverside County: 1993 and 2000

3.8 Geologic Mapping of Surficial Geology and Faults

Surficial geology in the area of the Bedford-Coldwater Basin has been mapped by the United States Geological Survey (USGS) in the 2004 *Preliminary Digital Geologic Map of the Santa Ana 30' x 60' Quadrangle* and the 2006 *Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangles*. This mapped geology has been digitized into GIS formats available from the USGS, and these complete datasets are included in the *Geology* feature dataset of the project geodatabase.

3.9 Subsidence - NASA JPL InSAR Dataset

Vertical ground surface displacement rates are derived from Interferometric Synthetic Aperture Radar (InSAR) data collected by the European Space Agency (ESA) Sentinel-1A satellite and processed by the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL), under contract with DWR. Changes in vertical displacement can be viewed through the DWR SGMA mapping tool. Data have been downloaded from the SGMA data viewer and stored in the project geodatabase.

3.10 Water Infrastructure

3.10.1 Imported Water

Imported water delivery pipelines and tie-in locations available from Corona, EVMWD, and TVWD are included in the GIS datasets in the *MunicipalWaterInfrastructure* feature dataset in the project geodatabase. TVWD did not provide pipeline location details but did indicate that imported water is delivered throughout their service area. Imported water delivery data are included in the *Corona Imported Water*, *EVMWD Imported Water*, and *TVWD Imported Water* tables in the project database.

3.10.2 Recycled Water and Wastewater

Corona and TVWD supplied waste discharge and recycled water use records and distribution locations. EVMWD does not deliver recycled water or discharge wastewater within the basin. Corona waste discharge and recycled water distribution and use locations are included in the GIS datasets in the *MunicipalWaterInfrastructure* feature dataset in the project geodatabase. TVWD waste discharge historically went either to Temescal Creek or ponds adjacent to their wastewater treatment facility and they provide recycled water throughout the Bedford portion of the basin and waste discharge. Recycled water use and wastewater discharge data are included in the *Corona Reclaimed Water Use*, *Corona Waste Discharge*, *TVWD All Waste Discharge*, and *TVWD Waste Discharge by Location* tables in the project database.

3.11 Climate Data

The CIMIS stations, NOAA stations, and other climate locations are available in the geodatabase as a point coverage. In addition, the PRISM isohyets are available as a raster.

3.12 Surface Water Gage Locations

The locations of USGS surface water gages are also stored in the Geodatabase. Three streamflow gage stations near the Bedford-Coldwater Basin that are maintained by the USGS were identified. These stations are located on Temescal Creek at about Main Street in Corona (USGS 11072100), Temescal Creek at Corona Lake (USGS 11071900), and San Jacinto River near Elsinore (USGS 11070500). Up to date surface water measurements are available from the USGS NWIS data repository.

4. ACCESS DATABASES

Tabular data are linked in relational databases by subject. The DMS include one access data base with stand-alone tables that pull together data from all sources for groundwater elevation, groundwater quality, and groundwater pumping. In addition, a table containing all know wells in Bedford-Coldwater links to the subject specific tables. The well table includes locational information as State Plane coordinates. These tables that include all sources of data are named with the prefix "ALL_". Additional tables from the individual agencies are included in the database for the records and are labels with the agency prefix (e.g. "EVMWD", "TVWD", "Corona"). Other tables are included to house subsets of data from other sources including the water master, EPA STORET, and data from outside the basin.

The types of data stored in the Access database are described below.

4.1 Well Information Table

Well locations and available information were collected from multiple sources, including previous investigations, USGS National Water Information System (NWIS), DWR California Groundwater Elevation Monitoring (CASGEM) program, and others. This data collection effort included available well locations, well construction information, and aquifer parameter information. Data from all the available sources for the basin and surrounding area were collected and reviewed and then the data were combined into a single unified dataset. The unified dataset retains detailed information from the source files. Well data from individual sources often use agency-specific identification numbers or names. This variation in identification number by source is problematic for organizing, relating, and querying data. A *UniqueID* field was added to the unified well dataset and assigned integer identification numbers for each well to serve as the primary field for joins, relating, and querying data. The unified well dataset includes wells with and without location data. In compiling these data, attempts were made to remove duplicate wells while compiling these data. In some cases of duplicate wells, it was not possible to determine which location is correct. In these instances, the duplicate records were maintained in the dataset. The unified well information dataset is included in the project database in the All_*Well Information Table* and the same information is presented in the project geodatabase in the *Well* feature class in the *Groundwater* feature dataset.

Well locations are not well tracked in California, and as a result it is always possible that wells are either completely missing from records or mis-located. While this is not a known data gap, there may be wells that are missing or mis-located in the data that has been compiled for this data collection task.

4.2 Groundwater Elevation Table

As with well locations, groundwater elevation records were collected from multiple sources, including previous investigations, Corona, USGS NWIS, DWR CASGEM, and others. Data from these sources were collected, reviewed, and compiled into a single unified groundwater

elevation dataset. The dataset includes all information from each source and uses the *UniqueID* field for linking, joining, or relating to the *Well Information* table in the project database or *Well* feature class of the project geodatabase. Groundwater elevation data were not calculated for wells without reference elevation data; records for these wells include only depth to water measurements. In addition, there are temporal gaps in some of the data records between the completion of previous investigations and the start of data collection for publicly available records. This is discussed further in the data gaps section below.

Groundwater elevation data is presented in the *ALL_Groundwater Elevation Data* table of the project database, and this dataset has been structured according to the requirements of the CASGEM program in accordance with DWR's grant funding agreement with the BCGSA.

4.3 Groundwater Quality Table

The groundwater quality database combines water quality data from a variety of sources for a comprehensive repository of regional water quality data. The relational database includes locations for all wells with water quality data, a table of water quality data, a table with information on the water system that was sampled, and a table of constituents monitored with agency codes, reporting levels, and applicable water quality goals. Queries are included to extract data on the key constituents of concern. Data from all three agencies, regional monitoring (Regional Water Quality Control Board and the Division of Drinking Water), and special studies (SNMP) are included in the *All_Water_Quality* table. The wells are linked to the Well Information table by the Unique_ID and the source recorded in the dataset attribute field.

4.4 Groundwater Pumping Table

Groundwater production in the basin was compiled from all available sources in the table *ALL_BC_Annual_Pumping*. Annual groundwater pumping for all wells is tracked by the Santa Ana River Watermaster, along with production in the rest of the watershed. Western Municipal Water District (WMWD) currently coordinates groundwater use data collection. Complete records of historical groundwater use were requested from and provided by WMWD. These groundwater production data were reviewed and organized for inclusion in the project database in a table named Bedford-Coldwater Annual Pumping. These production records are related to well locations by the Unique ID in the *Well Information* and *Bedford-Coldwater Annual Pumping* tables.

Annual totals from the Watermaster were confirmed and monthly information included when available from each individual agency.

4.5 Aquifer Parameter and Well Construction Data

There are very few aquifer parameter estimates in and around the Bedford-Coldwater Basin. Some aquifer parameter estimates were collected and/or developed during preparation of the Corona Groundwater Management Plan (Todd 2008a) and the *Feasibility Study, Recycled*

Water Recharge, Bedford Subbasin (Todd 2008b). Most of the transmissivity and hydraulic conductivity parameter estimates from those studies were based on an empirical relationship between specific capacity and transmissivity wherein transmissivity is 1,500 times specific capacity in unconfined aquifers. However, there was a constant rate aquifer test performed on TVWD Well 1A with observations in TVWD Wells 3 and 4. The data from this test were analyzed as part of the *Feasibility Study, Recycled Water Recharge, Bedford Subbasin* (Todd 2008b). The TVWD Well 1A test data are included in excel workbooks in a directory named *Pumping Test Data* and a summary table of all available aquifer test data in included in the project database (*Well Construction + Aquifer Parameters*). The records in the *Well Construction + Aquifer Parameter* table relate to the *Well Information* table through the *UniqueID* fields.

4.6 Additional Water Sources

Additional data on imported water is stored as tables from the individual agencies in the Access database.

4.6.1 Imported Water

Corona, EVMWD, TVWD each use imported water and the measured data is stored in the database separate for each agency. There is no combined table for basin-wide imported water.

4.6.2 Recycled Water and Wastewater

Wastewater information from TVWD is stored in the database as *TVWD Waste Discharge by Location.* Corona's reclaimed water use by address is stored as a separate table, *Corona Reclaimed Water.*

5. OTHER FORMATS

5.1 Climate Data (precipitation, evaporation, temperature) - Excel

Climate data are compiled and stored as an Excel file. The workbook also calculates the cumulative departure of precipitation and local water year type by quintiles.

We identified three currently active climate monitoring stations near the Bedford-Coldwater Basin: the Lake Elsinore station maintained by the National Oceanic Atmospheric Administration (NOAA), the Santiago Peak station maintained by Orange County, and the UC Riverside California Irrigation Management Information System (CIMIS). The Lake Elsinore and UC Riverside stations include daily precipitation and evapotranspiration data; the Santiago Peak station collects monthly precipitation data. Monthly data for the Santiago Peak station is from January 1949 to current, with a slight lag on recent data. The Lake Elsinore station has daily data from January 1961 through current and the UC Riverside station has daily data from January 1986 through the present.

6. BEDFORD-COLDWATER GROUNDWATER MODEL

The groundwater model datasets prepared for the GSP are stored separately from the DMS. These data and files have been prepared using various datasets described above, as documented in the Bedford-Coldwater GSP Model Documentation Report (Todd 2021). The results of the historical and future model simulations are documented in the GSP. Model outputs including surface water budgets and groundwater budgets are also documented in detailed tables. While these data are valuable to understanding the basin, they represent simulated conditions and are stored separately from the observed data in the DMS which are documented here.

7. DATA MANAGEMENT STORAGE

The DMS will continue to be updated with more recent data for annual reports and the GSP 5-year update. It is expected that new datasets will be added as projects and management actions are enacted to fill data gaps. For example, shallow monitoring wells near Temescal Wash may be added at a later date.

The geodatabase, Access databases, and excel workbooks will be updated annually as part of the Annual GSP Report. The GSA will maintain a copy of the annually updated files.

Appendix Q – Temescal Basin Groundwater Sustainability Plan

Home Gardens
County Water District

Groundwater Sustainability Plan

Temescal Basin



January 2022

TODD GROUNDWATER

carollo
Engineers...Working Wonders With Water®

This page is intentionally blank.

Home Gardens
County Water District

TEMESCAL BASIN GROUNDWATER SUSTAINABILITY PLAN

January 2022

TODD GROUNDWATER

And

carollo
Engineers...Working Wonders With Water®

This page is intentionally blank.

SIGNATURE PAGE

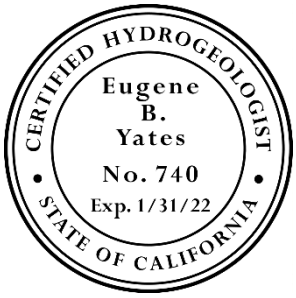


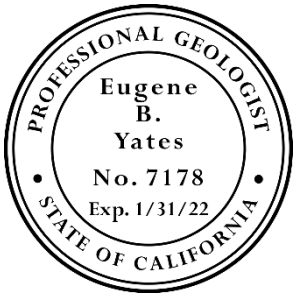


Chad N. Taylor, PG, CHG
Principal Hydrogeologist, Todd Groundwater



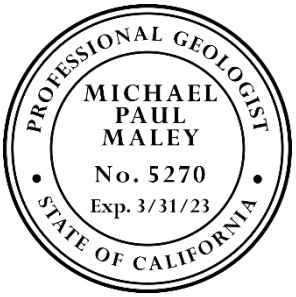
Maureen K Reilly, PE
Senior Engineer, Todd Groundwater





Gus Yates, PG, CHG
Senior Hydrologist, Todd Groundwater





Michael P. Maley, PG, CHG, CEG, PE
Principal Hydrogeologist, Todd Groundwater

Table of Contents

Executive Summary ES-1
ES-1 Basin Setting ES-1
ES-2 Groundwater Conditions ES-4
ES-3 Water Supply ES-5
ES-4 Water Budget ES-5
ES-5 Sustainable Management Criteria ES-7
ES-6 Monitoring Network ES-8
ES-7 Projects and Management Actions ES-8
ES-8 Implementation ES-9
1. Introduction 1-1
1.1. Purpose of the Groundwater Sustainability Plan 1-2
1.2. Sustainability Goal 1-2
1.3. Agency Information 1-2
1.4. Groundwater Sustainability Agency Information 1-3
1.4.1. Decision Making 1-3
1.4.2. Roles and Responsibilities 1-3
1.4.3. Legal Authority of the GSA 1-4
1.4.4. GSP Development Costs and Funding Sources 1-4
1.5. GSP Organization 1-5
2. Plan Area 2-1
2.1. Geographic Area 2-1
2.2. Land Use and Water Management Jurisdictional Agencies 2-1
2.2.1. Counties 2-2
2.2.2. Cities 2-2
2.2.3. Federal 2-2
2.2.4. State 2-2
2.2.5. Conservation Easements 2-3
2.2.6. Water Management Entities 2-3
2.3. Water Supply 2-4
2.3.1. Water Providers 2-4

2.3.2.Water Supply Sources 2-4
2.3.3.Water Use Sectors 2-6
2.4.Water Resources Monitoring Programs 2-7
2.4.1.Climate 2-8
2.4.2.Surface Water Flows 2-8
2.4.3.Surface Water Quality 2-8
2.4.4.Groundwater Levels 2-9
2.4.5.Groundwater Quality 2-9
2.4.6.Groundwater Production 2-9
2.4.7.Conjunctive Use/Managed Recharge 2-10
2.4.8.Recycled Water 2-10
2.4.9.Imported Water 2-10
2.4.10.Land use 2-10
2.4.11.Natural Resources 2-10
2.4.12.Land subsidence 2-10
2.4.13.Incorporation of Existing Monitoring into GSP 2-11
2.5.Water Resources Management 2-11
2.5.1.AB3030 Groundwater Management Plan 2-11
2.5.2.Groundwater Monitoring Program and Protocols 2-12
2.5.3.Recharge Master Plan for the Temescal Basin 2-12
2.5.4.Water Quality Control Plan for the Santa Ana River Basin 2-13
2.5.5.Integrated Regional Water Management Plan Update 2-13
2.5.6.Santa Ana River Watershed One Water One Watershed Plan 2-14
2.5.7.Corona and Norco Urban Water Management Plans 2-15
2.5.8.Reclaimed Water Master Plan 2-15
2.5.9.Water Resources Management Implementation Status 2-15
2.6.General Plans 2-15
2.6.1.Riverside County General Plan 2-16
2.6.2.City of Corona General Plan 2-16
2.6.3.City of Norco General Plan 2-19
2.6.4.General Plan Influences on Groundwater Sustainability Agency Ability to Achieve Sustainability 2-19
2.6.5.GSP Influences on General Plans 2-20

2.7.Additional GSP Elements 2-20
2.7.1.Wellhead Protection Areas and Recharge Areas 2-21
2.7.2.Groundwater Contamination Migration and Clean-up 2-21
2.7.3.Well Permitting, Construction, and Destruction Requirements 2-22
2.7.4.Efficient Water Management Practices 2-23
2.7.5.Relationships with State and Federal Agencies 2-23
2.7.6.Land Use Plan Coordination 2-23
2.8.Notice and Communication 2-23
2.8.1.Technical Advisory Committee (TAC) 2-24
2.8.2.Public Workshops 2-25
2.8.3.Directed Outreach and Coordination 2-25
2.8.4.Disadvantaged Community Outreach 2-25
2.8.5.Neighboring Basin Coordination 2-25
2.8.6.Comments and Responses on Draft GSP 2-25
3.Hydrogeological Conceptual Model 3-1
3.1.Physical Setting and Topography 3-1
3.2.Surface Water Features 3-2
3.3. Soils 3-2
3.4.Geologic Setting 3-3
3.5.Faults 3-3
3.6.Aquifers 3-3
3.6.1.Description of Principal Aquifer Units 3-4
3.6.2.Description of Lateral Boundaries 3-6
3.7.Structures Affecting Groundwater 3-6
3.8.Definable Basin Bottom 3-6
3.9.Recharge and Discharge Areas 3-7
3.10.Primary Groundwater Uses 3-7
3.11.Data Gaps in the Hydrogeologic Conceptual Model 3-8
4.Current and Historical Groundwater Conditions 4-1
4.1.Groundwater Elevations 4-1
4.1.1.Available Data 4-1
4.1.2.Groundwater Occurrence 4-1
4.1.3.Groundwater Elevations and Trends 4-2

4.1.4.Groundwater Flow 4-3
4.1.5.Vertical Groundwater Gradients 4-4
4.2.Changes In Groundwater Storage 4-4
4.3.Land Subsidence and Potential for Subsidence 4-5
4.3.1.Interferometric Synthetic Aperture Radar (InSAR) 4-6
4.4.Groundwater Quality 4-6
4.5.Key Constituents of Concern 4-8
4.5.1.Total Dissolved Solids (TDS) 4-9
4.5.2.Nitrate as Nitrate (NO_3) 4-9
4.6.Other Constituents 4-10
4.6.1.Naturally Occurring Contaminants 4-10
4.6.2.1,2,3- Trichloropropane 4-11
4.6.3.Per- and Polyfluoroalkyl Substances (PFAS) 4-11
4.6.4.Monitoring Networks 4-12
4.7.Threats to Water Quality 4-13
4.7.1.Regulated Facilities 4-13
4.7.2.Septic Systems 4-13
4.7.3.Non-point Sources 4-13
4.8.Vertical Variations in Water Quality 4-13
4.9.Seawater Intrusion Conditions 4-13
4.10.Interconnection of Surface Water and Groundwater 4-13
4.10.1.Stream Flow Measurements 4-14
4.10.2.Depth to Groundwater 4-16
4.10.3.Riparian Vegetation 4-17
4.10.4.Wetlands and Interconnected Surface Water 4-19
4.10.5.Animals and Interconnected Surface Water 4-22
5.Water Budget 5-1
5.1.Water Budget Methodology 5-1
5.2.Dry and Wet Periods 5-1
5.3.Water Balance Analysis Periods 5-2
5.4.Management Areas 5-3
5.5.Methods of Analysis 5-3
5.5.1.Rainfall-Runoff-Recharge Model 5-3

5.5.2.Groundwater Model 5-4
5.5.3.Simulation of Future Conditions 5-5
5.6.Surface Water Balance 5-10
5.6.1.Inflows to Surface Water 5-12
5.6.2.Outflows of Surface Water 5-13
5.7.Groundwater Balance 5-14
5.7.1.Inflows to Groundwater 5-17
5.7.2.Outflows from Groundwater 5-19
5.8.Change in Groundwater Storage 5-20
5.9.Estimate of Sustainable Yield 5-20
6.Sustainable Management Criteria 6-1
6.1.Sustainability Goal 6-2
6.1.1.Description of Sustainability Goal 6-2
6.1.2.Approach to Sustainability Indicators 6-2
6.1.3.Summary of Sustainable Management Criteria 6-4
6.2.Chronic Lowering of Groundwater Levels 6-5
6.2.1.Description of Undesirable Results 6-5
6.2.2.Potential Causes of Undesirable Results 6-6
6.2.3.Definition of Undesirable Results 6-7
6.2.4.Potential Effects on Beneficial Uses and Users 6-7
6.2.5.Sustainable Management Criteria for Groundwater Levels 6-7
6.2.6.Minimum Thresholds 6-9
6.2.7.Measurable Objectives 6-13
6.3.Reduction of Groundwater Storage 6-13
6.3.1.Description of Undesirable Results 6-14
6.3.2.Potential Causes of Undesirable Results 6-14
6.3.3.Definition of Undesirable Results 6-14
6.3.4.Potential Effects on Beneficial Uses and Users 6-15
6.3.5.Sustainable Management Criteria for Groundwater Storage 6-15
6.3.6.Minimum Threshold 6-16
6.3.7.Measurable Objectives 6-18
6.4.Seawater Intrusion 6-19
6.5.Land Subsidence 6-19

6.5.1.Description of Undesirable Results 6-20
6.5.2.Potential Causes of Undesirable Results 6-20
6.5.3.Potential Effects on Beneficial Uses and Users 6-21
6.5.4.Minimum Threshold 6-21
6.5.5.Measurable Objectives 6-23
6.6.Degradation of Water Quality 6-24
6.6.1.Potential Causes of Undesirable Results 6-24
6.6.2.Description of Undesirable Results 6-25
6.6.3.Potential Effects on Beneficial Uses and Users 6-25
6.6.4.Sustainable Management Criteria for Groundwater Quality 6-26
6.6.5.Minimum Thresholds 6-26
6.6.6.Measurable Objectives 6-30
6.7.Depletions of Interconnected Surface Water 6-31
6.7.1.Description of Undesirable Results 6-32
6.7.2.Potential Causes of Undesirable Results 6-32
6.7.3.Definition of Undesirable Results 6-33
6.7.4.Potential Effects on Beneficial Uses and Users 6-33
6.7.5.Sustainable Management Criteria for Interconnected Surface Water 6-34
6.7.6.Minimum Threshold 6-34
6.7.7.Measurable Objective 6-36
6.7.8.Data Gaps 6-37
7.Monitoring Network 7-1
7.1.Description of Monitoring Network 7-1
7.1.1.Chronic Lowering of Groundwater Levels 7-3
7.1.2.Reduction of Groundwater in Storage 7-3
7.1.3.Seawater Intrusion 7-5
7.1.4.Subsidence 7-5
7.1.5.Degraded Water Quality 7-6
7.1.6.Depletion of Interconnected Surface Water 7-7
7.2.Protocols for Data Collection and Monitoring 7-8
7.2.1.Field Methods for Monitoring Well Data 7-8
7.2.2.Field Methods for Groundwater Elevation Monitoring 7-8
7.2.3.Field Methods for Groundwater Quality Monitoring 7-9

7.3.Representative Monitoring 7-10
7.4.Data Management System (DMS) 7-10
7.5.Assessment and Improvement of Monitoring Network 7-10
7.5.1.Identification and Description of Data Gaps 7-11
7.5.2.Description of Steps to Fill Data Gaps 7-11
8.Projects and Management Actions 8-1
8.1.Group 1 Projects 8-3
8.1.1.Groundwater Treatment 8-3
8.1.2.Water Reclamation Facility (WRF) Percolation Ponds 8-4
8.1.3.Water Level Quality Assurance and Quality Control (QA/QC) 8-4
8.1.4.Water Shortage Contingency Plans 8-5
8.1.5.Water Conservation Program 8-5
8.1.6.Participation in Integrated Regional Water Management Plans (IRWMP) 8-6
8.1.7.Western Riverside County Regional Wastewater Authority (WRCRWA) 8-7
8.1.8.Santa Ana Watershed Involvement 8-7
8.2.Group 2 Projects 8-8
8.2.1.Shallow Monitoring Well Installation 8-8
8.2.2.Potable Reuse Feasibility Study 8-9
8.2.3.Mountain Runoff Capture Feasibility Study 8-11
8.3.Group 3 Projects 8-12
8.3.1.Groundwater Treatment 8-12
8.3.2.Stormwater Capture, Treatment, and Recharge 8-12
8.3.3.Santa Ana River Wastewater Discharge Coordination for Shallow Groundwater Conditions 8-13
9.Implementation Plan 9-1
9.1.Plan Implementation Resources and Responsibilities 9-1
9.2.Annual Reporting 9-1
9.3.New Information and Changes 9-2
9.4.Periodic Evaluations 9-2
9.5.Projects and Management Actions 9-3
9.6.Schedule For Implementation 9-4
9.7.GSP Implementation Costs 9-6
9.7.1.Funding Methods 9-6

10. References 10-1

List of Tables

Table 1-1. GSP Preparation Checklist 1-7
Table 2-1. Water Use and Land Use by Sector (2020)[1] 2-7
Table 2-2. Select Policies in the Riverside County General Plan 2-17
Table 2-3. Selected Policies in the City of Corona General Plan 2-18
Table 2-4. Selected Policies in the City of Norco General Plan 2-19
Table 2-5. Additional GSP Elements included in Water Code Section 10727.4 2-21
Table 2-6. Status of Contamination Sites in the Basin 2-22
Table 5-1. Water Year Type Classification 5-2
Table 5-2. Temescal Basin Land Use in 1990, 2018, and 2068 (acres) 5-9
Table 5-3. Annual Surface Water Budgets for the Temescal Basin 1990 to 2018 5-11
Table 5-4. Average Annual Groundwater Budgets 5-16
Table 5-5. Estimated Sustainable Yield 5-21
Table 6-1. Minimum Thresholds for Groundwater Levels 6-10
Table 6-2. Summary of Current Conditions for Nitrate (NO_3) and TDS 6-27
Table 7-1. Temescal Monitoring Program Summary 7-2
Table 7-2. Wells in the Temescal GSA Monitoring Network 7-4
Table 7-3. Identification and Description of Data Gaps 7-11
Table 8-1 Summary of Projects and Management Actions 8-2
Table 8-2. Existing and Projected Corona Groundwater Extraction Volumes (AFY) 8-3
Table 8-3. WRF Annual Percolation Pond Contributions (AFY) 8-4
Table 8-4. WSCP Shortage Level Determination 8-5
Table 8-5. City of Corona Santa Ana Watershed Task Forces/Groups 8-7
Table 9-1. Estimated Timeline for Projects and Management Actions 9-5
Table 9-2. GSP Implementation Cost Estimates 9-6

List of Figures

Figure ES-1. Temescal Basin ES-2
Figure ES-2. Channel Aquifer ES-3
Figure ES-3. Representative Hydrograph, Corona Well 15 ..... ES-4

Figure 1-1. Temescal Groundwater Basin, GSA, and Adjacent Basins 1-10
Figure 2-1. Temescal Basin GSP Area 2-27
Figure 2-2. Jurisdictional Areas 2-28
Figure 2-3. Federal and State Lands 2-29
Figure 2-4. Water Supply Sources within Basin - 2020 2-30
Figure 2-5. Basin Domestic Groundwater Wells 2-31
Figure 2-6. Basin Production Groundwater Wells 2-32
Figure 2-7. Basin Public Groundwater Wells 2-33
Figure 2-8. All Basin Groundwater Wells 2-34
Figure 2-9. Corona and Norco Facilities 2-35
Figure 2-10. Existing Land Use 2-36
Figure 2-11. 1984 Land Use 2-37
Figure 2-12. Disadvantaged and Severely Disadvantaged Communities 2-38
Figure 3-1. Basin Topography 3-9
Figure 3-2. Tributary Surface Water in Basin 3-10
Figure 3-3. Watersheds Tributary to Basin 3-11
Figure 3-4. Basin Soil Hydrologic Properties 3-12
Figure 3-5. Surficial Geology 3-13
Figure 3-6. Cross Section Line Orientation 3-14
Figure 3-7. Cross Section A to A' 3-15
Figure 3-8. Cross Section B to B' 3-16
Figure 3-9. Cross Section C to C' 3-17
Figure 3-10. Channel Aquifer Extent and Hydraulic Conductivity 3-18
Figure 3-11. Depth to Bedrock 3-19
Figure 3-12. Groundwater Recharge and Discharge Areas 3-20
Figure 4-1. Historically Monitored Wells 4-24
Figure 4-2. Representative Hydrographs City of Corona Well 15 4-25
Figure 4-3. Representative Hydrographs City of Corona Well 11 4-26
Figure 4-4. Representative Hydrographs City of Corona Well 22 4-27
Figure 4-5. Representative Hydrographs City of Corona Well 19 4-28
Figure 4-6. Representative Hydrographs City of Corona Well 26 4-29
Figure 4-7. Representative Hydrographs City of Corona Well 17A 4-30
Figure 4-8. Representative Hydrographs City of Corona Well 8A 4-31

Figure 4-9. Representative Hydrographs City of Corona Well 13 4-32
Figure 4-10. Groundwater Elevation Contours, Fall 2015 4-33
Figure 4-11. Groundwater Elevation Contours, Spring 2017 4-34
Figure 4-12. Concepts of Land Subsidence 4-35
Figure 4-13. Basin-Wide Subsidence Estimates from Satellite Measurements 4-36
Figure 4-14. Wells with Water Quality Data 4-37
Figure 4-15. Total Dissolved Solids Concentrations in Wells, Water Years 2011 - 2019 4-38
Figure 4-16. Nitrate Concentrations in Wells, Water Years 2011 through 2019 4-39
Figure 4-17. Regional Surface Water Features 4-40
Figure 4-18. Stream Flow at Four Gages 4-41
Figure 4-19. Temescal Wash Flow and Reclaimed Water Discharge 4-42
Figure 4-20. Depth to Water Spring 2017 4-43
Figure 4-21. Critical Habitat Areas 4-44
Figure 4-22. Historical Maximum Depth to Water Near Prado Wetlands 4-45
Figure 4-23. Factors Related to Prado Wetland Groundwater Levels 4-46
Figure 5-1. Cumulative Departure of Annual Precipitation at Lake Elsinore 5-23
Figure 5-2. Effect of Climate Change on Precipitation and Evapotranspiration 5-24
Figure 5-3. Land Use in 2018 5-25
Figure 5-4. Surface Water Budgets 1990 through 2018 5-26
Figure 5-5. Effect of Clipping on Simulated Tributary Stream Flow 5-27
Figure 5-6. Annual Groundwater Budgets 1990 to 2018 5-28
Figure 5-7. Annual Groundwater Budgets Future Baseline 5-29
Figure 5-8. Annual Groundwater Budgets, Growth Plus Climate Change 5-30
Figure 5-9. Dispersed Recharge 5-31
Figure 5-10. Cumulative Storage Changes 1990 to 2068 5-32
Figure 6-1. Water Level Key Wells 6-38
Figure 7-1. Groundwater Level Monitoring Wells 7-12
Figure 7-2. Water Quality Monitoring Wells 7-13
Figure 8-1. Potential Shallow Monitoring Well Locations 8-14

Appendices (following text)

Appendix A – Memorandum of Understanding forming the Temescal Groundwater Sustainability Agency

Appendix B – Temescal GSA Notice of Decision to become a Groundwater Sustainability Agency

Appendix C – Groundwater Sustainability Plan Elements Guide

Appendix D – Temescal Groundwater Sustainability Plan Stakeholder Outreach Plan

Appendix E – List of Public Meetings During GSP Development and GSP Comments and Responses

Appendix F – Summaries of Technical Advisory Committee Meetings

Appendix G – Summaries of Public Workshops and Associated Fact Sheets

Appendix H – Summaries of Neighboring Basin Coordination and Community Leader Outreach Meetings

Appendix I – Draft GSP Comments and Responses

Appendix J – Temescal Groundwater Sustainability Plan Numerical Groundwater Model Documentation Report

Appendix K – Detailed Annual Surface and Groundwater Budgets

Appendix L – Temescal Groundwater Sustainability Plan Data Management System Description

Acronyms

1,2,3-TCP	1,2,3- Trichloropropane
AF	acre-feet
AFY	acre-feet per year
Basin Plan	Water Quality Control Plan for the Santa Ana River Basin
Basin	Temescal Subbasin
BMP	Best management practices
CASGEM	California Statewide Groundwater Elevation Monitoring
CDA	Chino Desalter Authority
CEQA	California Environmental Quality Act
cfs	cubic feet per second
cfs/mi	cubic feet per second per mile
CIMIS	California Irrigation Management Information System
COC	constituent of concern
Corona	City of Corona
DAC	disadvantaged community
DBP	disinfection byproduct
DDW	State Water Resources Control Board Division of Drinking Water
DMS	Data Management System
DWR	California Department of Water Resources
DWSAP	Drinking Water Source Water Assessment Program
ET	Evapotranspiration
ET_o	Reference evapotranspiration
ft	feet
ft/day	feet per day
GAMA	Groundwater Ambient Monitoring and Assessment
GDE	groundwater dependent ecosystem
GIS	geographic information system
gpcd	gallons per-capita per day
gpd/ft^2	gallons per day per square foot
GPS	global positioning system
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWMP	Groundwater Management Plan
HCP	habitat conservation plan
HGCWD	Home Gardens County Water District
in/yr	inches per year
InSAR	Synthetic Aperture Radar
IRWMP	Integrated Regional Water Management Plan
JPA	joint powers authority
K	hydraulic conductivity
km^2	square kilometers
LSCE	Luhdorff and Scalmanini Consulting Engineers

M&I	Municipal, commercial, and industrial
MA	Management Area
MCL	Maximum Contaminant Level
Met	Metropolitan Water District of Southern California
mg/L	milligrams per liter
mgd	million gallons per day
mi^2	square miles
mm	millimeter
MO	Measurable Objective
MODFLOW	United States Geological Survey modular finite-difference flow model
MOU	Memorandum of Understanding
MSHCP	Western Riverside County Multiple Species Habitat Conservation Plan
msl	mean sea level
MT	Minimum Threshold
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NCCAG	Natural Communities Commonly Associated with Groundwater
NDMI	Normalized Difference Moisture Index
NDVI	Normalized Difference Vegetation Index
NO_3	nitrate
NOAA	National Oceanic and Atmospheric Administration
Norco	City of Norco
NPS	nonpoint source
NRCS	U.S. Department of Agriculture, Natural Resources Conservation Service
NTU	Nephelometric Turbidity Unit
NWIS	National Water Information System
O&M	operation and maintenance
ORP	oxidation-reduction potential
Outreach Plan	Stakeholder Outreach Plan
OWOW Plan	One Water One Watershed Plan
OWTS	On-Site Wastewater Treatment System
PCE	Tetrachloroethylene
pCi/L	picocuries per liter
PFAS	per and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PLSS	Public Land Survey System
POTW	publicly owned treatment works
ppt	parts per trillion
PVC	polyvinyl chloride
QA/QC	Quality Assurance and Quality Control

RCDEH	Riverside County Department of Environmental Health
RCFCWCD	Riverside County Flood Control and Water Conservation District
RFP	request for proposals
RMP	Recharge Master Plan
RO	reverse osmosis
RWMP	Reclaimed Water Master Plan
RWQCB	Santa Ana Regional Water Quality Control Board
SAR	Santa Ana River
SARHCP	Upper Santa Ana River Habitat Conservation Plan
SARWQCB	Santa Ana Regional Water Quality Control Board
SAWPA	Santa Ana Watershed Project Authority
SCAG	Southern California Association of Governments
SDAC	severely disadvantaged community
SFR	Streamflow Routing Package
SGMA	Sustainable Groundwater Management Act
SMCL	Secondary maximum contaminant level
SNMP	Salt and Nutrient Management Plan
SSURGO	Soil Survey Geographic Database
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TCE	Trichloroethylene
TCP	1,2,3-Trichloropropane
TDS	total dissolved solids
Temescal GSA	Temescal Groundwater Sustainability Agency
TMDL	Total Maximum Daily Load
TSS	total suspended solids
TVWD	Temescal Valley Water District
µg/L	micrograms per liter
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USEPA	United State Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VOCs	volatile organic compounds
WMWD	Western Municipal Water District
WRCRWA	Western Riverside County Regional Wastewater Authority
WRF	Water Reclamation Facility
WSCP	water shortage contingency plan

This page is intentionally blank.

EXECUTIVE SUMMARY

The Sustainable Groundwater Management Act (SGMA) requires local agencies in groundwater basins designated as high- or medium-priority to form Groundwater Sustainability Agencies (GSAs) and develop a Groundwater Sustainability Plan (GSP) to plan for achieving and/or maintaining sustainability within 20 years of implementing the plan. The Temescal Groundwater Subbasin (Basin) has been designated by the California Department of Water Resources (DWR) as medium priority and must prepare a GSP.

Wishing to provide a framework for cooperative groundwater management and SGMA compliance, the City of Corona (Corona), City of Norco (Norco), and the Home Gardens County Water District (HGCWD) executed a Memorandum of Understanding (MOU) in March 2017 establishing the Temescal Basin Groundwater Sustainability Agency (Temescal GSA). In August 2017, the Temescal GSA became the GSA for the Basin by submitting a formation notice to DWR. While Corona is leading this effort, the GSP will be developed jointly among the three agencies, with coordinated implementation toward sustainable management.

ES-1 BASIN SETTING

Figure ES-1 shows the Basin located in western Riverside County. **Figure ES-1** also shows the adjacent Bedford Coldwater, Chino, and Riverside-Arlington Subbasins of the Upper Santa Ana Groundwater Basin and the Coastal Plain of Orange County Basin. The Temescal Basin is bounded on the west by the Santa Ana Mountains and the east by low-lying El Sobrante de San Jacinto and La Sierra hills.

The Basin is located within one of the structural blocks of the Peninsular Ranges of Southern California. The Basin occurs in a linear low-lying block, referred to as the Elsinore-Temecula trough, between the Santa Ana Mountains on the west and the Perris Plain on the east (Todd and AKM 2008). The trough extends from Corona to the southeast some 30 miles and was formed along an extensive northwest-southeast trending fault zone including the Elsinore, Chino, and related faults. The Elsinore and Chino fault zones bound the Basin on the west and trend along the mountain fronts.

The basin-fill alluvial deposits and, to some extent, the underlying sedimentary units make up the aquifers in the Basin. However, these deposits do not fall neatly into two categories of permeability, such as bedrock and basin fill. Aquifer packages composed of various geologic units have been defined based on depositional environment, degree of consolidation, groundwater production, and location throughout the Basin.

Three aquifer packages provide water supply to wells in Basin: the Channel Aquifer, the Alluvial Fan aquifers, and, to a lesser extent, consolidated sandstone aquifers (Todd and AKM 2008). Of these three aquifers, the Channel Aquifer is the only principal aquifer as it the most productive aquifer and provides most of the groundwater supply in the Basin, **Figure ES-2**.

Figure ES-1. Temescal Basin

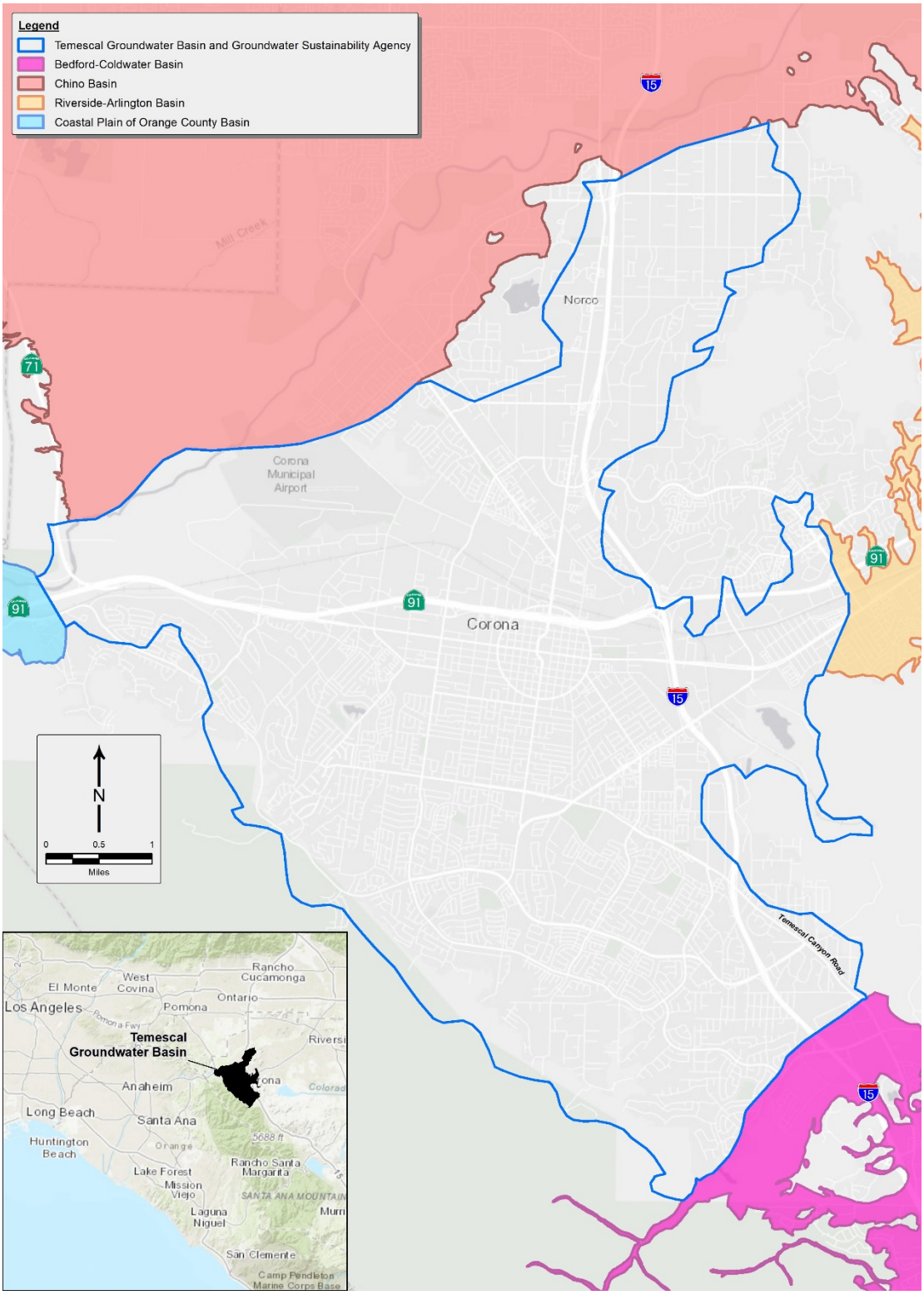
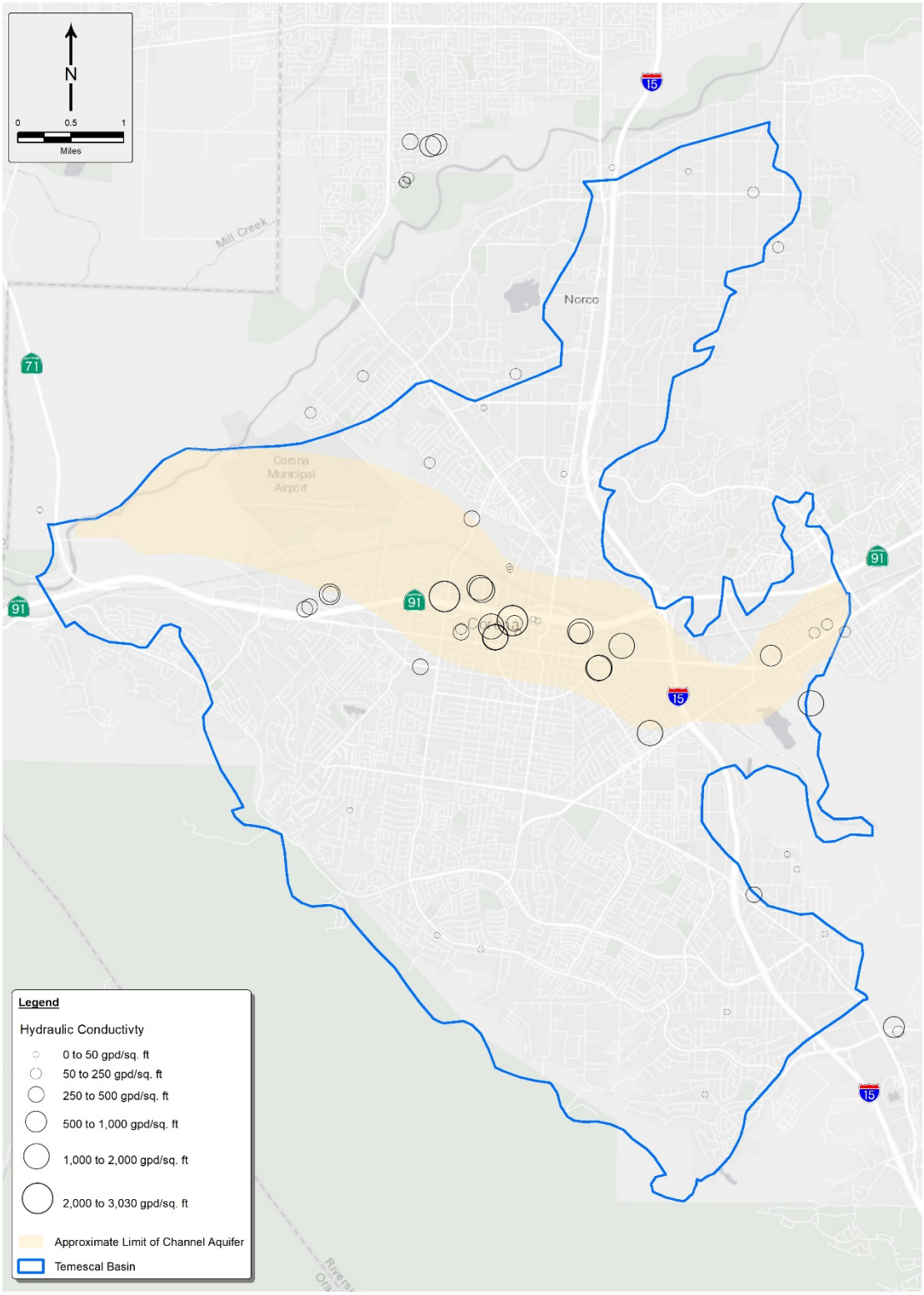


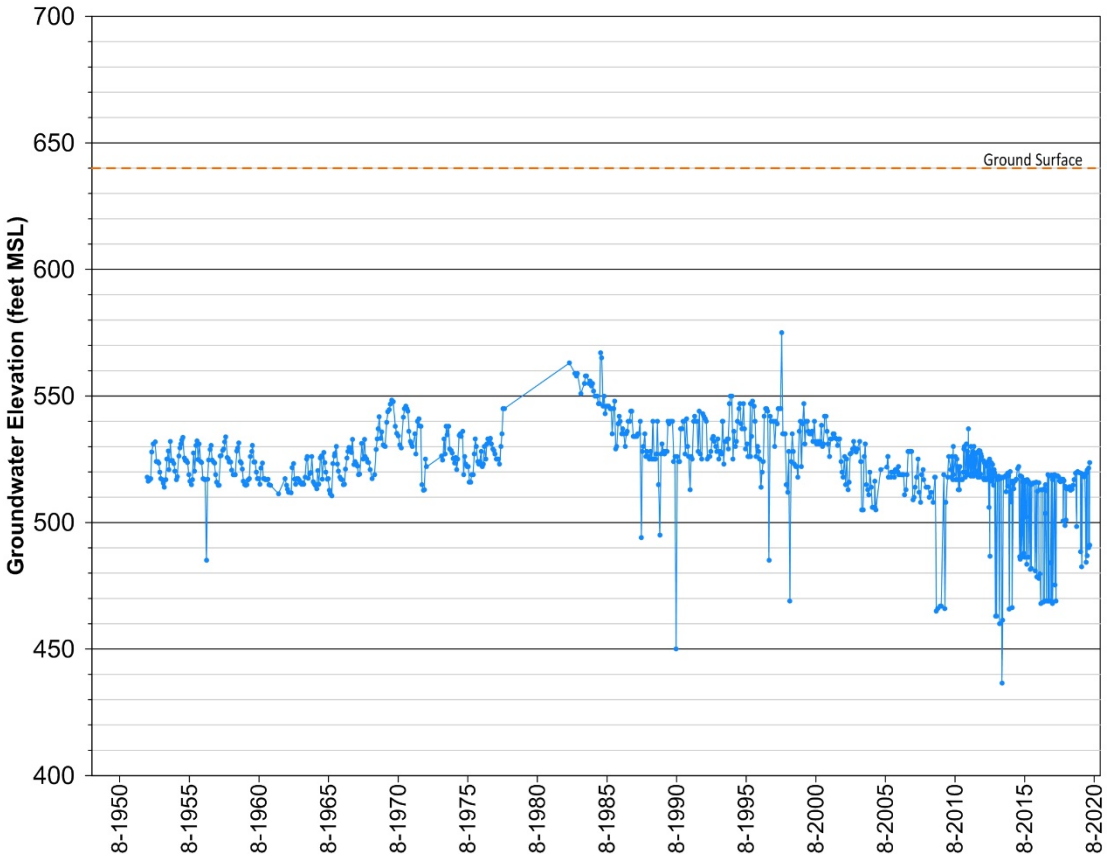
Figure ES-2. Channel Aquifer



ES-2 GROUNDWATER CONDITIONS

Water levels in the Channel Aquifer vary in response to wet and dry hydrologic cycles. Increased pumping and prolonged drought have resulted in a slight decline in water levels over the past twenty years. Groundwater levels reached their respective highs in the early 1980s in response to a wet hydrologic cycle that began in 1978. These higher levels also correlate to a period of relatively low pumping in the Basin. During a later wet cycle from 1992 to 1998, water levels did not recover to 1980s levels, likely related to an increase in Basin pumping. The lowest groundwater levels generally correspond to dry periods and periods of increased pumping, though the responses throughout the Basin are not uniform.

Figure ES-3. Representative Hydrograph, Corona Well 15



1980s levels; pumping in the Basin had increased in this period. Hydrographs from most wells show lowering water levels from 2000 to 2004, a period that was not hydrologically dry but had increased pumping in Corona. In the Well 15 hydrograph, the lowest water levels occurred during the 2015 to 2017 period, during and following drought conditions. There have been slight increases since then in 2018 through 2019 due in part to increased precipitation after 2015.

Total Dissolved Solids (TDS) and nitrate are the primary constituents of concern in the Basin. Groundwater in the Basin is somewhat mineralized, with high TDS concentrations in many monitored wells. Recent average TDS concentrations in the Basin are above the 500 milligrams per liter (mg/L) lower secondary maximum contaminant level (SMCL) for drinking water, but below the upper SMCL of 1,000 mg/L.

Groundwater in the Basin has been impacted by human activities both in the Basin and watershed including agricultural, urban, and industrial land uses. Elevated nitrate concentrations have been documented in the Basin since at least the 1950s. Recent average nitrate as nitrate (NO_3) concentrations in the Basin are moderate; the recent average concentration in the Basin is 42.8 mg/L. The maximum contaminant level (MCL) for nitrate as NO_3 in drinking water is 45 mg/L.

ES-3 WATER SUPPLY

Sources of water supply for agricultural, municipal and industrial (M&I), and domestic uses include groundwater, imported water, and recycled water. Metropolitan Water District of Southern California (Met) is the wholesaler for imported water and its sources of water include the Colorado River and the State Water Project. Both Corona and Norco receive imported water from Met for distribution in the Basin.

Groundwater has been an important component of water supply in the Basin for more than 100 years. Until the 1970s, most of the groundwater production in the Basin was for agricultural supply. A few well owners have also produced small amounts of groundwater for domestic and industrial use. There are no current private domestic groundwater users in the Basin. Production for municipal supply increased in the 1960s and 1970s and continues today.

For more than 50 years, Corona and HGCWD have relied on groundwater from the Basin for municipal uses, and these agencies have long been responsible for managing groundwater conditions in the Basin. Norco has also relied on groundwater but their wells are located outside of the Temescal Basin (in the unadjudicated portion of the Chino Subbasin). Corona, in coordination with HGCWD and Norco, adopted a Groundwater Management Plan (GWMP) in 2008 that covers the Basin.

ES-4 WATER BUDGET

A water balance (or water budget) is a quantitative tabulation of all inflows, outflows, and storage change of a hydrologic system. This GSP contains a detailed water balance for both the groundwater system and surface water system of the Basin. The water budgets were

developed for time periods representing historical, current, future no project (baseline), and future growth plus climate change (growth plus climate change) conditions.

Surface water and other inflows came from multiple sources. Monthly inflows in Temescal Wash were obtained from the baseline and growth plus climate change simulations produced by the Bedford-Coldwater Subbasin groundwater model (Todd, H&H, and Stantec 2021), which is concurrently being used to develop the GSP for that subbasin. Small stream and bedrock inflows simulated for 1993 to 2017 of the calibration model period were repeated twice to obtain 50 years of data.

In the historical model, the Basin water budgets were overall negative for the historical and current analysis periods, due to a variety of reasons and reflecting the different time periods. Storage declines during the early years of the simulation may have resulted from incorrectly estimated initial water levels. During 2000 to 2011, relatively high amounts of municipal groundwater pumping might have caused a gradual decrease in storage. Since 2011, the predominantly dry climatic conditions have resulted in reduced inflows and thus a decrease in storage. These historical storage declines have not resulted in undesirable results related to water levels or groundwater storage in the Basin to date. Most groundwater production in the Basin is for Corona municipal use, and Corona and the other GSA agencies have a portfolio of alternative water supply sources for future use.

Two future scenarios were simulated to test sustainability. In the baseline scenario, land use remains the same as the current conditions. The growth plus climate change scenario incorporated anticipated effects of climate change, urban development, and associated changes in water and wastewater management.

In both future scenarios, the total pumping was adjusted to pump within the sustainable yield of the Basin; the remaining municipal water demand will be supplied by imported and recycled water. Simulating pumping within the sustainable yield of the Basin in the groundwater model produced essentially no long-term storage change in the future baseline simulation.

Growth and climate change had relatively small effects that tended to offset each other. The warmer, drier climatic conditions tended to decrease stream percolation and rainfall recharge. Urban growth—much of which is projected to be in tributary watershed areas—tended to increase recharge because of irrigation deep percolation, pipe leaks and percolation of runoff from disconnected impervious areas. Notably, total water use and percolation of reclaimed water were assumed not to change appreciably, consistent with assumptions in the Corona's Urban Water Management Plan (UWMP) (Michael Baker 2021) that population growth will be offset by decreases in per-capita water use. Consequently, individual inflows and outflows in the growth plus climate change scenario were identical to or very close to the values in the future baseline scenario.

Average annual storage changes during both future scenarios were very slightly positive, with total inflows about34 AFY greater than total outflows. This was the intentional result of adjusting Corona pumping to achieve close to zero net storage change during 2019 to 2068.

ES-5 SUSTAINABLE MANAGEMENT CRITERIA

The sustainable management goal of the Temescal Basin is to sustain groundwater resources for the current and future beneficial uses of the Basin in a manner that is adaptive and responsive to the following objectives:

- Provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses
- Provide reliable storage for water supply resilience during droughts and shortages
- Protect groundwater quality
- Support beneficial uses of interconnected surface waters, and
- Support integrated and cooperative water resource management.

This goal is consistent with SGMA and is based on information from the Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget sections of this GSP that:

- Identify beneficial uses of Temescal Basin groundwater and document the roles of local water and land use agencies
- Describe the local hydrogeologic setting, groundwater quality conditions, groundwater levels and storage, and inflows and outflows of the Basin
- Document the ongoing water resource monitoring and conjunctive management of groundwater, local surface water, recycled water, and especially imported water sources that help protect groundwater quality and maintain water supply.

A GSP must develop quantitative sustainability criteria for all applicable sustainability indicators that allow the GSA to define, measure, and track sustainable management. These criteria include the following:

- Undesirable Result – significant and unreasonable conditions for any of the six sustainability indicators.
- Minimum Threshold (MT) – numeric value used to define undesirable results for each sustainability indicator.
- Measurable Objective (MO) – specific, quantifiable goal to track the performance of sustainable management.

The sustainability indicators and sustainable management criteria are clearly defined and provide a quantitative analysis of the Basin's sustainability. As the Basin has been managed without significant undesirable results, the following sustainability criteria are defined to avoid future undesirable results:

- The Minimum Threshold for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well by historical groundwater low levels. Undesirable results are indicated when two consecutive exceedances occur in each of two consecutive years, in sixty percent or more of the Key Wells.

- The Minimum Threshold for reduction of groundwater storage for all Management Areas is fulfilled by the minimum threshold for groundwater levels as proxy.
- The Minimum Threshold for subsidence is defined as a cumulative decline equal to or greater than one foot since 2015, which represents current conditions and the SGMA start date. This corresponds to a rate of decline equal to or greater than 0.2 feet in any five-year period.
- The Minimum Thresholds for degradation of water quality address nitrate and total dissolved solids (TDS) for the entire Basin.
    - The Minimum Threshold for nitrate is defined initially as the percentage of wells with concentrations exceeding the nitrate MCL (45 mg/L) based on current conditions (2015-2019).
    - The Minimum Threshold for TDS is defined initially as the percentage of wells with concentrations exceeding the TDS value of 1,000 mg/L based on current conditions (2015-2019).
- The Minimum Threshold for depletion of interconnected surface water is the amount of depletion that occurs when the depth to the water along the southern edge of the Prado Wetlands is greater than 15 feet for a period exceeding one year.

ES-6 MONITORING NETWORK

The monitoring network for GSP implementation has been established to document groundwater and related surface conditions as relevant to the sustainability indicators, MTs, and MOs. The components of the monitoring network are built from existing programs and will be carried out by the Temescal GSA.

The Temescal GSA, Corona specifically, has actively engaged in assessment and improvement of its monitoring network. This process has been intensified as part of the GSP, given the need to identify data gaps and to assess uncertainty in setting and tracking sustainability criteria. Monitoring improvements such as adding or replacing monitoring infrastructure are part of GSP implementation and will be reviewed and updated for each five-year GSP update.

ES-7 PROJECTS AND MANAGEMENT ACTIONS

During the preparation of the GSP, the Temescal GSA identified five specific management actions (Actions) and three projects (Projects) to achieve the sustainability goal. The Actions are generally focused on data collection, storage and reporting of information necessary to monitor sustainability, and assessment of when Actions may be necessary (i.e., when MTs are approached or exceeded). The projects are generally designed to reduce uncertainty in areas where data gaps have been identified during development of the GSP. These projects and management actions are aimed at achieving sustainability goals and responding to changing conditions in the Basin. The projects and management actions are divided into three groups:

- Group 1 - Existing or established projects and management actions
    - Groundwater Treatment

    - Water Reclamation Facility (WRF) Percolation Ponds
    - Water Level Quality Assurance and Quality Control (QA/QC)
    - Water Shortage Contingency Plans
    - Water Conservation Program
    - Participation in Integrated Regional Water Management Plans (IRWMP)
    - Western Riverside County Regional Wastewater Authority (WRCRWA)
    - Santa Ana Watershed Involvement
- Group 2 - Projects and management actions that have been or are under development
    - Shallow Monitoring Well Installation
    - Potable Reuse Feasibility Study
    - Mountain Runoff Capture Feasibility Study
- Group 3 - Conceptual projects and management actions that can be considered in the future if any Group 2 projects fail to be implemented or additional intervention is required to achieve basin sustainability goals
    - Groundwater Treatment
    - Stormwater Capture, Treatment, and Recharge
    - Santa Ana River Wastewater Discharge Coordination for Shallow

The Projects and Actions will be implemented by a combination of existing resources from the three agencies within the Plan Area and contracted resources.

ES-8 IMPLEMENTATION

The official adoption of the GSP by the Temescal GSA will initiate Plan implementation. After submittal of the GSP to DWR, and during the DWR review period, the Temescal GSA will continue to communicate with stakeholders via the Corona's website and begin implementing the projects and management actions described in this GSP. The Plan will be implemented to sustainably manage groundwater in the Basin under the authority of the Temescal GSA and its member agencies.

The Temescal GSA is required to submit an annual report to DWR by April 1st of each year following adoption of the GSP. The first annual report will be due in April of 2022. The Temescal GSA has committed to implementing the GSP upon adoption and completing the projects and management actions necessary to monitor and maintain sustainability within the first five years of initiation of the GSP.

1. INTRODUCTION

The City of Corona (Corona) is actively managing the Temescal Subbasin (Basin) of the Upper Santa Ana River Groundwater Basin (**Figure 1-1**) in collaboration with the City of Norco (Norco) and Home Gardens County Water District (HGCWD). Corona, Norco, and HGCWD have previously participated in active management of water resources in the Basin. This management has included cooperation in preparing the 2008 Groundwater Management Plan (Todd and AKM 2008) and participation in regional planning and management. This historical experience provides a good foundation for continuation of groundwater management consistent with the Sustainable Groundwater Management Act (SGMA).

Wishing to provide a framework for cooperative groundwater management and SGMA compliance Corona, Norco, and HGCWD executed a Memorandum of Understanding (MOU) in March 2017 (**Appendix A**) establishing the Temescal Basin Groundwater Sustainability Agency (Temescal GSA). In August 2017, the Temescal GSA became the GSA for the Basin by submitting a formation notice to the California Department of Water Resources (DWR). This notice included publication of the MOU and each individual party's resolutions to become a GSA to DWR through the SGMA web portal. In the MOU, Corona has accepted the primary responsibility to develop a GSP for the Basin, to submit the GSP to DWR, and to prepare Annual Reports and GSP updates thereafter. While Corona is leading this effort, the GSP will be developed jointly among the three agencies, with coordinated implementation toward sustainable management.

The GSP reflects the rigorous, systematic process through which the Temescal GSA will manage the Basin. **Figure 1-1** shows the Plan Area for this GSP, which encompasses the entire Basin.

Sustainable management of the Temescal Basin is critical to local water supply reliability. The three local agencies (both individually and jointly) in the Temescal GSA have developed water supply portfolios including imported water, groundwater from multiple local basins, and reclaimed water for landscape irrigation. Water conservation measures also have been implemented (as documented in the recent Corona and Norco Urban Water Management Plans (Michael Baker 2021, Norco 2021)), providing an important tool for responding to water shortages. Local agencies are active in regional water management and recognize that local groundwater is a primary source of supply and needs to be reliable. The Temescal Basin area historically has experienced significant land use changes—shifting from agricultural to urban land uses—and subsequent water demand and supply changes. This transition was achieved in part with reliance on local groundwater. In fact, the Corona Groundwater Management Plan indicated that overdraft conditions occurred in the Temescal Basin during the last three years of the 1990 to 2004 period as pumping increased. While conditions subsequently improved, this illustrates that overdraft can occur. Concerns about water supply reliability persist, given the uncertainties of imported water and climate change. Moreover, groundwater quality generally is poor; in fact, sustainable groundwater use is dependent on treatment at the Temescal Desalter. SGMA and the GSP process provide an important set of tools for Corona and the Temescal GSA partners to address these conditions and plan for water supply reliability into the future.

1.1. PURPOSE OF THE GROUNDWATER SUSTAINABILITY PLAN

The purpose of this GSP is to assess water resource and land use conditions within the Basin, through an open and collaborative process, and to implement management activities to achieve (or maintain) long-term groundwater sustainability as defined by SGMA.

The GSP assesses sustainability related to each of the six SGMA defined sustainability criteria listed below:

- Lowering Groundwater Levels
- Reduction of Groundwater Storage
- Seawater Intrusion
- Degraded Water Quality
- Land Subsidence
- Surface Water Depletion.

The GSP presents conditions in the Basin relevant to each of these categories, defines thresholds for maintaining sustainability, outlines groundwater monitoring protocols, and management actions and projects designed to improve monitoring capabilities and/or to protect and enhance groundwater conditions. The GSP also includes a schedule and cost estimate for GSP implementation. Each element of the GSP is designed to promote Basin health and achieve and maintain the sustainability goal established for the Basin by the GSA.

1.2. SUSTAINABILITY GOAL

The sustainability goal is to sustain groundwater resources for the current and future beneficial uses of the Basin in a manner that is adaptive and responsive to the following objectives:

- Provide a long-term, reliable, and efficient groundwater supply for municipal, industrial, and other uses
- Provide reliable storage for water supply resilience during droughts and shortages
- Protect groundwater quality
- Support beneficial uses of interconnected surface waters, and
- Support integrated and cooperative water resource management.

1.3. AGENCY INFORMATION

The GSA agencies collaborated on preparation of this GSP, as described in the March 2017 MOU between the agencies. The City of Corona, City of Norco, and HGCWD each passed resolutions to authorize the MOU to establish the GSA:

- City of Corona - On March 15, 2017, Corona held a public hearing to determine whether to become a GSA, and adopted Resolution No. 2017-013, electing to jointly become a GSA with Norco and HGCWD.
- Norco - On March 15, 2017, Norco held a public hearing to determine whether to become a GSA, and adopted Resolution No. 2017-12, electing to jointly become a GSA with Corona and HGCWD.

- HGCWD - On March 23, 2017, HGCWD held a public hearing to determine whether to become a GSA, and, by minute action, elected to jointly become a GSA with Corona and Norco.

On May 10, 2017, Temescal GSA submitted to DWR a Notice of Decision to Become a Groundwater Sustainability Agency, along with required information including a boundary map of the GSA and a list of interested parties. After the 90-day review period, on August 8, 2017, Temescal GSA became the groundwater sustainability agency for the Basin.

As required by GSP Regulations §354.6 and SGMA §10723.8, the Notices of Decision to become a Groundwater Sustainability Agency are included in **Appendix B**. These each include the resolution, list of interested parties, and boundary map.

The point of contact for the Temescal GSA is:

Katie Hockett, Assistant General Manager
City of Corona Department of Water and Power
Temescal Basin GSA
755 Corporation Yard Way Corona, CA 92880
(951) 279-3601
Katie.Hockett@CoronaCA.gov

1.4. GROUNDWATER SUSTAINABILITY AGENCY INFORMATION

As described above, the Temescal GSA was formed through a MOU between Corona, Norco, and HGCWD to act as the GSA for the Basin (Temescal Subbasin of the Upper Santa Ana Valley Basin, Basin Number 8-002.09), which is a DWR-designated medium priority basin. The Temescal GSA is dedicated to participating in the collective goal of reaching groundwater sustainability in California.

Corona, Norco, and HGCWD have relied on groundwater from the Basin for municipal use for decades. In 2008, Corona adopted a Groundwater Management Plan that covers the entire Basin.

1.4.1. Decision Making

As detailed in the MOU, decisions in by the Temescal GSA are reached by unanimous consent of the parties; however, if unanimous consent is not possible, a majority vote of the three agencies rules.

1.4.2. Roles and Responsibilities

The MOU also documents the responsibilities of the individual agencies, including:

- Corona shall have the primary responsibility to develop a GSP within the boundaries of the Temescal GSA and submit the GSP to DWR for review and evaluation.Corona shall also have the primary responsibility to prepare and submit the annual and five year reports to DWR pursuant to SGMA and DWR's implementing regulations.

- The parties will work jointly to fulfill the purpose of the MOU within the boundaries of the Temescal GSA.
- The parties will meet regularly to discuss SGMA, GSP development, and implementation activities, assignments, and ongoing work progress.
- The parties may form committees as necessary from time to time to discuss issues that impact the Temescal GSA.
- Corona is responsible for implementing the GSP in areas of the Temescal GSA that are within Corona's service area boundaries and within Corona's sphere of influence.
- Norco is responsible for implementing the GSP in areas of the Temescal GSA that are within Norco's service area boundaries.
- HGCWD is responsible for implementing the GSP in areas of the Temescal GSA that are within HGCWD's service area boundaries.

1.4.3. Legal Authority of the GSA

The GSA has authority to develop a GSP and implement SGMA in the Temescal Basin. SGMA specifies additional enabling powers; for example, GSAs may choose to adopt standards for measuring and reporting water use, develop and implement metering, and manage extraction from individual wells.

Corona's Authority. Corona is a local agency qualified to become a GSA because Corona manages water, has a water supply, and has land use responsibilities over a portion of the Basin.

Norco's Authority. Norco is also a local agency qualified to become a GSA because Norco manages water, has a water supply, and has land use responsibilities over a portion of the Basin.

HGCWD's Authority. HGCWD is also a local agency qualified to become a GSA because HGCWD is a county water district formed and operating pursuant to and in accordance with Division 12 of the California Water Code that manages water, has a water supply and overlies a portion of the Basin.

Those portions of the Basin outside of these service areas are not within the area of any other proposed GSA. While the service areas of Corona, Norco, and HGCWD do not cover the entire Basin, these agencies do propose to serve as the GSA for the entire Basin. The three agencies in the GSA are coordinating with Riverside County Flood Control and Water Conservation District (RCFCWCD) for these currently unmanaged areas. Specifically, the RCFCWCD recognized the ongoing efforts for this GSA and offered to participate in any advisory or stakeholder committee formed by the GSA.

1.4.4. GSP Development Costs and Funding Sources

In November 2017, the City of Corona applied for a Sustainable Groundwater Management Planning (SGMP) Grant to fund preparation of this GSP. In April 2018, DWR awarded the City of Corona with full funding of $732,338.

Each party will be financially responsible for collecting data or information from within that party's service area that is required to be provided for development of the GSP. Norco and HGCWD will not incur any financial expense related to development of the GSP and submittal of the GSP to the DWR.

Implementation costs include costs to continue monitoring as described in Chapter 7, implement management actions and projects as described in Chapter 8, and complete annual reports and periodic GSP evaluation and updates as required by SGMA. As summarized in Chapter 9, total annual costs (2021 dollars) are estimated at approximately $100,000 per year and single occurrence costs for projects and management actions anticipated to occur in the first five years of GSP implementation and the first periodic GSP evaluation and update total approximately $515,000 to $575,000 (2021 dollars).

The funding method for operating expenses and GSP implementation costs is by contributions by GSA member agencies (Corona, Norco, and HGCWD). This is the same mechanism utilized to fund development of the GSP (with significant supplemental contribution though California Proposition 1 Grant funding). Corona will be responsible for most of the ongoing implementation costs, which are within budget projections for the next several years. Funding for planning and implementation of some projects and management actions may be achieved with local, state, and federal sources. The local agencies track opportunities for outside financing (grants or loans) from state water programs and federal infrastructure funding. For local financing, the agencies update their financial plans and rates as needed.

1.5. GSP ORGANIZATION

This GSP is organized generally to follow the GSP Annotated Outline provided by DWR as one of its Guidance Documents (DWR 2016a). Major sections include:

- **Executive Summary**
- **Chapter 1 – Introduction**, purpose of the GSP, sustainability goal, agency information, and GSP organization.
- **Chapter 2 – Plan Area** description, water use sectors, water supply sources, water resources monitoring and management programs, current general plans, and other GSP elements.
- **Chapter 3 – Hydrogeologic Conceptual Model**, description of the physical basin setting including surface water features, soils, geologic setting, faults, and aquifers, defined basin bottom, recharge and discharge areas, and cross sections.
- **Chapter 4 – Current and Historical Groundwater Conditions**, discussion of groundwater elevations, land subsidence, groundwater quality and current monitoring, constituents of concern regarding water quality, interconnection of surface water and groundwater and the effects on groundwater dependent ecosystems (GDEs).
- **Chapter 5 – Water Budget**, discussion of the water budget, groundwater model, surface water and groundwater balance, change in groundwater storage, and estimate of sustainable yield.

- **Chapter 6 – Sustainable Management Criteria**, sustainability goal and sustainability criteria for the six undesirable results.
- **Chapter 7 – Monitoring Network**, discussion of the monitoring that will continue to assess sustainability in the future.
- **Chapter 8 – Projects and Management Actions**, descriptions of projects and management actions for the Basin.
- **Chapter 9 – Implementation Plan**, estimate of GSP implementation costs, schedule, and plan for annual reporting and periodic evaluations.
- **Chapter 10 – References**

A Preparation Checklist providing further organizational guidance to the GSP content requirements is provided in **Table 1-1** and the GSP Elements Guide detailing GSP content in comparison to SGMA articles is included in **Appendix C**.

Table 1-1. GSP Preparation Checklist

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 3. Technical and Reporting Standards				
352.2		Monitoring Protocols	- Monitoring protocols adopted by the GSA for data collection and management - Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin	Section 7.2
Article 5. Plan Contents, Subarticle 1. Administrative Information				
354.4		General Information	- List of references and technical studies	Section 10
354.6		Agency Information	- GSA mailing address - Organization and management structure - Contact information of Plan Manager - Legal authority of GSA - Estimate of implementation costs	Section 1.3
354.8(a)	10727.2(a)(4)	Map(s)	- Area covered by GSP (Figure 1-1) - Adjudicated areas, other agencies within the basin, and areas covered by an Alternative (Figure 1-1) - Jurisdictional boundaries of federal or State land (Figure 2-1) - Existing land use designations (Figures 2-7, 2-8) - Density of wells per square mile (Figures 2-3 through 2-6)	Section 2
354.8(b)		Description of the Plan Area	- Summary of jurisdictional areas and other features	Section 2.1
354.8(c) 354.8(d) 354.8(e)	10727.2(g)	Water Resource Monitoring and Management Programs	- Description of water resources monitoring and management programs - Description of how the monitoring networks of those plans will be incorporated into the GSP - Description of how those plans may limit operational flexibility in the basin - Description of conjunctive use programs	Section 2.4,2.5 Section 2.4 Section 2.6 Section 2.3.2
354.8(f)	10727.2(g)	Land Use Elements or Topic Categories of Applicable General Plans	- Summary of general plans and other land use plans - Description of how implementation of the GSP may change water demands or affect achievement of sustainability and how the GSP addresses those effects - Description of how implementation of the GSP may affect the water supply assumptions of relevant land use plans - Summary of the process for permitting new or replacement wells in the basin - Information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management	Section 2.6 Section 2.6.4 Section 2.6.5 Section 2.7.3 Section 2.7.6
Article 5. Plan Contents, Subarticle 1. Administrative Information (Continued)				
354.8(g)	10727.4	Additional GSP Contents	**Description of Actions related to:** - Control of saline water intrusion - Wellhead protection - Migration of contaminated groundwater - Well abandonment and well destruction program - Replenishment of groundwater extractions - Conjunctive use and underground storage - Well construction policies - Addressing groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects - Efficient water management practices - Relationships with State and federal regulatory agencies - Review of land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity - Impacts on groundwater dependent ecosystems	Section 2.7
354.10		Notice and Communication	- Description of beneficial uses and users - List of public meetings - GSP comments and responses - Decision-making process - Public engagement - Encouraging active involvement - Informing the public on GSP implementation progress	Section 2.3 Section 2.8 and Appendices E and F Appendix J (pending) Section 1.4.1 Appendix D Section 2.8 Section 2.8

Table 1-1. GSP Preparation Checklist

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 2. Basin Setting				
354.14		Hydrogeologic Conceptual Model	- Description of the Hydrogeologic Conceptual Model - Two scaled cross-sections - Map(s) of physical characteristics: topographic information, surficial geology, soil characteristics, surface water bodies, source and point of delivery for imported water supplies	Section 3, Figure 3-6 through 3-9
9	10727.2(a)(5)	Map of Recharge Areas	- Map delineating existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas	Figure 3-12
	10727.2(d)(4)	Recharge Areas	- Description of how recharge areas identified in the plan substantially contribute to the replenishment of the basin	Section 3.9
354.16	10727.2(a)(1) 10727.2(a)(2)	Current and Historical Groundwater Conditions	- Groundwater elevation data - Estimate of groundwater storage - Seawater intrusion conditions - Groundwater quality issues - Land subsidence conditions - Identification of interconnected surface water systems - Identification of groundwater-dependent ecosystems	Section 4
354.18	10727.2(a)(3)	Water Budget Information	- Description of inflows, outflows, and change in storage - Quantification of overdraft - Estimate of sustainable yield - Quantification of current, historical, and projected water budgets	Section 5.7 Not Applicable Section 5.9 Section 5.7
	10727.2(d)(5)	Surface Water Supply	- Description of surface water supply used or available for use for groundwater recharge or in-lieu use	Sections 2.3.2, 2.4.6, and 5.6.2
354.20		Management Areas	- Reason for creation of each management area - Minimum thresholds and measurable objectives for each management area - Level of monitoring and analysis - Explanation of how management of management areas will not cause undesirable results outside the management area - Description of management areas	Not Applicable
Article 5. Plan Contents, Subarticle 3. Sustainable Management Criteria				
354.24		Sustainability Goal	- Description of the sustainability goal	Section 6.1
354.26		Undesirable Results	- Description of undesirable results - Cause of groundwater conditions that would lead to undesirable results - Criteria used to define undesirable results for each sustainability indicator - Potential effects of undesirable results on beneficial uses and users of groundwater	Section 6.2.1, 6.3.1, 6.5.1, 6.6.1, 6.7.1 Section 6.2.2, 6.3.2, 6.5.2, 6.6.2, 6.7.2 Section 6.2.3, 6.3.3, 6.5.3, 6.6.3, 6.7.3 Section 6.2.4, 6.3.4, 6.5.4, 6.6.4, 6.7.4
354.28	10727.2(d)(1) 10727.2(d)(2)	Minimum Thresholds	- Description of each minimum threshold and how they were established for each sustainability indicator - Relationship for each sustainability indicator - Description of how selection of the minimum threshold may affect beneficial uses and users of groundwater - Standards related to sustainability indicators - How each minimum threshold will be quantitatively measured	Sections 6.2 through 6.7
354.30	10727.2(b)(1) 10727.2(b)(2) 10727.2(d)(1) 10727.2(d)(2)	Measureable Objectives	- Description of establishment of the measureable objectives for each sustainability indicator - Description of how a reasonable margin of safety was established for each measureable objective - Description of a reasonable path to achieve and maintain the sustainability goal, including a description of interim milestones	Sections 6.2 through 6.7

Table 1-1. GSP Preparation Checklist

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 4. Monitoring Networks				
354.34	10727.2(d)(1) 10727.2(d)(2) 10727.2(e) 10727.2(f)	Monitoring Networks	- Description of monitoring network - Description of monitoring network objectives - Description of how the monitoring network is designed to: demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features; estimate the change in annual groundwater in storage; monitor seawater intrusion; determine groundwater quality trends; identify the rate and extent of land subsidence; and calculate depletions of surface water caused by groundwater extractions - Description of how the monitoring network provides adequate coverage of Sustainability Indicators - Density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends - Scientific rational (or reason) for site selection - Consistency with data and reporting standards - Corresponding sustainability indicator, minimum threshold, measureable objective, and interim milestone - Location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used - Description of technical standards, data collection methods, and other procedures or protocols to ensure comparable data and methodologies	Section 7.1 Section 7.0
354.36		Representative Monitoring	- Description of representative sites - Demonstration of adequacy of using groundwater elevations as proxy for other sustainability indicators - Adequate evidence demonstrating site reflects general conditions in the area	Section 7.3
354.38		Assessment and Improvement of Monitoring Network	- Review and evaluation of the monitoring network - Identification and description of data gaps - Description of steps to fill data gaps - Description of monitoring frequency and density of sites	Section 7.5 Section 7.5.1 Section 7.5.2 Section 7.1.1
Article 5. Plan Contents, Subarticle 5. Projects and Management Actions				
354.44		Projects and Management Actions	- Description of projects and management actions that will help achieve the basin's sustainability goal - Measureable objective that is expected to benefit from each project and management action - Circumstances for implementation - Public noticing - Permitting and regulatory process - Time-table for initiation and completion, and the accrual of expected benefits - Expected benefits and how they will be evaluated - How the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included. - Legal authority required - Estimated costs and plans to meet those costs - Management of groundwater extractions and recharge	Section 8.0
354.44(b)(2)	10727.2(d)(3)		- Overdraft mitigation projects and management actions	Not Applicable
Article 8. Interagency Agreements				
357.4	10727.6	Coordination Agreements - Shall be submitted to the Department together with the GSPs for the basin and, if approved, shall become part of the GSP for each participating Agency.	**Coordination Agreements shall describe the following:** - A point of contact - Responsibilities of each Agency - Procedures for the timely exchange of information between Agencies - Procedures for resolving conflicts between Agencies - How the Agencies have used the same data and methodologies to coordinate GSPs - How the GSPs implemented together satisfy the requirements of SGMA - Process for submitting all Plans, Plan amendments, supporting information, all monitoring data and other pertinent information, along with annual reports and periodic evaluations - A coordinated data management system for the basin - Coordination agreements shall identify adjudicated areas within the basin, and any local agencies that have adopted an Alternative that has been accepted by the Department	Not Applicable

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 1 - Introduction\Figure 1-1 Temescal Basin.mxd

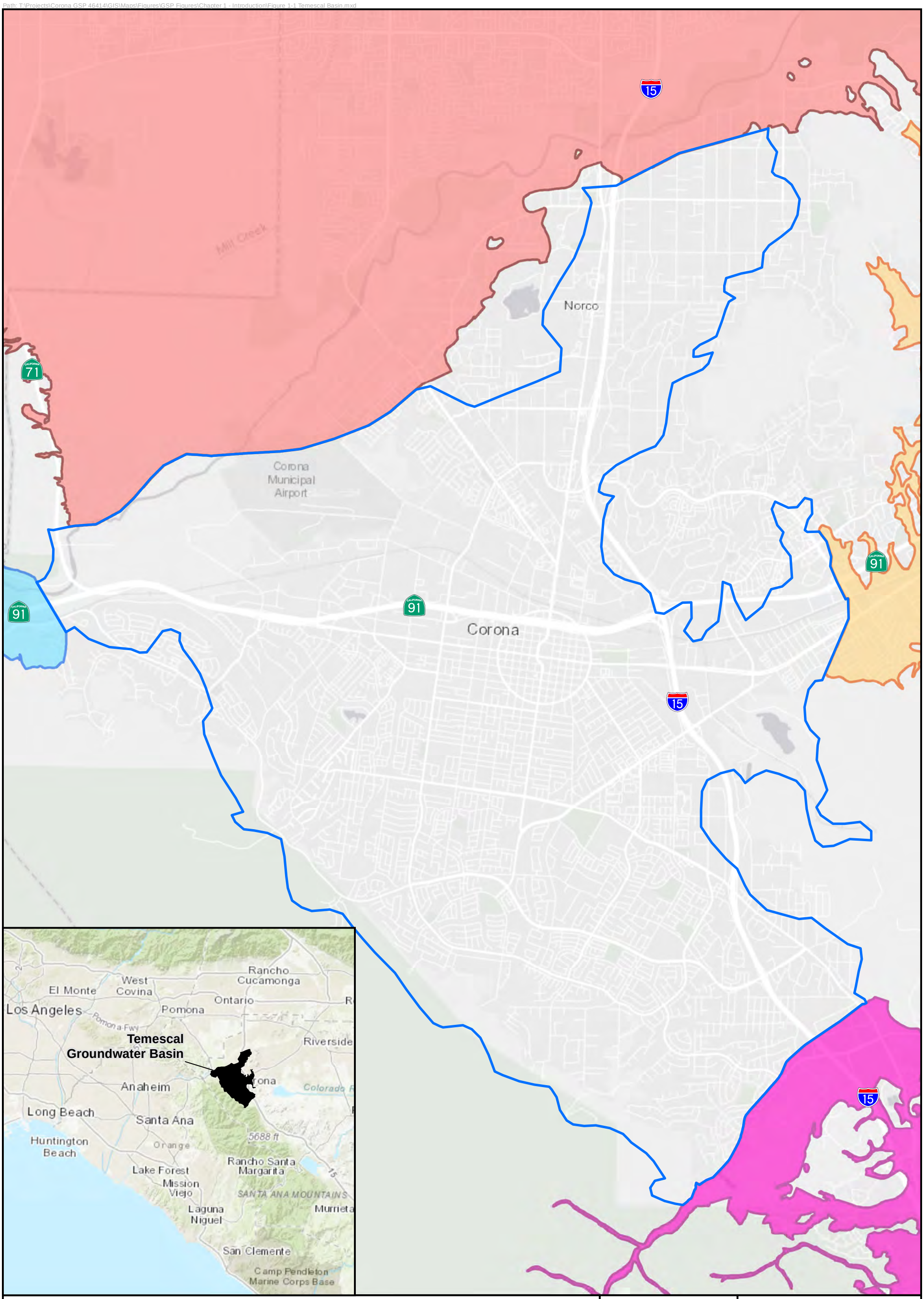


Figure 1-1
Temescal Groundwater Basin, GSA, and Adjacent Basins

TODD GROUNDWATER

2. PLAN AREA

This chapter provides a general description of the Temescal Baasin Groundwater Sustainability Plan Area (GSP Area, Plan Area or Basin), consistent with GSP Regulations §354.8, and is organized into the follow sections:

- Geographic Area
- Jurisdictional Agencies
- Water Supply
- Water Resources Monitoring and Management Programs
- General Plans
- Additional GSP Elements
- Notice and Communication

The description of the Plan Area was developed from previous reports and studies, including the 2008 Groundwater Management Plan (2008 GWMP) for the City of Corona (Corona) (Todd and AKM 2008).

2.1. GEOGRAPHIC AREA

The GSP Area is the Temescal Subbasin of the Upper Santa Ana Valley Groundwater Basin (DWR 2016b) located in Riverside County. The Temescal Subbasin (Basin) underlies the southwest portion of the upper Santa Ana Valley, as shown on **Figure 2-1**.

The GSP Area is coincident with the Basin and covers approximately 23,500 acres or 37 square miles. The Basin borders the Chino Subbasin to the north, the Riverside-Arlington Subbasin to the east, the Bedford-Coldwater Subbasin of the Elsinore Basin to the south, and the Coastal Plain Subbasin of the Orange County Basin to the west. These adjacent basins are shown on **Figures 2-1**.

In general, the Basin is bounded by the Santa Ana River to the north, the El Sobrante de San Jacinto and La Sierra Hills and the Riverside-Arlington Subbasin to the east, the Santa Ana Mountains to the west, and Bedford-Coldwater Subbasin to the south (DWR 2016b).

2.2. LAND USE AND WATER MANAGEMENT JURISDICTIONAL AGENCIES

Land use and land management activities can influence water demands, recharge potential, and water quality. This section identifies and describes the agencies with land use management responsibilities within the Basin. Detailed discussion of land use planning and policies relevant to groundwater management is included in Section 2.6. In general, these agencies can be categorized as follows:

- Counties
- Cities
- Federal

- State
- Conservation Easements
- Water Management Entities.

The jurisdictional boundaries for agencies that have land use management responsibilities in the Basin are shown on **Figures 2-2** and **2-3.**

2.2.1. Counties

The Basin lies within the northwestern portion of Riverside County. Riverside County has jurisdiction for land use planning for unincorporated areas in the County. Small portions of the Basin along its northwestern side are unincorporated areas in Riverside County. Riverside County also has responsibility for on-site wastewater treatment systems (i.e., septic systems) through its Department of Environmental Health. Riverside County Department of Environmental Health (RCDEH) is also responsible for regulation of the construction, destruction, and maintenance of groundwater wells.

2.2.2. Cities

The Basin is almost entirely overlaid by Corona's sphere of influence and the City of Norco (Norco). Corona and Norco have land use planning authority within their respective boundaries. General plan elements relevant to the GSP are discussed in Section 2.6. In addition to land use planning, the cities of Corona and Norco are responsible for stormwater management for their respective jurisdictions, which can impact basin recharge and therefore shallow ground water quality.

2.2.3. Federal

Federal Lands in the Basin, presented on **Figure 2-3**, include small portions of the northwestern Basin owned by the Department of Defense. Land along the southwestern edge of the Basin is US Forest Service (USFS) Cleveland National Forest and other federal Non-Forest Service Land within USFS. Resource management efforts in the Cleveland National Forest target fire, ecology, archaeological resources, and recreational resources. These management activities can impact basin recharge, surface run-off, and surface and groundwater quality.

Prado Dam lies in the northwest corner of the Basin and is owned and operated by the U.S. Army Corps of Engineers. The Prado Dam and Reservoir is the principle regulating structure on the Santa Ana River.

2.2.4. State

State Lands in the Basin are presented on **Figure 2-3**. A very small portion of northwestern edge of the Basin is in the Chino Hills State Park.

2.2.5. Conservation Easements

Conservation easements for the Dos Lagos Golf Course, Temescal Canyon, and Lee Lake are held by the Riverside-Corona Resource Conservation District (RCRCD) just to the south of the Basin. RCRCD aims to conserve natural resources, including soil, water, plants, and wildlife in western Riverside and San Bernardino counties. RCRCD activities include conducting conservation projects, educating the community, and providing technical advice to land users.

Additionally, there is a 13-acre Fresno Canyon conservation easement that partially overlaps a small area of the westernmost portion of the Basin.

2.2.6. Water Management Entities

While Corona and Norco are the primary water suppliers in the Basin, other water management entities have jurisdictional and/or monitoring and management responsibilities in the Basin.

The Riverside County Flood Control and Water Conservation District (Flood Control District) is located in the western portion of Riverside County and overlies the Basin. The Flood Control District regulates development in relation to floodplains and drainage, identifies potential flood hazards, and constructs flood control structures.

The Santa Ana Watershed Project Authority (SAWPA) is a joint power authority formed of several water agencies in the Santa Ana River watershed aimed at protecting the watershed and maximizing beneficial uses within the watershed. SAWPA focuses on water resource issues including water supply reliability, water quality improvement, recycled water, wastewater treatment, groundwater management, brine disposal, and integrated regional planning. SAWPA also administers the Basin Monitoring Program Task Force for the watershed, which monitors and reports surface water quality as well as produces Santa Ana River Wasteload Allocation Model Reports. These monitoring and reporting activities are necessary to determine compliance with the nitrogen and total dissolved solids (TDS) objectives for the watershed.

The Orange County Water District (OCWD) owns and operates the Prado Wetlands, 2,150 acres of constructed wetlands behind the Prado Dam, located just north of the northeast corner of the Basin. These wetlands improve water quality in the Santa Ana River by removing nitrate from the water.

Chino Basin Watermaster manages groundwater in the adjacent basin, Chino Basin (Upper Santa Ana Valley Basin 8-002.01). Chino Basin is upgradient of Temescal Basin and groundwater management in Chino will likely impact Temescal Basin. The GSA has been in communication with Chino Basin Watermaster through the GSP preparation process.

2.3. WATER SUPPLY

Water supply for municipal and industrial uses include groundwater and imported water from the Western Municipal Water District (WMWD). In addition, recycled water is used for non-potable uses. The water providers within the Basin and additional detail on their various water sources are described in the following sections.

2.3.1. Water Providers

Corona serves water to the majority of the population within the Basin. Norco and the Home Gardens County Water District (HGCWD) serve water to smaller portions of the Basin.

Corona provides water and wastewater services to residential, institutional, commercial, and industrial customers within the city as well as to the unincorporated communities of El Cerrito, Coronita, and parts of Temescal Canyon. Corona's water service area encompasses approximately 39 square miles. Corona's water sources include groundwater pumped from the Basin and the Coldwater Subbasin and imported water purchased from WMWD.

Norco is the sole water purveyor for the residents and businesses within its city boundaries, which encompass approximately 15 square miles. Norco purchases imported water from WMWD, purchases desalinated groundwater from the Chino Desalter Authority (CDA), and pumps groundwater from the Basin.

HGCWD serves water to a portion of the census-designated place of HGCWD and purchases all water from Corona.

The 2020 water supplies for each water purveyor from each water source are shown on **Figure 2-4**. Purchased imported water and groundwater from the Basin make up 53 percent and 47 percent of Corona's supply, respectively (Michael Baker 2021). Purchased imported water and groundwater from the Chino Subbasin make up 93 percent and 7 percent of Norco's supply, respectively (Norco 2021). Purchased imported water makes up 100 percent of the supply for HGCWD. Note that all of HGCWD purchased supply and a portion of Norco's purchased supply are from Corona and are thus included in Corona's total supply. It should be noted that these water supply distributions are based on year 2020 only and typically vary from year to year.

2.3.2. Water Supply Sources

2.3.2.1. Groundwater

Corona is the primary producer of groundwater in the Basin. Corona has 18 wells that extract water from the Basin for the purpose of potable water supply (Michael Baker 2021). Norco has four active wells but they are located in the unadjudicated portion of the Chino Subbasin not the Basin.

A number of private wells were historically installed in the Basin. Well densities for domestic wells, production wells, public wells, and all groundwater wells completed and reported to DWR are shown on **Figures 2-5, 2-6, 2-7**, and **2-8** respectively. Well density varies throughout the Basin from 0 to 15 wells per square mile section. These well density maps

show all the well completion reports that have been submitted to DWR over time. There are no records of which of these wells are currently active. However, the GSA agencies searched for existing active wells within the Basin. This search included reviewing water use records and contacting owners of large private properties (domestic, commercial, and industrial), inquiring about private wells in discussions with knowledgeable local residents and community leaders, and polling interested parties during public meetings. This effort indicated that the only private pumpers in the Basin are All American Asphalt, Dart Corporation, and 3M. No active private domestic wells were identified in this search.

Corona owns and operates the 10 million gallons per day (mgd) Temescal Desalter, a reverse osmosis (RO) treatment facility where groundwater from the Basin high in TDS is forced one-way through membranes that reject salts as waste brine. Corona then blends this water with locally produced groundwater. The location of the Temescal Desalter is shown along with other Corona water and wastewater facilities in **Figure 2-9**.

In addition to pumping groundwater from the Basin, Norco purchases groundwater from the CDA, which is extracted from the Chino Subbasin. This water purchase is further described in Section 2.3.2.3.

2.3.2.2. Local Surface Water

No surface water is used as a water supply source within the Basin. Just to the south of the Basin, Corona utilizes surface flows from Coldwater Canyon in percolation basins and then extracts groundwater from the Coldwater portion of the Bedford-Coldwater Subbasin.

2.3.2.3. Purchased or Imported Water

The Basin's primary sources of imported water are supplied through WMWD, a member agency of Metropolitan Water District of Southern California (Met). Imported water supply from WMWD consists of treated surface water, untreated surface water and desalinated brackish groundwater.

WMWD supplies treated surface water via the Mills Pipeline from Henry J. Mills filtration plant. The Mills Pipeline delivers treated water directly to Corona through metered turnout WR-24. This connection has an effective capacity of 6.5 mgd (Michael Baker 2021). Norco also receives water from WMWD via the Mills Pipeline, which is then wheeled through a metered connection from Corona to Norco (Norco 2021).

WMWD supplies untreated surface water via the Lower Feeder. The Lower Feeder supplies raw water to Corona's Lester Water Treatment Plant through metered turnout WR-19 and to Corona's Sierra del Oro Water Treatment Plant through metered turnout WR-33. The Lester Plant has a peak capacity of 30 mgd, and the Sierra del Oro Plant has a peak capacity of 9.0 mgd (Michael Baker 2021).

WMWD supplies desalinated brackish groundwater via the Arlington Desalter to both Corona and Norco. Norco entered into a purchase water agreement with WMWD to purchase a minimum of 4,400 acre-feet per year (AFY) of treated groundwater annually from the Arlington Desalter reverse-osmosis treatment facility (Norco 2021). Excess production from the desalter is made available to Corona (Michael Baker 2021).

Norco is a member agency of the CDA, a Joint Powers of Authority. Norco has an annual obligation to purchase 1,000 AFY of reverse osmosis treated potable groundwater water from CDA (City of Norco 2021).

The City of Corona operates well(s) for HGCWD and supplies them with all their water supply.

The reliability of imported water is documented in WMWD's 2020 UWMP (WSC 2021). The WMWD UWMP details the potential constraints facing Met, the wholesaler that provides most of the imported water supply for WMWD, Corona, and Norco. Various past and ongoing actions address the water supply threats including water conservation, increased storage programs, and augmenting water supplies. Because of their robust planning efforts, WMWD's UWMP indicates there would be 99 percent of supply available in a single dry year and 100 percent of supply in multiple dry years. In addition, Corona maintains a two-way connection with the City of Riverside that can be used in the event of an emergency.

2.3.2.4. Recycled Water

As shown on **Figure 2-9**, three wastewater reclamation facilities are located in the Basin. Existing reclaimed water supply is provided by three Water Reclamation Facilities (WRF1, WRF2 and WRF3) and two non-potable wells owned and operated by Corona. The average annual production from these sources is approximately 11.35 mgd or 12,700 AFY. Corona is a member of the Western Riverside County Regional Wastewater Authority (WRCRWA), which operates a new wastewater reclamation facility in Eastvale. When WRCRWA is fully implemented, Corona's level of recycled water production will stay the same. However, the location of sources of supply will shift to the north and Corona will have access to additional recycled water supply from WRCRWA (Corona 2018).

Norco is also a member of WRCRWA but does not currently receive and distribute recycled water.

2.3.2.5. Conjunctive Use/Managed Recharge/In-Lieu Recharge

In 2013, Corona prepared a Recharge Master Plan (RMP) for the Basin that defines the groundwater management objectives for the Basin. The RMP lays out goals and alternatives for artificial recharge in the Basin. Implementation of the RMP is ongoing. Corona currently discharges tertiary treated effluent from its Wastewater Treatment Plants No. 1 and No. 2 to the Lincoln/Cota Ponds, where the effluent is either lost to evapotranspiration or percolated to groundwater (WEI 2013).

2.3.3. Water Use Sectors

Water use sectors are defined in the GSP Regulations as categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.

The distribution of current land use types in the Basin is presented on **Figure 2-10**. While the land use types are more detailed than the water sector categories, the land use mapping provides relevant background information for understanding the various water uses and

locations of these uses in the Basin. A significant portion of the Basin is characterized as single-family residential land use. The next most common land use type within the Basin is industrial. Water use and land use by sector for Corona, Norco, and the Basin are presented in **Table 2-1**.

Table 2-1. Water Use and Land Use by Sector (2020)[1]

Water Use Sector	Corona Water Use	Norco Water Use	Basin Land Use
Urban[2]	87 percent	82 percent	70 percent
Industrial[3]	13 percent	18 percent	11 percent
Agricultural	0 percent	0 percent	1 percent
Managed Wetlands	0 percent	0 percent	0 percent
Managed Recharge	0 percent	0 percent	0 percent
Native Vegetation	0 percent	0 percent	18 percent

Notes:
1) Water use data is provided by Corona and Norco's Urban Water Management Plans (UWMPs) (Michael Baker 2021 and Norco 2021) and land use data is based on an analysis of the land use parcels included in the Basin as shown in **Figure 2-10**.
2) Urban water use for Corona does not include commercial uses, which is reported as combined with industrial.
3) Industrial water use includes commercial uses.

2.4. WATER RESOURCES MONITORING PROGRAMS

This section summarizes the following water resources monitoring activities in the Basin:

- Climate
- Surface Water Flow
- Surface Water Quality
- Groundwater Levels
- Groundwater Quality
- Groundwater Production
- Conjunctive Use/Managed Recharge
- Recycled Water
- Imported Water
- Land Use
- Land Subsidence
- Incorporation of Existing Monitoring into GSP

Several ongoing monitoring programs provide data and information relevant to the Basin. Corona, Norco, other local agencies, state agencies and federal agencies are responsible for the various monitoring programs, which are summarized briefly below (Sections 2.4.1 through 2.4.12).

2.4.1. Climate

The State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) compiles climate data in the California Irrigation Management Information System (CIMIS). This database includes total solar radiation, soil temperature, air temperature/relative humidity, wind direction, wind speed, and precipitation. While the CIMIS database is a comprehensive source for climate data, there are no CIMIS stations in the Basin. The closest CIMIS stations are:

- Chino No. 255 - This station is located north of the Basin (Latitude: 33.985350, Longitude: -117.656528).
- U.C. Riverside No. 44 - This station is located east of the Basin (Latitude: 33.964942, Longitude: -117.33698).

2.4.2. Surface Water Flows

United States Geological Survey (USGS) owns and operates two streamflow gauges in the Basin. These include:

- TEMESCAL C AB MAIN ST A CORONA CA (11072100) - This station is located on the Temescal Creek near Main Street in Corona.
- SANTA ANA R BL PRADO DAM CA (11074000) - This station is located along the Santa Ana River below Prado Dam.

2.4.3. Surface Water Quality

Corona and Norco are both members of the Middle Santa Ana River Watershed Total Maximum Daily Load (TMDL) Task Force. The Task Force is a collaborative effort of public- and private-sector agencies and interests focused on the development of pathogen TMDLs for Santa Ana River Reach 3, its tributaries, and other water bodies in the Chino Basin area, located immediately north of the Basin. Formed in 2007, the Task Force has been working on several pathogen-related activities and studies for the Chino Basin. The objectives of this Task Force are to implement a number of tasks identified by the Regional Board in their 2005 Amendment to the water quality control plan (Basin Plan) (SWRCB 2020a). These include the implementation of a watershed-wide monitoring program to assess compliance with water contact recreation (REC-1) beneficial use water quality objectives for fecal coliform, evaluate numeric targets established for E. coli, and identify and implement measures to control sources of impairment. The Task Force works with the Regional Board in the formulation of pathogen TMDL allocation and implementation strategies (SAWPA 2018).

The Upper Temescal Valley Salt and Nutrient Management Plan (SNMP) developed by Elsinore Valley Municipal Water District and Eastern Municipal Water District includes several management actions, one of which is the implementation of a monitoring program. This monitoring program includes seven surface water monitoring sites, one of which is in the GSP Area. This privately-owned continuous flow gage is located at the All American Aggregate pit in Corona, the discharge point of the Temescal Wash (WEI 2017).

Data is also collected by OCWD and other monitoring entities associated with local habitat conservation programs (HCPs) throughout the Santa Ana River region, including in the Prado Management Area. These data have been and will continue to be incorporated into the GSA's database.

Releases to the Temescal Wash are monitored by various dischargers through NPDES permit requirements (Todd and AKM 2008), and these data also have been and will continue to be incorporated into the GSA's database.

2.4.4. Groundwater Levels

Corona has monitored water quality in production wells in the Basin to protect water quality and to comply with regulations over time. Since 1998, Corona has conducted a monitoring program including water level measurements in about 19 production wells, maintaining these data in a water level database. In 2006, Corona expanded the water level monitoring program to include wells that are not currently pumping (or pump on a limited basis). These wells include inactive irrigation wells, inactive or periodically used production wells, and dedicated monitoring wells installed by Corona (Todd and AKM 2008).

In addition, groundwater levels are measured in and around the Basin by Western Riverside County Regional WastewaterAuthority, OCWD, Chino Basin Watermaster, monitoring programs through the Upper Santa Ana River Habitat Conservation Plan (SARHCP). Data from these ongoing programs are used to supplement GSA collected data and inform the understanding of the Basin.

2.4.5. Groundwater Quality

Groundwater quality monitoring occurs at Corona's active production wells on a continuous basis, ranging in frequency from semi-monthly to semiannual depending on the water quality constituent. However, no formal water quality monitoring program has been established at the monitoring wells, primarily because of an inability to pump some of the wells. Additional groundwater quality is available from neighboring basins including OCWD and Chino Basin Watermaster. The SWRCB groundwater ambient monitoring program (GAMA) Groundwater Information System (SWRCB 2020b) also compiles available water quality data from cooperating agencies. Data from these sources has been compiled and assessed as needed.

2.4.6. Groundwater Production

Corona's groundwater pumping accounts for most groundwater production from the Basin, however, there are also a few known private pumpers. WMWD serves as the Santa Ana Watershed water master and records annual production for the watershed.

According to Watermaster records, other current and historical pumpers include:

- All American Asphalt
- Dart Corporation
- 3M Company (formerly Minnesota Mining and Manufacturing Company).

2.4.7. Conjunctive Use/Managed Recharge

Corona currently discharges tertiary treated effluent from its Wastewater Treatment Plants No. 1 and No. 2 to the Lincoln/Cota Ponds, where the effluent is either lost to evapotranspiration or percolated to groundwater. Effluent discharge quantity is monitored and recorded by Corona (WEI 2013).

2.4.8. Recycled Water

Corona records recycled water flows and quality at the three reclamation facilities: WRF1, WRF2 and WRF3. Corona also records recycled water deliveries to the 282 metered connections in the recycled water service areas for landscape irrigation, toilet flushing via dual plumbed systems, firefighting, dust control and various construction applications.

2.4.9. Imported Water

Corona maintains records of imported water purchases and deliveries from WMWD and water delivered to Norco and HGCWD.

2.4.10. Land use

Land use data for the Basin are available through the Southern California Association of Governments (SCAG), as well as the planning departments of the cities of Corona and Norco. The most recent land use mapping data from SCAG are from 2016, while the latest general plans from Corona and Norco were adopted in 2004 and 2014, respectively. The current land use shows much of the Basin is now single-family residential homes with very little agricultural area.

The Basin was historically an agricultural area and has significantly urbanized since the middle 1980s. In the 1950s and 1960s, the Basin consisted mainly of irrigated agricultural lands with a variety of crops, especially citrus. The 1984 land use map on **Figure 2-11** suggests that much of the southern part of the Basin continued to be used for agriculture, but most of this land was likely fallow or non-irrigated pasture by 1984.

The contributing watersheds that surround the Basin consist mostly of native vegetation or grasslands used for grazing. With the exception of urbanization of the small watershed on the northeastern side of the Basin, land use in the contributing watersheds has not changed significantly over the last 20 years.

2.4.11. Natural Resources

Additional monitoring from OCWD and other local HCP programs focus on natural resources including biological surveys and other information.

2.4.12. Land subsidence

While the potential for subsidence was recognized in the 2008 Groundwater Management Plan, it has not been a known issue in the Basin and ground surface elevations have not been monitored until recently. The TRE Altamira Interferometric Synthetic Aperture Radar

(InSAR) Dataset, provided by the California Department of Water Resources (DWR) through the Sustainable Groundwater Management Act (SGMA) Data Viewer (DWR 2020), shows vertical ground surface displacement from June 2015 to September 2019 and indicates that the Basin has been characterized by uplift over that period, likely reflecting tectonic factors. No known available sources of data indicate subsidence in the Basin.

2.4.13. Incorporation of Existing Monitoring into GSP

Data from existing monitoring programs have been collected and incorporated into the GSP. The existing monitoring data and locations are discussed further as part of the Monitoring Plan, Chapter 7 of this GSP.

2.5. WATER RESOURCES MANAGEMENT

This section summarizes previous plans related to different aspects of water resources management in the Basin. Generally, this previous work falls into two main categories: groundwater basin management and water resources management. The categorization helps to provide some context for the summaries that follow:

- **Groundwater Basin Management** - Plans and studies focusing on groundwater management include the 2008 GWMP, the monitoring program in the 2008 GWMP, and the 2013 RMP. Management of groundwater quality is described in general in the Water Quality Control Plan for the Santa Ana Basin.
- **Water Resources Management** - There are a number of water resources planning documents. WMWD's Updated Integrated Regional Water Management Plan (IRWMP) (Kennedy/Jenks 2008) and SAWPA's One Water One Watershed Plan (OWOW Plan) (SAWPA 2018) provide information on water resources on a regional scale. However, WMWD's IRWMP plan is over 10 years old and SAWPA's OWOW Plan is very high level as it covers the entire Santa Ana River Watershed. Additional plans developed by Corona and Norco are more recent and more focused on the Basin. The 2020 Corona Urban Water Management Plan and the 2020 Norco Urban Water Management Plan include information on existing and future water demands and supplies, including groundwater, imported water, surface water, and recycled water (Michael Baker 2021 and Norco 2021). The 2020 Urban Water Management Plans (UWMPs) also identified water supply strategies for meeting future demands. The Reclaimed Water Master Plan (Corona 2018) provides recommendations for expansion of Corona's reclaimed water program.

2.5.1. AB3030 Groundwater Management Plan

The GWMP was prepared in June 2008 and includes the Basin and the Bedford-Coldwater Subbasin (Todd and AKM 2008). The goals of the 2008 GWMP included operating the groundwater basin in a sustainable manner for beneficial uses and increasing the reliability of water supply for basin users.

The major components of the 2008 GWMP included:

- Data compilation and management
- State of the groundwater basins
- Corona water demand and supply
- Basin management objectives
- Basin management strategies
- Implementation plan.

The 2008 GWMP included a thorough evaluation of the groundwater conditions and conceptual model. The study found that the Basin was potentially in a state of overdraft from 2001 through 2004, when groundwater pumping in the Basin increased from a previous average of 10,000 AFY to an average of 20,000 AFY. The 2008 GWMP recommended numerous strategies for managing groundwater while maintaining groundwater production including:

- Develop new wells that will allow flexibility in pumping distribution and maintenance of water levels
- Enhance recharge directly into the Basin
- Provide the infrastructure necessary for the conveyance of water to recharge facilities
- Provide replacement water sources for a portion of the groundwater demand, potentially decreasing Basin production
- Increase monitoring of groundwater levels and storage for the tracking of overdraft mitigation.

Since 2008, Corona has added new wells, which allow flexibility in pumping distribution.

2.5.2. Groundwater Monitoring Program and Protocols

The 2008 GWMP included a groundwater monitoring program for the Basin and the Bedford-Coldwater Subbasin (Todd and AKM 2008).

Objectives of the 2008 GWMP monitoring program included:

- Characterize water levels and water quality basin-wide
- Monitor areas of concern to address specific problems
- Evaluate the performance of groundwater management activities
- Track changes in groundwater levels, quality and storage over time.

2.5.3. Recharge Master Plan for the Temescal Basin

The RMP for Corona's use of the Temescal Basin was prepared in September 2013 by Wildermuth Environmental to address the groundwater overdraft identified in the 2008 GWMP. The major components of the RMP included:

- Define goals for artificial recharge and develop planning criteria
- Characterize potential source waters for artificial recharge
- Characterize the universe of potential sites for artificial recharge

- Develop alternatives for artificial recharge
- Evaluate and rank alternatives for artificial recharge.

The RMP recommended implementation of Alternative 1 (Divert base flow in Temescal Creek for Recharge at the Lincoln/Cota Ponds) and Alternative 4b (Stormwater and recycled water recharge at the Main Street and Oak Street basins), which would result in about 7,200 to 9,300 AFY of new recharge to the Temescal Basin. This would exceed the goal for the RMP to increase recharge by 4,000 AFY and would allow Corona to decrease its reliance on purchased imported water and decrease the total cost of its water supply.

Since 2013, Corona conducted research on Alternative 4b and found that the water quality analysis of stormwater is not high enough to use for recharge to the Basin. Implementing this alternative would require the additional use of clarifying equipment to address debris and silt in the stormwater runoff. Although it may be pursued in the future, Alternative 4b is not being pursued at this time.

2.5.4. Water Quality Control Plan for the Santa Ana River Basin

The Water Quality Control Plan for the Basin Plan provides the framework for how surface water and groundwater quality in the Santa Ana Region should be managed to provide the highest water quality reasonably possible. The Basin Plan (i) designates beneficial uses for surface and ground waters, (ii) sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state's antidegradation policy, and (iii) describes implementation programs to protect all waters in the Santa Ana Region (SWRCB 2020a).

The Basin Plan includes site-specific objectives for un-ionized ammonia, cadmium, copper, and lead for the Santa Ana River System, which includes Temescal Creek. These objectives aim to prevent chronic toxicity to aquatic life in the Santa Ana River. The Basin Plan also states water quality objectives for the Temescal Groundwater Management Zone for 770 milligrams per liter (mg/L) TDS and 10.0 mg/L nitrate as nitrogen.

The Basin Plan outlines the statewide monitoring activities aimed at assessing attainment of water quality goals and objectives specified in the Basin Plan. The groundwater monitoring program relies on data collected by municipal supply districts. The Santa Ana Regional Water Quality Control Board (SARWQCB) contributes to the data collection effort.

2.5.5. Integrated Regional Water Management Plan Update

Corona and Norco purchase imported water from WMWD. Therefore, it is relevant to track WMWD planning efforts that affect the Corona and Norco service areas or the imported water delivered to Corona and Norco.

WMWD completed its most recent Integrated Regional Water Management Plan in 2008 (Kennedy/Jenks 2008). The purpose of the IRWMP was to address long range water quantity, quality, and environmental planning needs within WMWD’s service area.

The 2008 WMWD IRWMP focused on:

- Identifying and evaluating water management strategies that could increase local water supply, thereby improving water supply reliability.
- Evaluating local and regional water quality, environmental, and disadvantaged community issues.

The IRWMP also includes discussion of other regional planning efforts that impact water management within the WMWD service area as well as compilation of estimates of water demands by member agencies, water supplies (e.g., local groundwater, recycled water, surface water, and imported water) available to the agencies, and efforts to coordinate investments in water management, as appropriate, between agencies.

The IRWMP included several projects relevant to Corona:

- New water wells
- Replacement water wells
- Groundwater blending program
- Improvement of groundwater quality/quantity monitoring program
- Recharge basins within Oak Avenue detention basin
- Recharge basins within Main Street detention basin
- Upgradient injection wells
- Recycled water injection wells
- Lincoln and Cota street percolation ponds maintenance program.

Several of these projects include groundwater recharge projects that were also recommended in the 2013 RMP.

2.5.6. Santa Ana River Watershed One Water One Watershed Plan

Corona, Norco, and HGCWD are involved in SAWPA, which in 2018 updated its One Water One Watershed Plan (OWOW Plan). The OWOW Plan's goals for the entire Santa Ana River Watershed are as follows:

- Achieve resilient water resources through innovation and optimization
- Ensure high-quality water for all people and the environment
- Preserve and enhance recreational areas, open space, habitat, and natural hydrologic function
- Engage with members of disadvantaged communities and associated supporting organizations to diminish environmental injustices and their impacts on the watershed
- Educate and build trust between people and organizations
- Improve data integration, tracking, and reporting to strengthen decision making.

The Plan includes ongoing water management projects and programs undertaken by Corona, Norco, and HGCWD.

2.5.7. Corona and Norco Urban Water Management Plans

The California Urban Water Management Planning Act requires preparation of Urban Water Management Plans (UWMPs) by urban water providers with 3,000 or more connections. The UWMPs, generally required every five years, provide information on water supply and water demand—past, present, and future—and allow comparisons as a basis for ensuring reliable water supplies. UWMPs examine water supply and demand in normal years and during one-year and multi-year droughts. UWMPs also provide information on per-capita water use, encourage water conservation, and present contingency plans for addressing water shortages.

According to its 2020 UWMP, Corona is in compliance with the state requirements to reduce per capita water use by 20 percent by 2020 (Senate Bill X7-7). The 2020 per capita daily water use of 180 gallons per capita per day (gpcd) was below the target of 213 gpcd (Michael Baker 2021). Per the UWMP, Corona should be able to meet demands through 2040 in normal, dry, and multiple-dry years using their existing water sources.

For the City of Norco, the 2020 per capita daily water use of 151 gpcd was currently below the target of 263 gpcd (Norco 2021). Per its 2020 UWMP, Norco is in compliance with Senate Bill X7-7 and should be able to meet demands through 2040 in normal, dry, and multiple-dry years using their existing water sources.

2.5.8. Reclaimed Water Master Plan

The purpose of the 2018 Reclaimed Water Master Plan (RWMP) (Corona 2018) was to assist Corona with meeting its goals for reclaimed water use by recommending the implementation of appropriate projects, programs, and additional studies. The RWMP identified, evaluated, prioritized, and scheduled 33 projects. The recommendations from the RWMP fell into four categories:

- Improvements involving receiving future supply from WRCWRA
- Improvements to add demand for reclaimed water
- Enhancements to data collection
- Additional studies related to future uses of reclaimed water

The RWMP does not include projects relating to recharge of the Basin with reclaimed water.

2.5.9. Water Resources Management Implementation Status

Most of the previous plans summarized above have included recommendations for water resources management activities in the Basin. Since the time of publication, many of these recommendations have been implemented.

2.6. GENERAL PLANS

This section presents elements of general plans and other land use planning in the Basin as relevant to groundwater sustainability. It focuses on planning goals and objectives that are aligned with potential groundwater management activities. In addition, this section

highlights the potential for future changes in land use that may influence water demands and infiltration/recharge of the Basin.

The goals, objectives, policies, and implementation measures as described in the general plans for Riverside County, Corona, and Norco, which together encompass the Basin, are summarized below. The jurisdictional boundaries in the Basin are presented on **Figure 2-2**.

Applicable general plans include:

- The Riverside County General Plan - The entire Basin is within Riverside County (Riverside County 2015).
- Corona General Plan - Most of the Basin is within the Corona jurisdictional boundary. Corona's General Plan includes plans and policies applicable to the entire city as well as its sphere of influence (Corona 2021).
- Norco - The northeastern portion of the Basin is within the Norco jurisdictional boundary (Norco 2009).

The goals and policies that are water resources related are summarized as follows.

2.6.1. Riverside County General Plan

The Riverside County General Plan was adopted in 2015. The General Plan covers the entire unincorporated portion of the County and also includes 19 detailed Area Plans covering most of the County.

The Multipurpose Open Space Element of the Riverside County General Plan addresses the conservation, development, and use of natural resources including water, soils, rivers, and mineral deposits. A number of policies are related to water supply and conveyance, water conservation, watershed management and groundwater recharge. Several of these policies are summarized in **Table 2-2**.

2.6.2. City of Corona General Plan

The City of Corona's General Plan was updated in 2021 and covers the 37.6 square miles within City limits and provides guidance to Riverside County for the 35.2 square miles within the Corona Sphere of Influence. The General Plan chapters most relevant to water resource management are the chapters on Infrastructure and Public Services and Environmental Resources. Additional relevant policies are in the Land Use and Public Health and Safety chapters as well.

Relevant policies included in the General Plan are summarized in **Table 2-3**.

Table 2-2. Select Policies in the Riverside County General Plan

Category	Policy[1]
Water Supply and Conveyance	Balance consideration of water supply requirements between urban, agricultural, and environmental needs.
	Provide active leadership in the regional coordination of water resource management and sustainability efforts affecting Riverside County.
	Promote the use of recycled water for landscape irrigation.
Water Conservation	Implement water-efficient landscape ordinance and policies.
	Seek opportunities to coordinate water-efficiency policies and programs with water service providers.
Watershed Management	Encourage wastewater treatment innovations, sanitary sewer systems, and groundwater management strategies that protect groundwater quality in rural areas.
	Minimize pollutant discharge to storm drainage systems, natural drainages, and aquifers
	Where feasible, decrease stormwater runoff by reducing pavement in development areas, reducing dry weather urban runoff, and by incorporating "Low Impact Development," green infrastructure and other Best Management Practice design measures.
Groundwater Recharge	Support efforts to create additional water storage where needed, in cooperation with federal, state, and local water authorities.
	Participate in the development, implementation, and maintenance of a program to recharge the aquifers underlying the county.
	Ensure that aquifer water recharge areas are preserved and protected.
	Use natural approaches to managing streams, to the maximum extent possible, where groundwater recharge is likely to occur.
	Discourage development within watercourses and areas within 100 feet of the outside boundary of the riparian vegetation, the top of the bank, or the 100 year floodplain, whichever is greater.

Notes:

[1] : Some policy statements have been shortened for use in this table. The full text is included in the Riverside County General Plan.

Table 2-3. Selected Policies in the City of Corona General Plan

Category	Policy[1]
Land Use	Accommodate the types, densities, and mix of land uses that can be adequately supported by transportation and utility infrastructure (water, sewer, etc.) and public services (schools, parks, libraries, etc.)
	Require new residential, commercial, office, and industrial development be designed to minimize consumption of and sustain scarce environmental resources through methods including drought-tolerant species and recycled water for irrigation in landscaping, capturing rainwater and using it onsite, and water efficient fixtures.
Infrastructure and Utilities	Establish guidelines and standards for water conservation and actively promote use of water conserving devices and practices in both new construction and major alterations and additions to existing buildings.
	Encourage the use of recycled water by industrial, commercial, and institutional, users through incentives such as differential pricing.
	Require the use of recycled water for landscaped irrigation, grading, and other non-contact uses in new developments, parks, golf courses, sports fields, and comparable uses, where feasible.
	Encourage the use of rainwater capture and storage facilities in residential and nonresidential developments.
Environmental Resources	Prohibit the discharge of toxins, debris, refuse, and other pollution into watercourses, other drainages and groundwater basins.
	Balance consideration of water supply requirements between urban, agricultural, and environmental needs so that sufficient supply is available to meet each of these different demands.
	Provide active leadership in the regional coordination of water resource management and sustainability efforts affecting Riverside County and continue to monitor and participate in, as appropriate, regional activities to prevent overdraft caused by population growth.
	Support efforts to create additional water storage where needed, in cooperation with federal, State, and local water authorities. Additionally, support and/or engage in water banking in conjunction with these agencies where appropriate, as needed.
	In cooperation with Riverside County, participate in the development, implementation, and maintenance of a program to recharge the aquifers underlying Corona and SOI areas.
	Retain storm water at or near the site of generation for percolation into the groundwater to conserve for future uses and mitigate flooding.
	Use natural approaches to managing streams, to the maximum extent possible, where groundwater recharge is likely to occur.
	Require new private or public developments to preserve and enhance riparian habitat and prevent obstruction of natural watercourses.
	Consider wetlands for use as natural water treatment areas that will result in improvement of water quality
Public Health & Safety	Promote the collection of relevant data on groundwater levels and liquefaction susceptibility, as a basis for future refinement of liquefaction policies or procedures.
	Use natural watercourses as Corona's primary flood control channels, whenever feasible and practical.
	Minimize the potential risk of contamination to surface water and groundwater resources and implement restoration efforts to resources adversely impacted by past urban and rural land use activities.

Notes:

[1] : Some policy statements have been shortened for use in this table. The full text is included in the City of Corona General Plan.

2.6.3. City of Norco General Plan

Norco's General Plan Update includes several elements, of which Conservation is the most relevant for water resources planning (Norco 2014). Relevant policies included in the General Plan are listed in **Table 2-4.**

Table 2-4. Selected Policies in the City of Norco General Plan

Category	Policy[(1)]
Water Supply	Continue to promote water conservation through the use of xeriscape designs in new development and public spaces where feasible.
	Continue to provide information to the public on ways to conserve water and reduce consumption.
	Monitor the demand for reclaimed water and file for Petitions of Change with the SARWQCB as-needed to reduce the amount of reclaimed water that is discharged from treatment facilities and make that water available for transmission into Norco's reclaimed water infrastructure system.
	Insure that there are adequate increases in water production and distribution capabilities to meet future growth demands.
Water Quality	Develop and maintain inter-agency agreements and infrastructure improvements to have back-up water supply sources from adjoining water districts during times of emergencies and system maintenance requirements.
	Continue public information campaigns to all residents with large animals to ensure awareness that manure spreading as a means of disposal is strictly prohibited to prevent contamination to groundwater supplies.

Notes:
1. Some policy statements have been shortened for use in this table. The full text is included in the City of Norco General Plan Update.

2.6.4. General Plan Influences on Groundwater Sustainability Agency Ability to Achieve Sustainability

The general plans for Riverside County, Corona, and Norco all include policies to increase water conservation and protect groundwater and surface water quality. They also include policies promoting the preservation of natural floodplains, which contribute to groundwater recharge. However, the planned growth in the Basin would convert open space uses that allow groundwater infiltration to more developed land use types with more impervious cover that will likely not allow the same amount of groundwater infiltration. Use of low impact development practices and stormwater best management practices (BMPs) that promote infiltration would help mitigate loss of infiltration due to land use changes.

Riverside County. The Riverside County General Plan addresses the importance of groundwater. The policies and implementation of the land use and public facilities/services elements indicate that the County role is to support and encourage local water agencies in ensuring that water supply is available. Similarly, with wastewater issues and protection of water quantity and quality, the County role is limited to encouragement of other agencies,

developers, and landowners. The General Plan contains little policy to manage land use within the constraints of available water supply other than to encourage drought resistant plants and the use of recycled water.

Corona serves a population that is predicted to increase from 170,100 in 2020 to about 185,600 residents by 2045 (Michael Baker 2021). Some of this growth will be along the southern edge of Corona in the Eagle Creek area within and adjacent to the Basin. The UWMP anticipates future growth in the City will be offset by lower per capita water use. However, the general plan indicates that Met may build an additional treatment plant in the area to meet increased water demand, if warranted. Corona land use policies generally are protective of agricultural land and hillsides, and conservation policies address water efficiency, water recycling, sustainability measures, and coordination with other agencies, including HGCWD and Norco.

The increased development included in the general plans was simulated by the numerical model described in Chapter 5. Based on these scenarios, the Basin remains sustainable even with future growth.

2.6.5. GSP Influences on General Plans

The Temescal Groundwater Sustainability Agency (Temescal GSA) agencies will work together to implement this GSP and rely on their portfolio of water supply to maintain sustainability. Future growth is expected to be limited based on the general plans.

City of Corona. Implementation of the GSP will support Corona in providing continued groundwater to its population. In addition, the GSP will ensure good quality water in sufficient quantities to serve its residents into the future, including drought periods.

Riverside County. The Riverside County General Plan generally assumes that local water agencies can ensure adequate high-quality water supplies into the future. The GSP provides additional specific information, documents potential challenges to water supply, and explores undesirable results that may occur with future increases in groundwater demand. Undesirable results will be defined with sustainability criteria, and if identified, will be addressed with management actions. These management actions may have ramifications for County land use planning. For example, GSPs are authorized within the GSP Plan Areas to impose well spacing requirements and control groundwater pumping and control extractions by regulating, limiting, or suspending extractions from individual groundwater wells. Such regulation may present a constraint on potential land uses.

2.7. ADDITIONAL GSP ELEMENTS

The GSP requirements include a list of additional GSP elements from Water Code Section 10727.4 that may or may not be relevant to a GSP. As shown in **Table 2-5**, several of these elements are not applicable to the Basin. The elements that are applicable to the Basin, are presented in the sections below.

Table 2-5. Additional GSP Elements included in Water Code Section 10727.4

Water Code Section 10727.4 Elements	GSP Section or N/A
a) **Control of saline water intrusion**	N/A
b) **Wellhead protection areas and recharge areas**	2.7.1
c) **Migration of contaminated groundwater**	2.7.2
d) **A well abandonment and well destruction program**	2.7.3
e) **Replenishment of groundwater extractions**	N/A
f) **Activities implementing, opportunities for, and removing impediments to, conjunctive use or underground storage**	N/A
g) **Well construction policies**	2.7.3
h) **Measures addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects**	N/A
i) **Efficient water management practices, as defined in Section 10902, for the delivery of water and water conservation methods to improve the efficiency of water use**	2.7.4
j) **Efforts to develop relationships with state and federal regulatory agencies**	2.7.5
k) **Processes to review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity**	2.7.6
l) **Impacts on groundwater dependent ecosystems**	4.10 and 6.7

2.7.1. Wellhead Protection Areas and Recharge Areas

In 2002, Corona conducted an assessment of the vulnerability of their drinking water wells under the California Drinking Water Source Assessment Program. This program, developed by the California Department of Public Health, delineates the area around drinking water sources, such as wells, through which contaminants might reach the water supply. This assessment identified surface recharge areas in the vicinity of Corona's wells. In addition, the analysis in the 2008 GWMP identified the main areas of basin recharge for the aquifers tapped by Corona's wells. These areas include the entire footprint of the unconfined Channel Aquifer, recharge areas along washes and alluvial fans, and areas of subsurface inflow such as Temescal Canyon and Arlington Gap (Todd and AKM 2008).

2.7.2. Groundwater Contamination Migration and Clean-up

There are several groundwater contaminated sites in the Basin in varied stages of remediation. The pollutants of concern for these sites include gasoline, diesel, and volatile organic compounds (VOCs). The status of each site is summarized in **Table 2-6**. The

remediation activities for contaminated sites directly over the Basin are managed and tracked by the SARWQCB. GeoTracker is the SWRCB data management system for sites that impact groundwater or have the potential to impact groundwater. GeoTracker provides information on sites that require groundwater cleanup and the status of required clean-up activities. In the Basin, there are a number of closed sites (where clean-up activities have been completed) and five open sites, as shown on **Figure 2-12**.

Table 2-6. Status of Contamination Sites in the Basin

Site	Contaminants of Concern	Status
ARCO #1924	Gasoline	OPEN – Eligible for closure as of 2/18/2016
Thomas Ranch (Schofield)	Benzene, other acid or corrosive, other petroleum, xylene	OPEN – Site assessment as of 8/21/1986
Dry Clean Express	Tetrachloroethylene (PCE), Trichloroethylene (TCE)	OPEN - Inactive as of 2/13/2020
Private Residence	Diesel	OPEN - Inactive as of 11/17/2017
All American Asphalt Landfill	Non-Specified	OPEN – Operating as of 11/1/2014

2.7.3. Well Permitting, Construction, and Destruction Requirements

The RCDEH is responsible for issuing well permits. Permits are required for the construction and/or abandonment of all water wells including, but not limited to driven wells, monitoring wells, cathodic wells, extraction wells, agricultural wells, and community water supply wells. The process includes an application by the property owner and certified well driller, and a site inspection by the County. The wells are also inspected during different stages of construction to help verify standards are being met. All drinking water wells are evaluated once they complete installation to ensure they comply with State well standards and meet minimum drinking water standards. If found in compliance, the land or well owner is issued a clearance letter authorizing their use.

Corona and Norco have not developed their own well construction standards but do require compliance with DWR standards and RCDEH standards.

Through their Water Engineering Program, RCDEH requires that a permit be obtained for the abandonment of any well in the County (RC DEH 2020). Guidance for well abandonment procedures is consistent with the standards developed by DWR and included in the California Water Code (§ 13800 through 13806) for drilling and destroying wells in California. The 2008 GWMP recommended increased coordination with RCDEH Water Engineering Program regarding well abandonment procedures.

2.7.4. Efficient Water Management Practices

Corona and Norco encourage and facilitate efficient water management practices, which are discussed at a high level in each city's General Plan (Corona 2021 and Norco 2014). In addition, specific water conservation targets and demand management measures, including metering, conservation pricing, public education, water loss auditing, and other water conservation program activities, are documented in each city's 2020 UWMP (Michael Baker 2021 and Norco 2021). As documented in Section 2.5.7 of this GSP, Corona and Norco have both met and exceeded their 2020 water efficiency goals.

Water conservation reduces reliance on potable water supplies, including groundwater. Increasing water conservation through the implementation of water efficiency practices may reduce groundwater pumping and promote sustainable groundwater management.

2.7.5. Relationships with State and Federal Agencies

The Temescal GSA has developed an interested parties list, which includes stakeholders, neighboring water agencies, local groups, State and Federal agencies, and others who have expressed interest in the GSP process. Notices have been sent to these interested parties throughout GSP preparation. In addition, State and Federal agencies have had the opportunity to participate in the Technical Advisory Committee (TAC), attend public meetings, and review and comment on public drafts of the GSP.

2.7.6. Land Use Plan Coordination

Land use planning agencies have been invited as interested parties to the GSP planning process. The GSA recognizes the importance of the natural recharge areas, where stormwater is recharged into the Basin and has developed projects and management actions to further assess enhanced recharge in coordination with local land use planning efforts (see Chapter 8).

2.8. NOTICE AND COMMUNICATION

As described in this and later chapters, groundwater is a major source of supply in the Basin and supports a range of beneficial uses: municipal, industrial, commercial, agricultural, and environmental. To some degree in the Basin, all land and property owners, residents, businesses, employees, and visitors are potentially affected by groundwater use. This reflects the orientation of the communities in the Basin and the amenities for small-city living and recreation. While recognizing the critical importance of imported supply, reliable groundwater is essential.

The Temescal GSA has encouraged public participation in the ongoing planning and development activities supporting the GSP process. Corona organized a TAC to support the GSP process; regularly scheduled TAC meetings have been announced on the GSA website and have been open to the public. In addition, public workshops regarding development of the GSP have been conducted to encourage public participation and to provide educational outreach. Early in the GSP preparation process the GSA contacted potential interested partis, including private well owners, environmental stakeholder, local and regional community organizations, and the community at large. Parties that expressed interest were included on the list of interested maintained pursuant to Water Code Section 10723.2.

Organizations and individuals that expressed interest throughout GSP preparation were added to this list. Meeting notices were provided to all those on the interested parties list in advance of all public meetings relating to the GSP and when draft portions of the GSP were made available on the GSA website. Additionally, GSP development information and meeting notices have been regularly posted to the GSA website.

The Communication Plan in **Appendix D** provides an overview of outreach to the public by means of public TAC meetings, public workshops, informational materials (e.g., Fact Sheets), focused outreach, and the GSA website. These inform the public about the GSP development and implementation process and encourage active involvement by interested parties.

The GSA developed and maintained an interested parties list and has communicated to the individuals and organizations on the list during GSP development. These parties represent a variety of interests and perspectives. Additionally, the interested parties group brings a variety of expertise, including public and private groundwater users, local business interests, public water systems, land use planning agencies, regulatory agencies, etc. These parties have been engaged throughout the development of this GSP to provide them with information about the purpose of the GSP, educate about Basin characteristics, and obtain input on sustainability goals and management actions. A list of public meetings held during development of the GSP, comments received on the draft GSP prior to adoption, and how those comments were addressed is included in **Appendix E**.

2.8.1. Technical Advisory Committee (TAC)

The Temescal GSA formed a TAC to provide input and guidance to the staff and consultant team of the GSA during preparation of the GSP based on their expertise, knowledge, resources, and understanding of their communities, environment, commerce, and applicable regulations. The intent of the TAC is to contribute community and stakeholder perspectives and interests in GSP planning and GSP and SGMA implementation in the Basin. The TAC includes representatives from the following public and private organizations:

- 3M Industrial Mineral Products Division
- All American Asphalt
- Santa Ana Regional Water Quality Control Board (RWQCB)
- City of Norco
- Home Gardens County Water District
- Riverside County Flood Control and Water Conservation District
- Corona City Council
- City of Corona Department of Water and Power.

The TAC held quarterly meetings throughout the GSP preparation period that were open to the public. Notification for these meetings was posted on the GSA's website prior to meeting dates and presentation materials and meeting summaries were posted following each meeting. Meeting summaries and presentation materials from the TAC meetings are included in **Appendix F**.

2.8.2. Public Workshops

Three public workshops were held during preparation of the GSP to engage with interested parties and stakeholders. The GSA agencies publicized these public meetings through the GSA website, social media, and distribution of targeted bilingual Fact Sheets. The workshops were held virtually in 2020 and 2021 and all presentations and materials were presented simultaneously in English and Spanish. These workshops were also streamed on Corona's website, Facebook, and YouTube channels and on Corona TV (locally Channel 29 on Time Warner Spectrum and Channel 99 on AT&T).

Meeting summaries, presentation materials, and associated Fact Sheets from the public workshops are included in **Appendix G**.

2.8.3. Directed Outreach and Coordination

The GSA focused significant outreach efforts to engage and inform important local and regional stakeholders. This included engaging community leaders in historically underserved communities in the Basin and coordination with neighboring basins and local agencies.

2.8.4. Disadvantaged Community Outreach

Areas of the Basin identified as disadvantaged and severely disadvantaged communities (DACs and SDACs) are shown on **Figure 2-13**. These DACs and SDACs are within the service areas of Corona and HGCWD and receive water supply from those agencies. There are no active private wells in these DAC and SDAC areas. This fact notwithstanding, the GSA worked to identify individuals and/or organizations in or representing these DACs and SDACs and engage them in the GSP process. Outreach to DAC and SDAC areas of the Basin included communication with and distribution of Fact Sheets to and through local churches and community centers in the DAC/SDAC areas and individual and group meetings with politically active individuals, community leaders, and community action organizations, and elected officials. This outreach focused on presentations regarding SGMA, the Basin, the GSP process and components, and encouraged participation in public meetings and GSP review. These meetings also generated feedback on additional outreach that the GSA could undertake, much of which was implemented. Notes from these meetings are included in **Appendix H**.

2.8.5. Neighboring Basin Coordination

The GSA held meetings to facilitate communication and coordination with groundwater basins neighboring the Temescal Basin. This included meetings with representatives of the Chino Basin, Riverside-Arlington Basin GSA, and Coastal Plain of Orange County Basin GSA. The meetings focused on data sharing between basins, water budget coordination, and GSP preparation timelines. Summary notes from these meetings are included in **Appendix H**.

2.8.6. Comments and Responses on Draft GSP

On September 15, 2021, the GSA notified stakeholders, including local City and County agencies, of their intent to adopt this GSP after a 90-day review period. Two letters with

comments on the Draft GSP were received in mid-December. These letters, along with responses from the GSA and indications of how the GSP has been modified are included in **Appendix I**.

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-1 TemescalHydrogeology.mxd

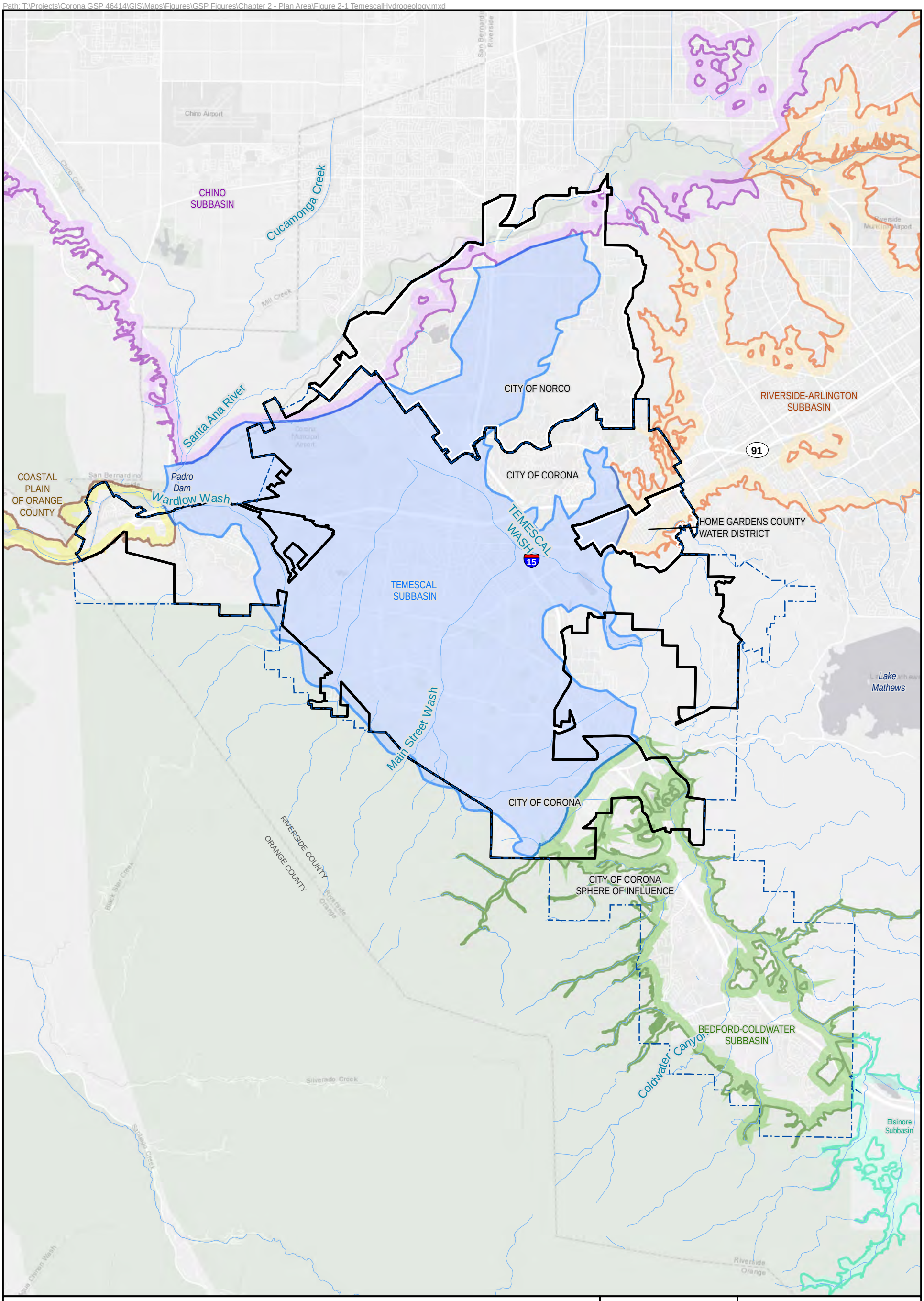
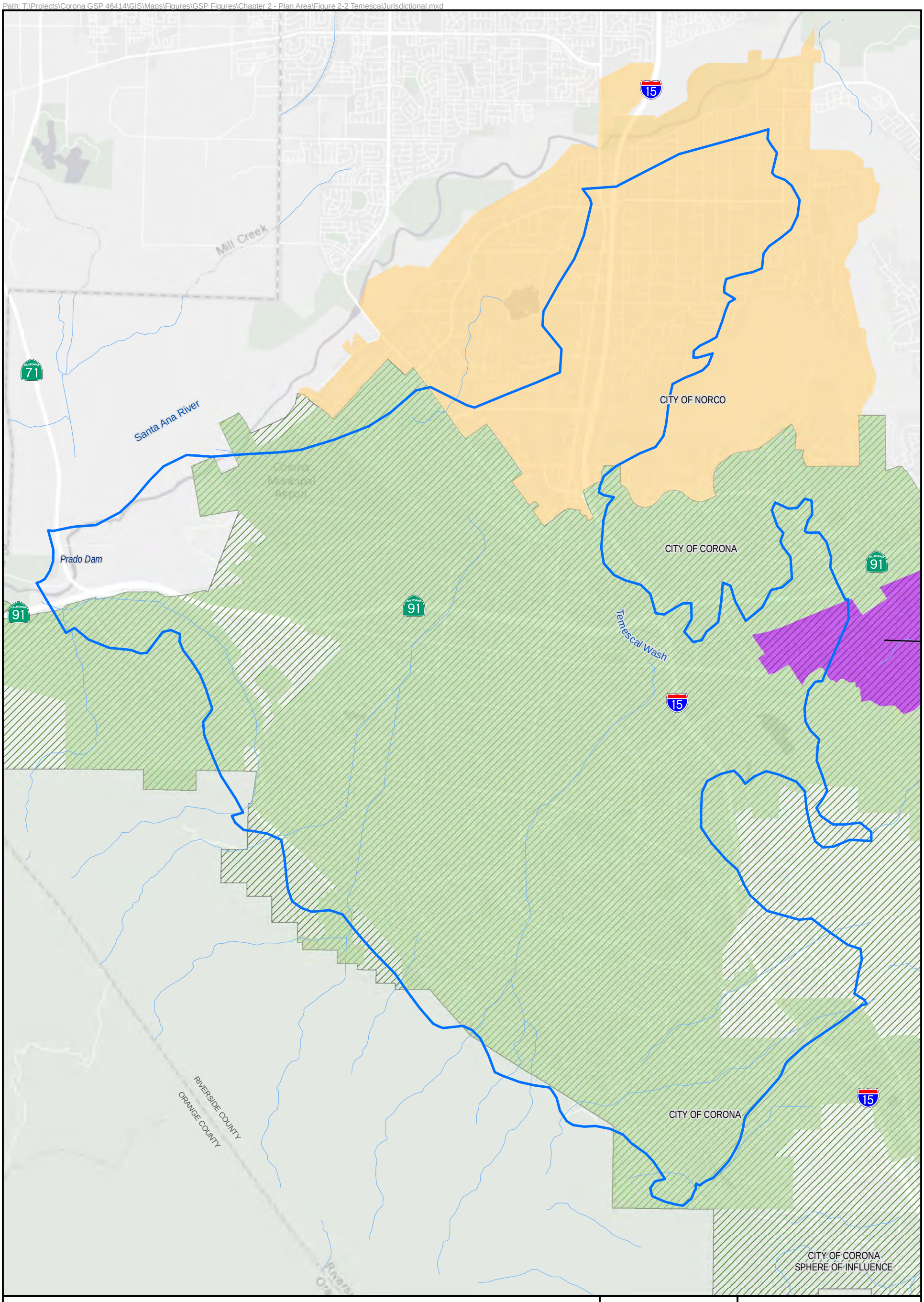


Figure 2-1
Temescal Basin GSP Area

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-2 TemescalJurisdictional.mxd



Streams
Temescal Basin
City of Corona
City of Norco
Home Gardens County Water District
City of Corona Sphere of Influence

Data Sources:
Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset, SAWPA

Disclaimer:
Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

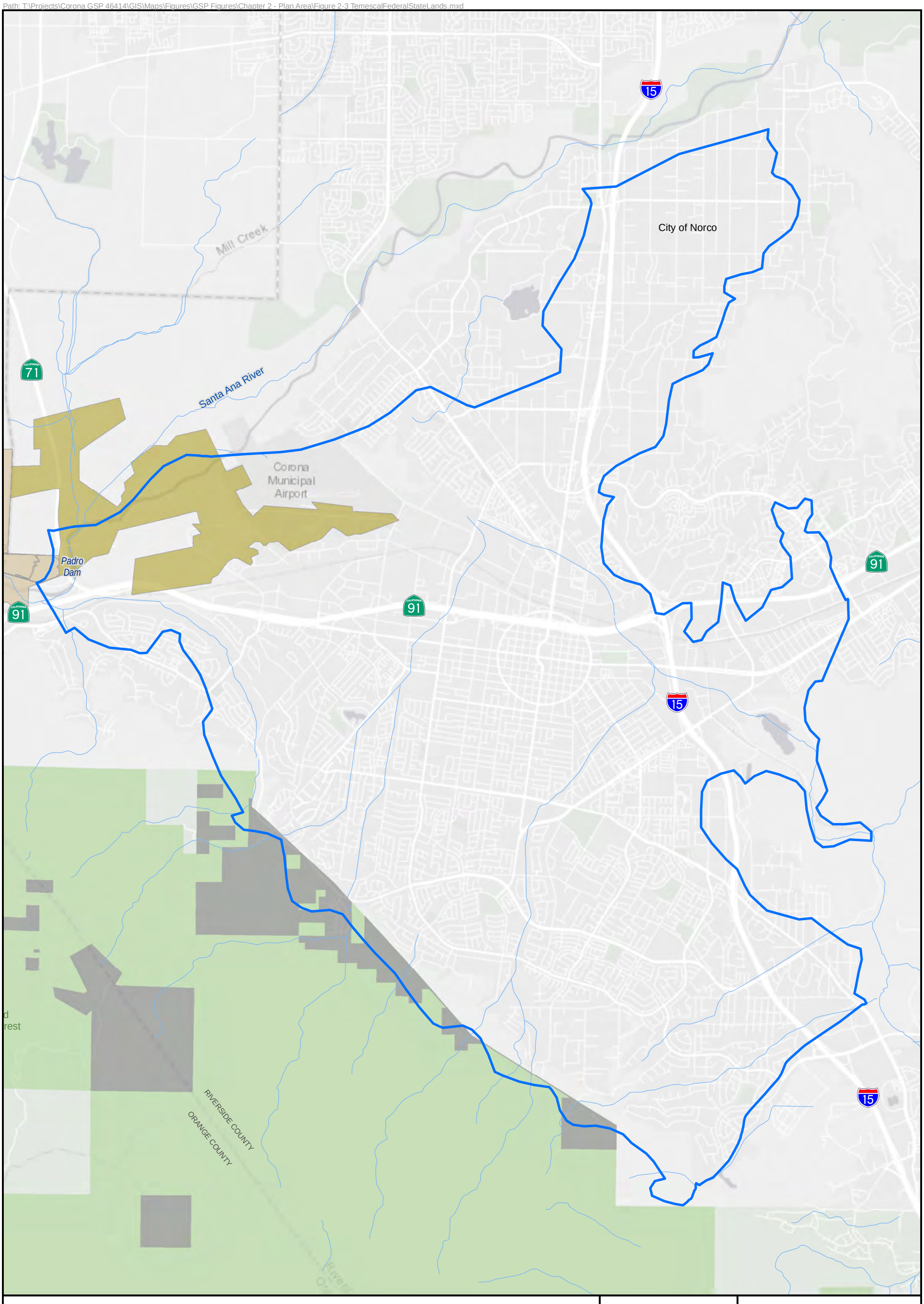
N

0 0.5 1
Miles

Figure 2-2
Jurisdictional Areas

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-3 TemescalFederalStateLands.mxd



Department of Defense
State of California
Federal Lands - Non-Forest Service Land within USFS
Federal Lands - US Forest Service
Temescal Basin

Data Sources:
EVMUD, Cal-Atlas, DWR Bulletin 118, BLM

Disclaimer:
Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

N

0 0.5 1
Miles

Figure 2-3
Federal and State Lands

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER

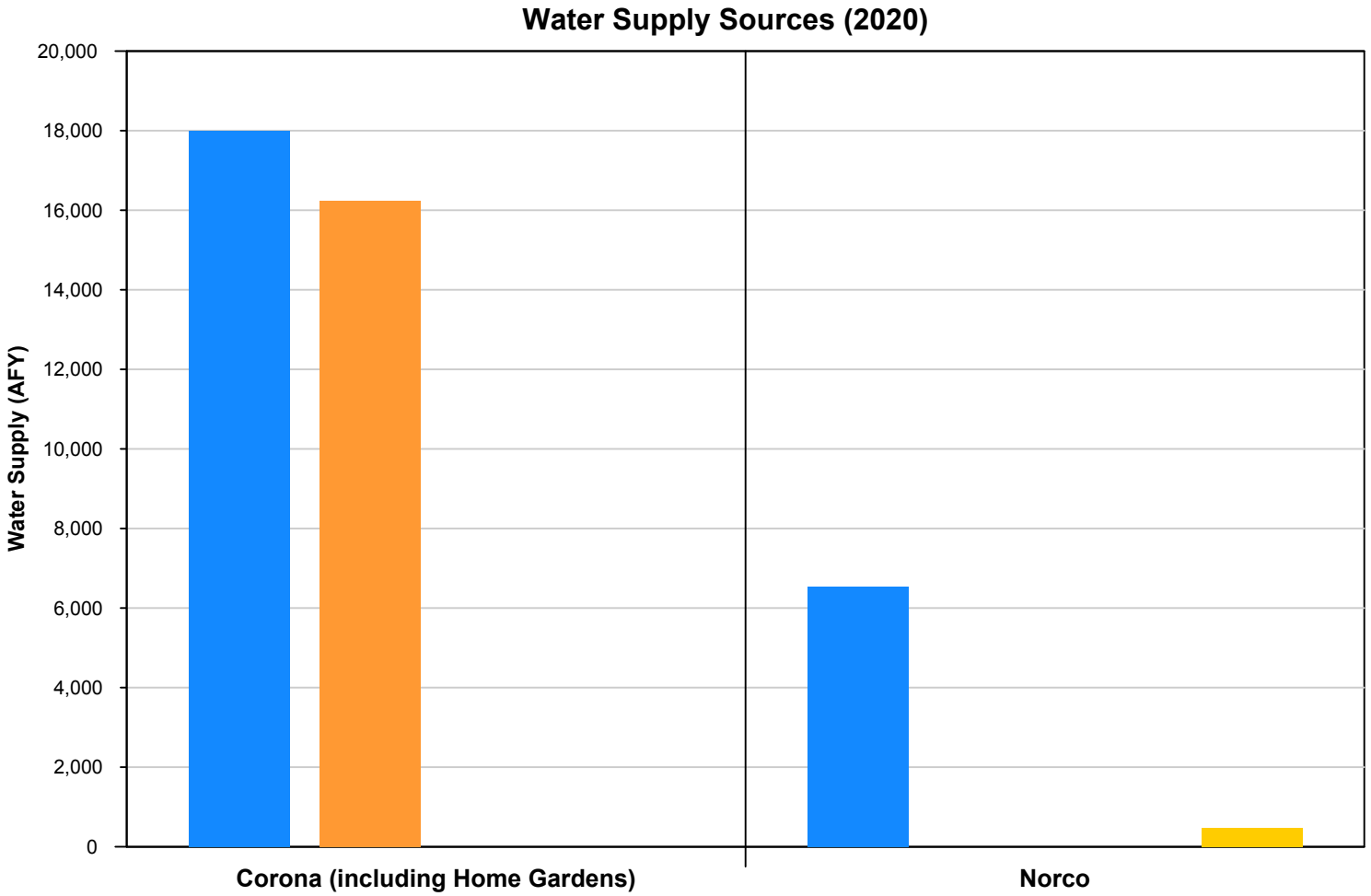


Figure 2-4
Water Supply Sources within Basin - 2020

- Imported Water
- Temescal Basin Groundwater
- Bedford-Coldwater Basin Groundwater
- Chino Basin Groundwater

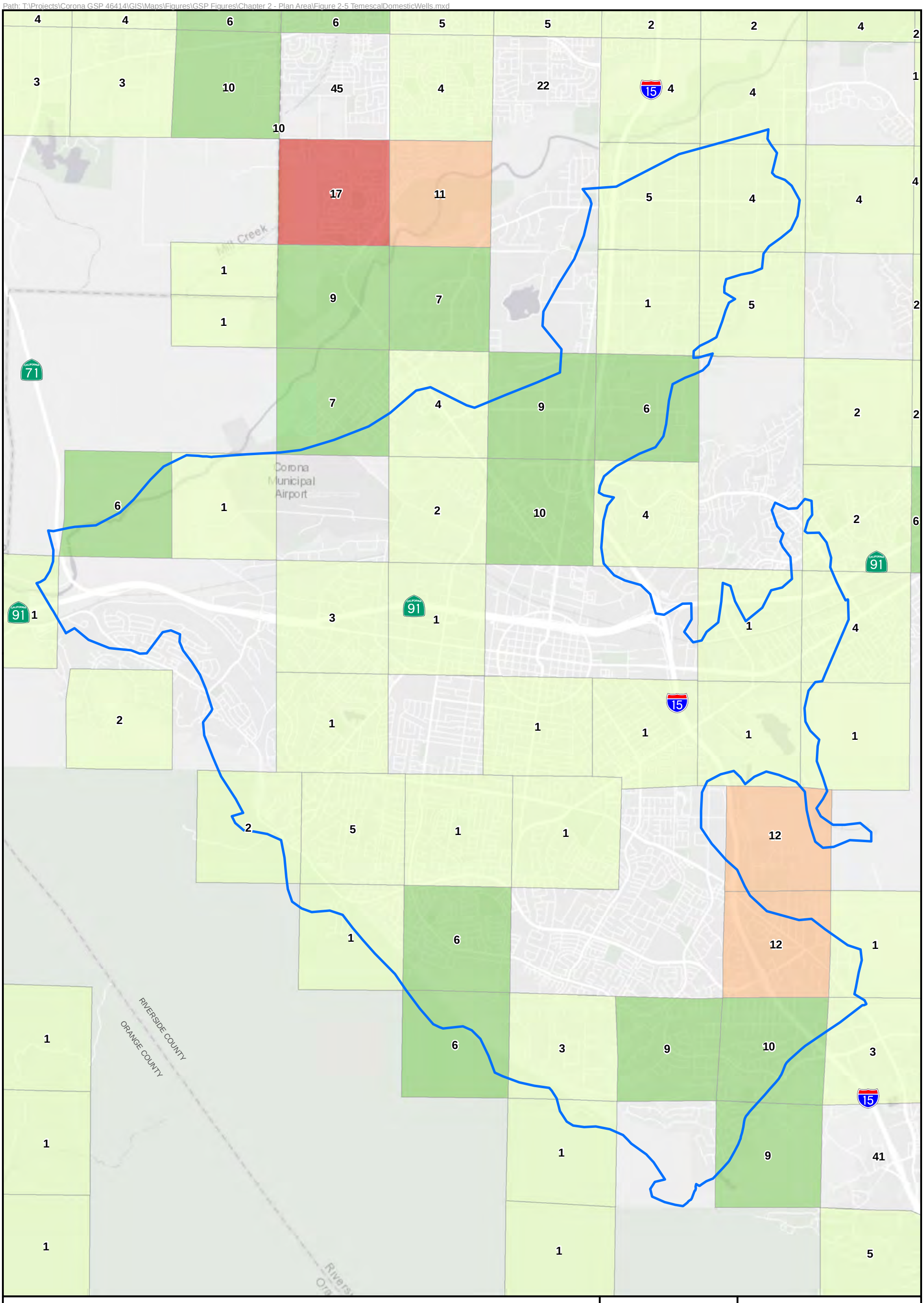
Notes:

Corona has the ability to pump groundwater from the Coldwater portion of the Bedford-Coldwater Basin, but did not do so in 2020.

Norco produces groundwater from wells in the un-adjudicated portion of the Chino Basin; they currently have no wells in the Temescal Basin.

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-5 TemescalDomesticWells.mxd



Domestic Wells by Section

- 1 - 5
- 6 - 10
- 11 - 15
- 16 - 20
- Temescal Basin

Data Sources:
Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset

Disclaimer:
Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

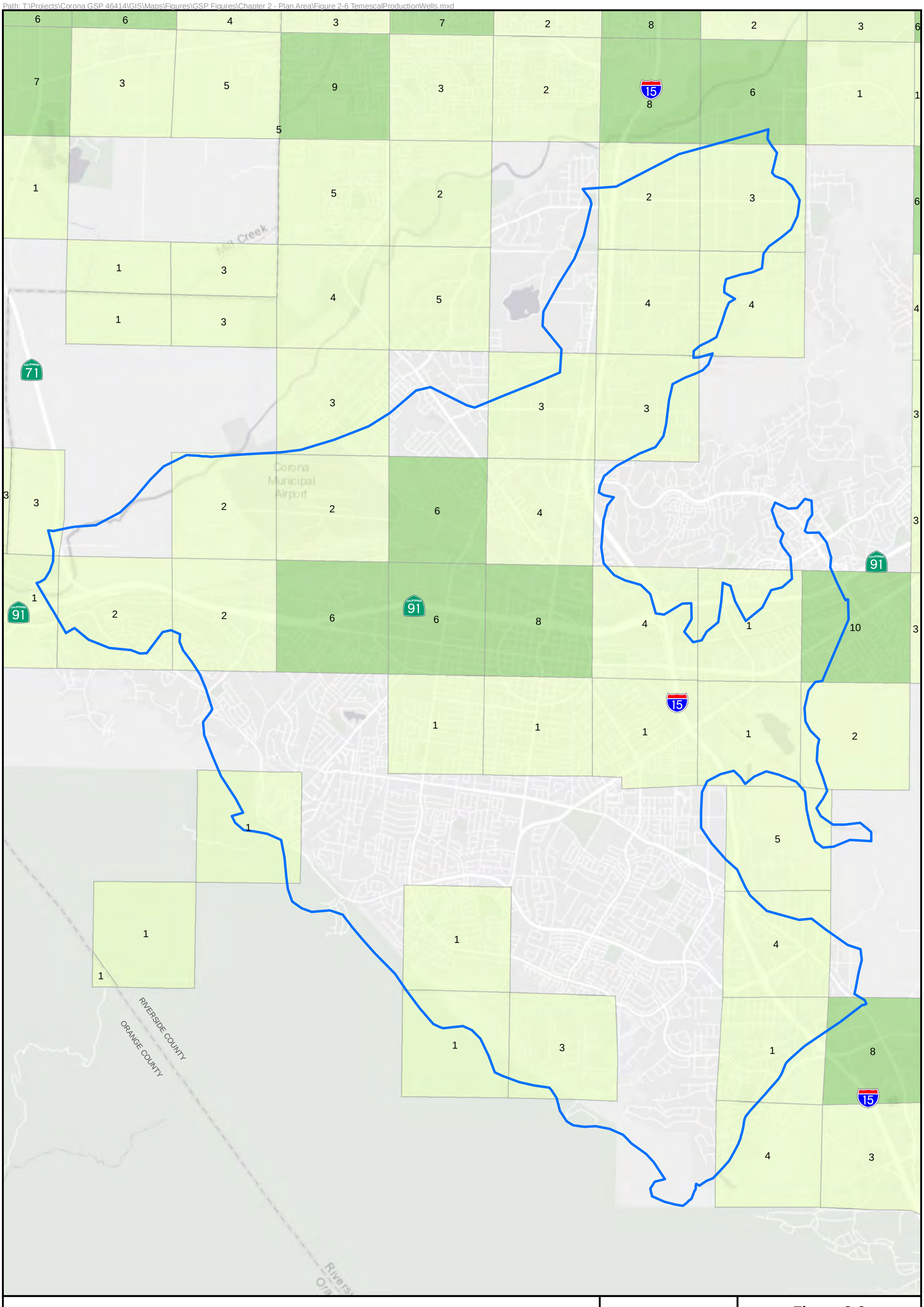
N

0 0.5 1
Miles

Figure 2-5
Basin Domestic Groundwater Wells

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-6 TemescalProductionWells.mxd



Production Wells by Section

- 1 - 5
- 6 - 10
- 11 - 15
- 16 - 20
- Temescal Basin

Data Sources:
Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset

Disclaimer:
Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

N

0 0.5 1

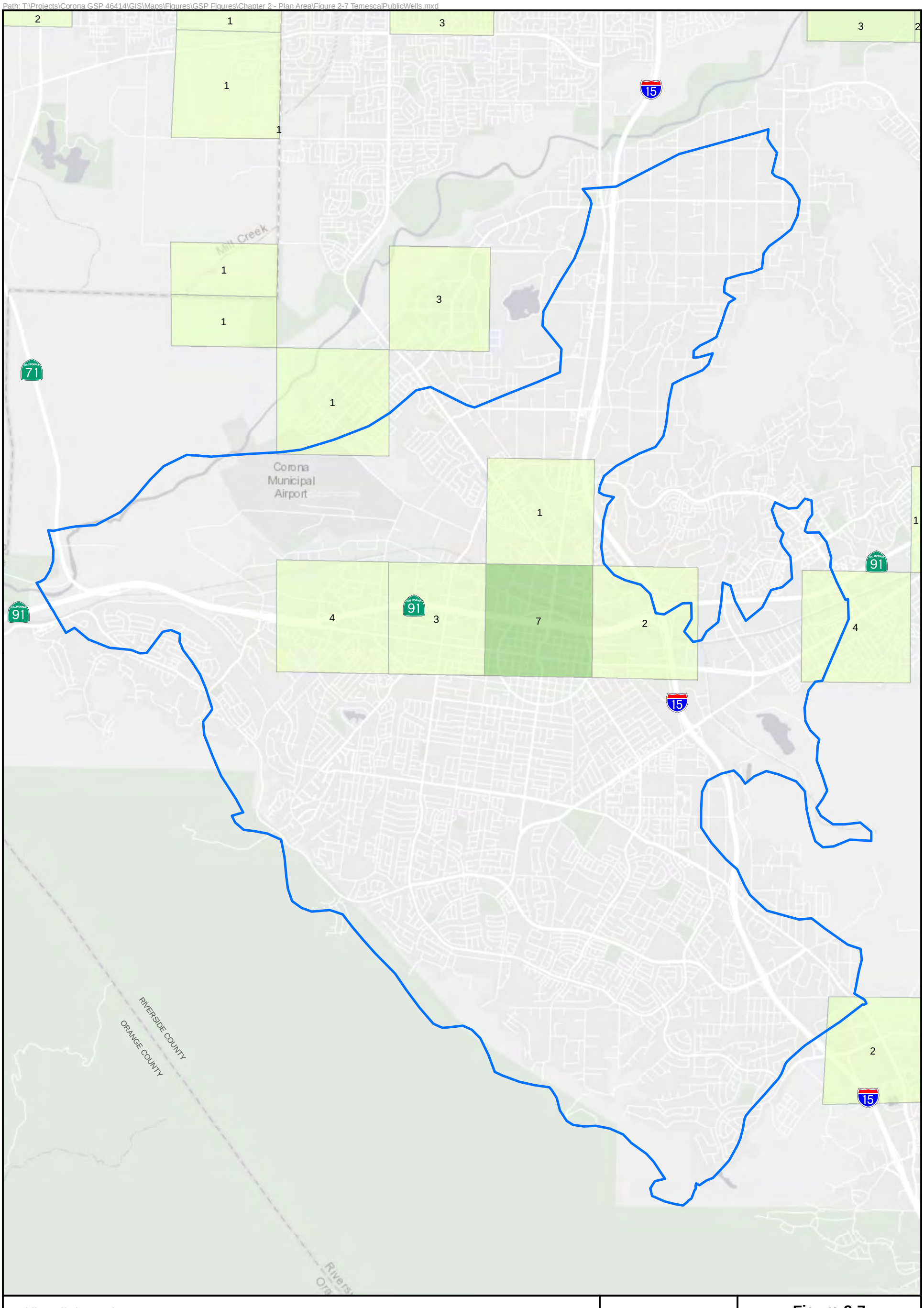
Miles

Figure 2-6
Basin Production Groundwater Wells

carollo
Engineers...Working Wonders With Water®

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-7 TemescalPublicWells.mxd



Public Wells by Section

- 1 - 5
- 6 - 10
- 11 - 15
- 16 - 20
- Temescal Basin

Data Sources:
Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset

Disclaimer:
Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

N

0 0.5 1

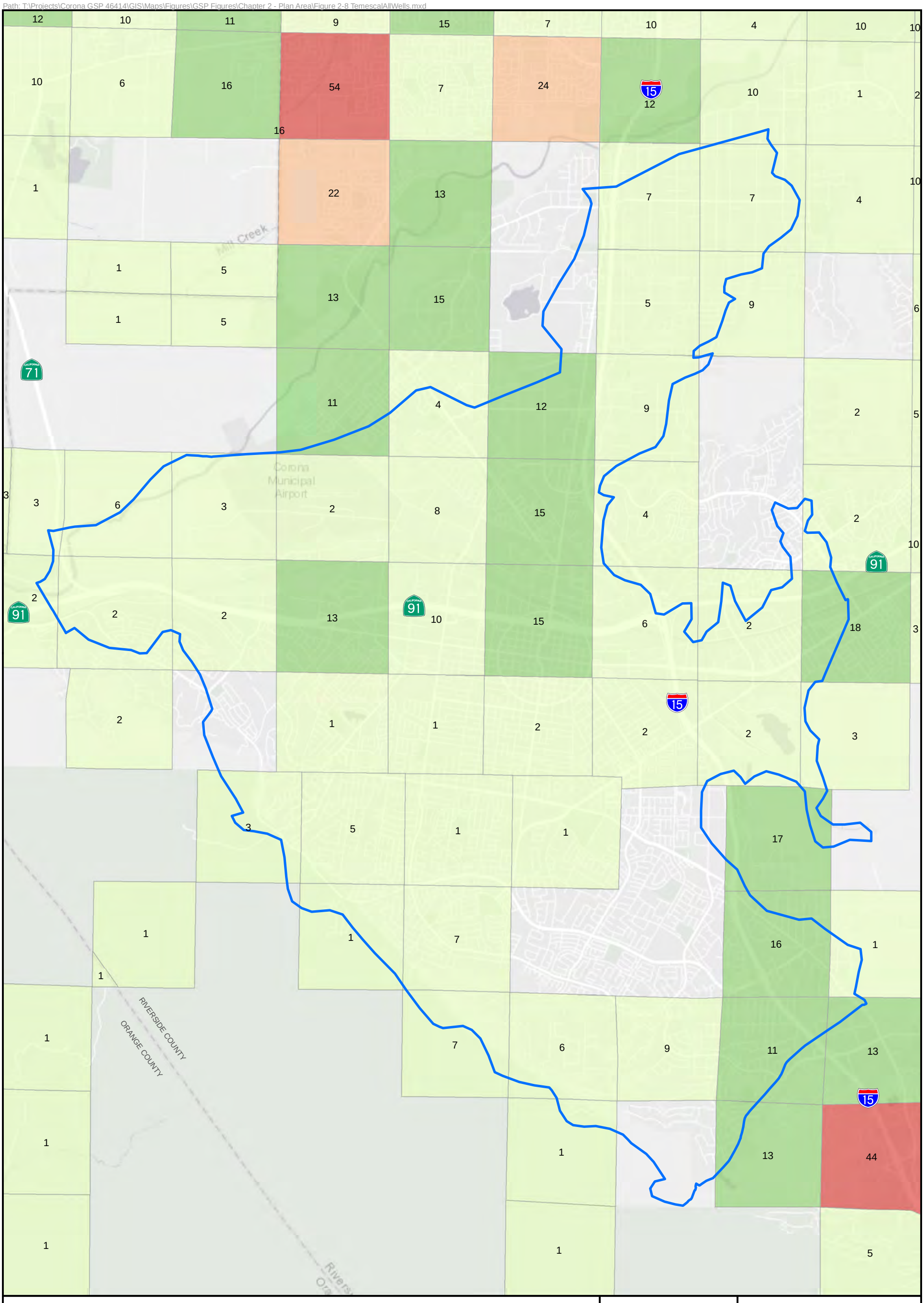
Miles

Figure 2-7
Basin Public Groundwater Wells

carollo
Engineers...Working Wonders With Water®

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-8 TemescalAllWells.mxd



All Wells by Section

- 1 - 10
- 11 - 20
- 21 - 40
- 41 - 80
- Temescal Basin

Data Sources:
Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset

Disclaimer:
Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

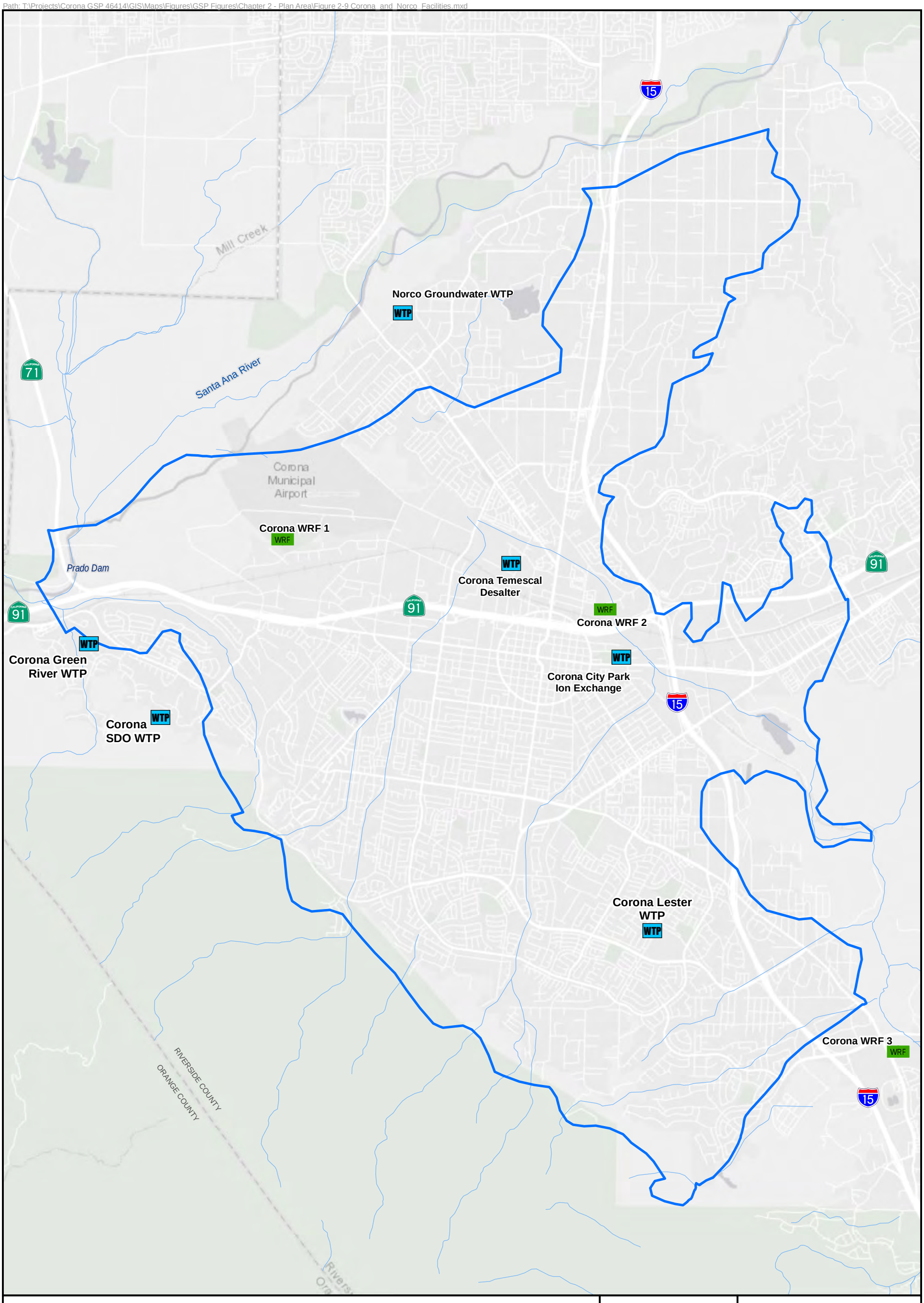
N

0 0.5 1
Miles

Figure 2-8
All Basin Groundwater Wells

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-9 Corona_and_Norco_Facilities.mxd



WTP Water Treatment Plant

WRF Water Reclamation Facility

Temescal Basin

Data Sources:
Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset, SAWPA

Disclaimer:
Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

N

0 0.5 1

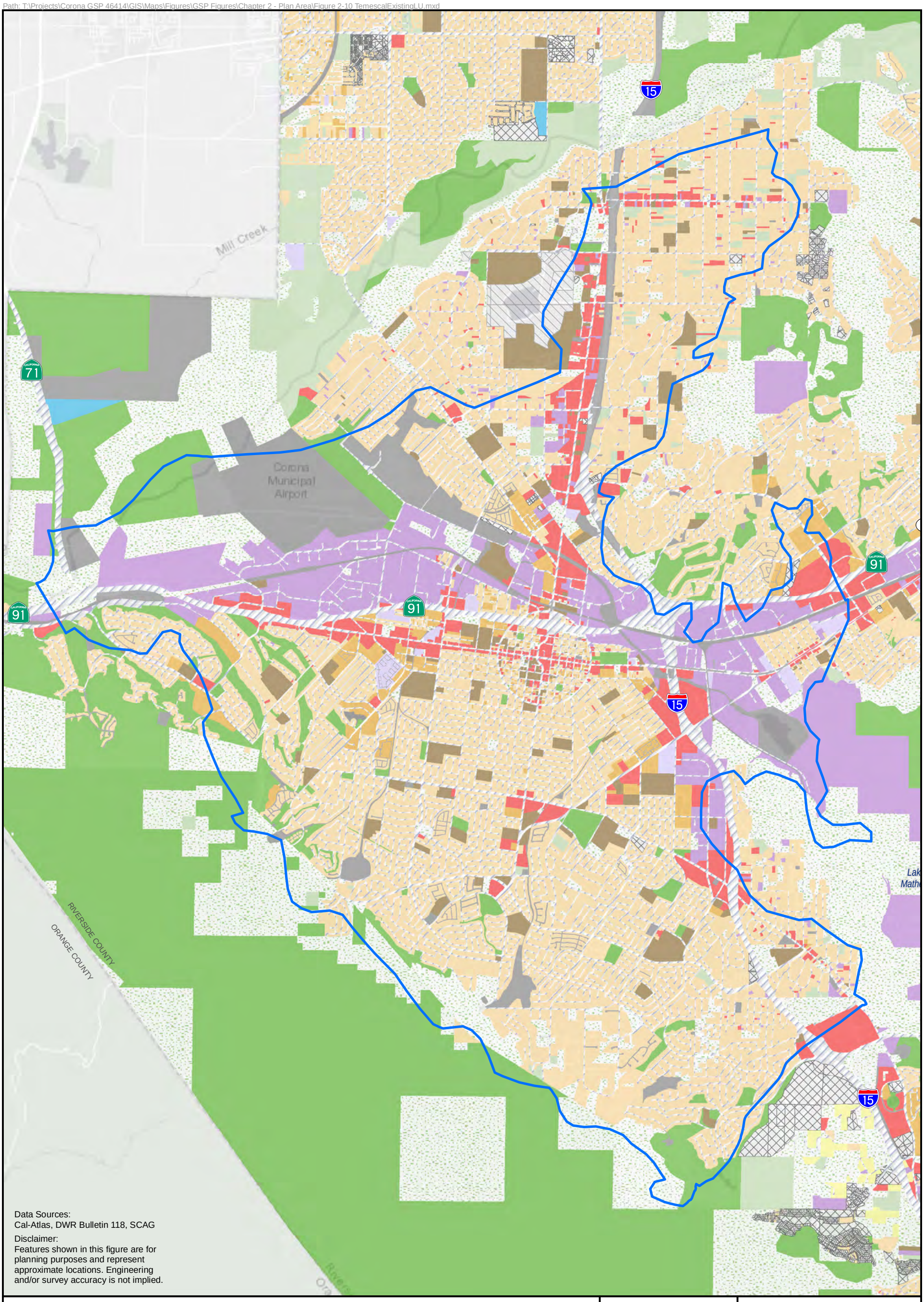
Miles

Figure 2-9
Corona and Norco Facilities

carollo
Engineers...Working Wonders With Water®

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-10 TemescalExistingLU.mxd



- Agriculture
- Commercial
- Industrial
- Military Installations
- Mixed Residential; Mixed Use
- Mobile Homes and Trailer Parks
- Multi-Family Residential
- Open Space/Recreation
- Public
- Rural Residential
- Single Family Residential
- Specific Plan
- Transportation/Utilities
- Undevelopable/Protected
- Under Construction
- Unknown
- Vacant
- Water
- Temescal Basin

N

0 0.5 1
Miles

Figure 2-10
Existing Land Use

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-11 Temescal_LU_1984.mxd

Mill Creek

Corona Municipal Airport

RIVERSIDE COUNTY

ORANGE COUNTY

Data Sources:
DWR Bulletin 118, FMMP

Disclaimer:
Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

- Urban
- Grazing Land
- Agricultural Areas
- Water
- Native
- Temescal Basin

N

0 0.5 1

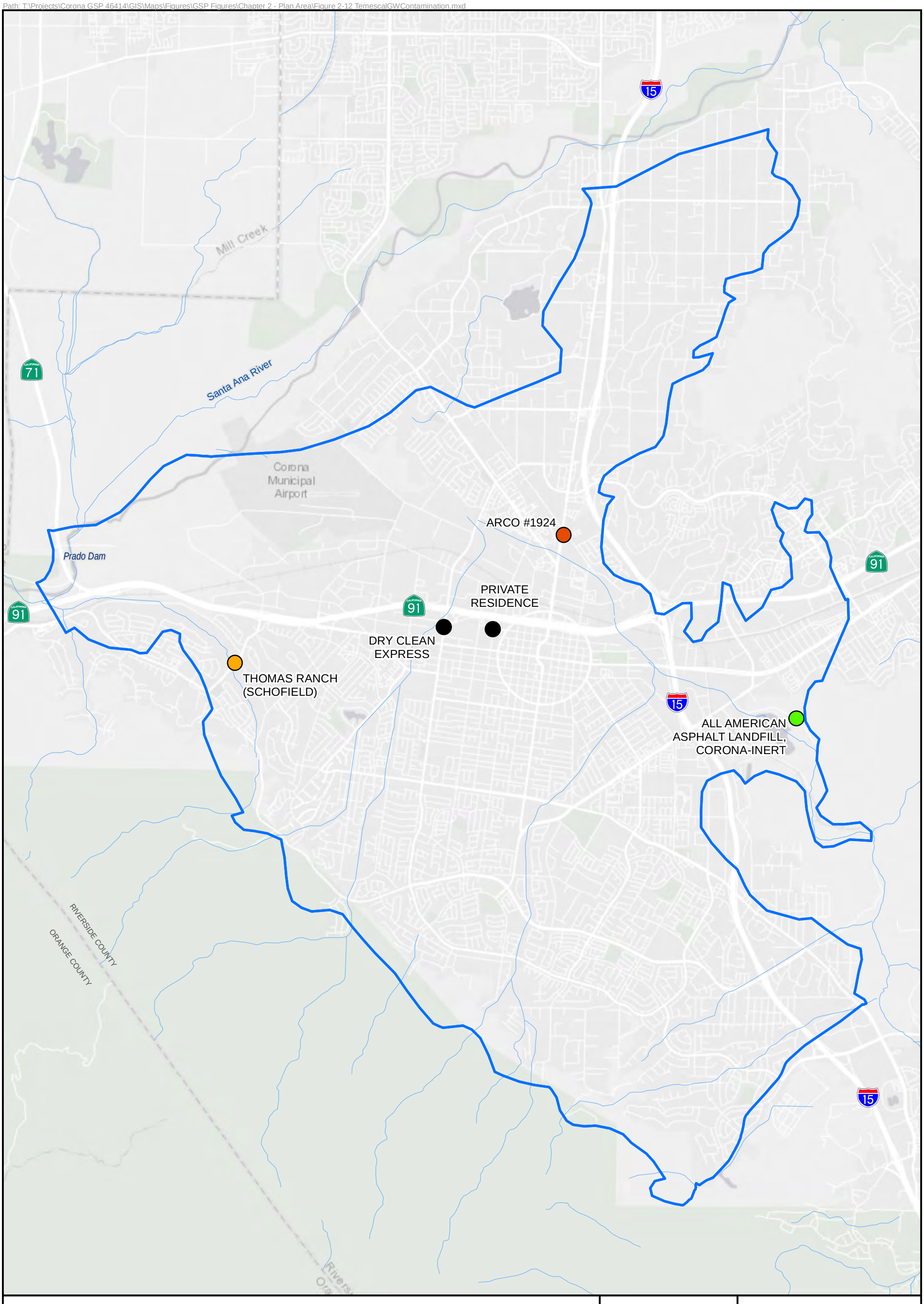
Miles

Figure 2-11
1984 Land Use

carollo
Engineers...Working Wonders With Water®

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-12 TemescalGWContamination.mxd



Open - Eligible for Closure
Open - Inactive
Open - Operating
Open - Site Assessment
Temescal Basin

Data Sources:
Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset, CA GeoTracker

Disclaimer:
Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

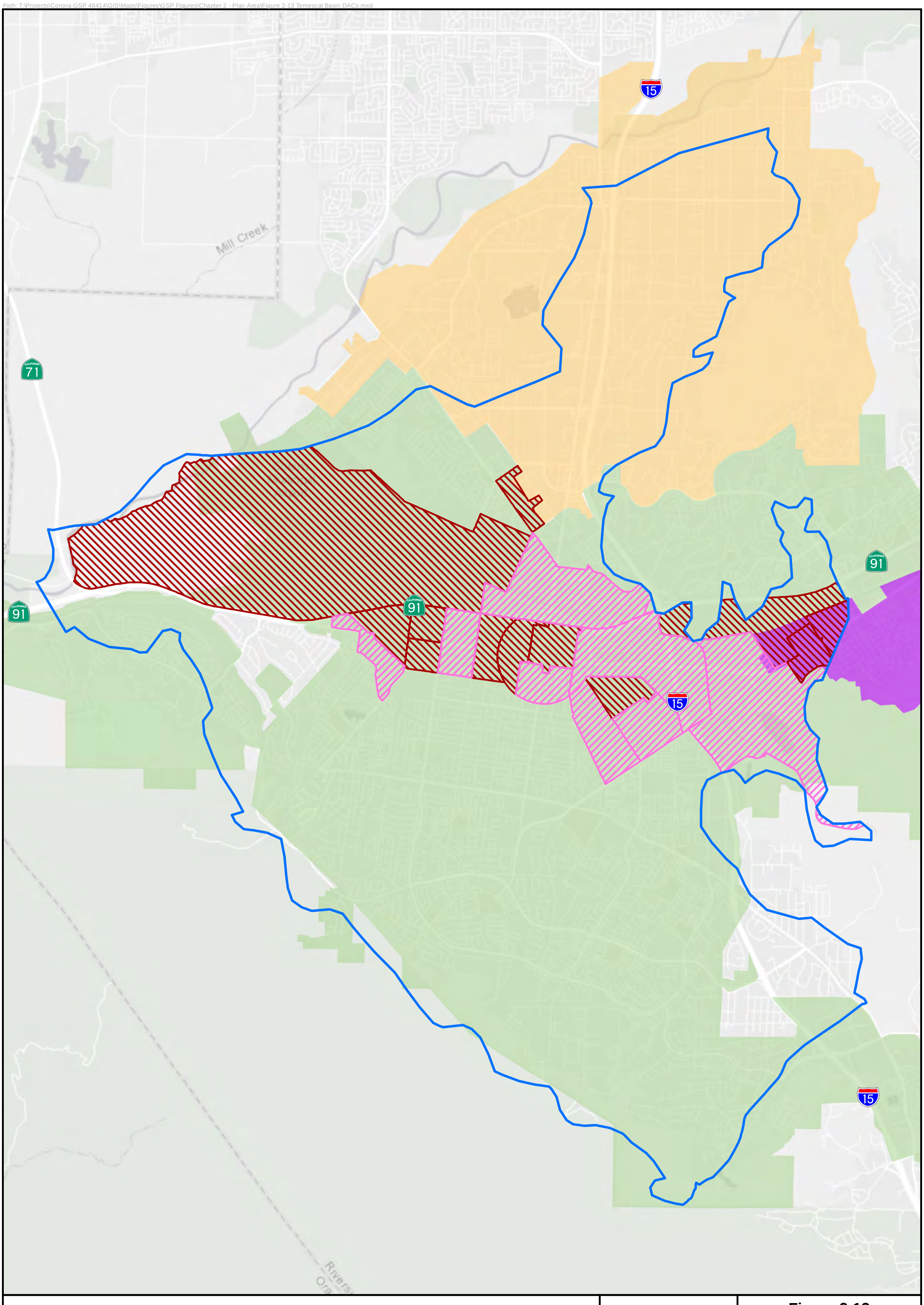
N

0 0.5 1
Miles

Figure 2-12
Groundwater Contamination Sites

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 2 - Plan Area\Figure 2-13 Temescal Basin DACs.mxd



Disadvantaged Community
Severely Disadvantaged Community
City of Corona
City of Norco
Home Gardens County Water District
Temescal Basin
Temescal Basin

N

0 0.5 1
Miles

Figure 2-13
Disadvantaged and Severely Disadvantaged Communities

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER

3. HYDROGEOLOGICAL CONCEPTUAL MODEL

This chapter describes the hydrogeologic conceptual model of the Temescal Subbasin (Basin) of the Upper Santa Ana Groundwater Basin, including the Basin boundaries, geologic formations and structures, and principal aquifer units. The chapter also discusses groundwater recharge and discharge areas. The hydrogeologic conceptual model presented here is a summary of relevant and important aspects of the Basin hydrogeology that influence groundwater sustainability. While the Chapter 1 Introduction and Chapter 2 Plan Area establish the institutional framework for sustainable management in the Groundwater Sustainability Plan (GSP), this chapter, along with Chapter 4 Groundwater Conditions and Chapter 5 Water Budget, sets the physical framework.

The hydrogeologic conceptual model and basin conditions description document the Basin's hydrogeology as the technical foundation for management. Later sections addressing the water budget and sustainability criteria will refer to and rely on the technical material contained here.

3.1. PHYSICAL SETTING AND TOPOGRAPHY

The Temescal Basin as defined by the California Department of Water Resources (DWR) is bounded on the west by the Santa Ana Mountains and the east by low-lying El Sobrante de San Jacinto and La Sierra hills. **Figure 3-1** illustrates the topography of the Basin.

The Basin is connected to three adjacent groundwater basins, the Chino and Riverside-Arlington Subbasins of the Upper Santa Ana Groundwater Basin and the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin. The boundary with the Chino Subbasin (DWR Basin No. 8-2.01) to the north is generally marked by the Santa Ana River and a series of low-lying hills in the Norco area. The Basin is connected to the Riverside-Arlington Subbasin (DWR Basin No. 8-2.03) in a narrow valley groundwater restriction between the El Sobrante de San Jacinto and La Sierra hills, referred to as the Arlington Gap. Groundwater flows into the Basin from the Riverside-Arlington Subbasin through the Arlington Gap. The southern boundary of the Basin is located at the Bedford Canyon where it connects with the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin (DWR Basin No. 8-4).

The floor of Basin slopes from about 1,500 feet above mean sea level (msl) along the base of the Santa Ana Mountains in the southwest to about 500 feet msl in the northwest. The ground surface elevation in the city center is about 650 feet msl. In the southeast where the Temescal Wash enters the Basin from the Bedford-Coldwater Subbasin, the ground surface elevation is approximately 850 feet msl (**Figure 3-1**).

The Basin receives runoff and recharge from over 8,000 acres of uplands in the adjacent Santa Ana Mountains. Watersheds contributing runoff from the east are almost as large but contribute less runoff because of lower elevations and corresponding precipitation.

3.2. SURFACE WATER FEATURES

The Basin includes a portion of the Santa Ana River watershed and a main tributary to the Santa Ana River, Temescal Wash, which flows through the Basin from the southeast to northwest. Surface water in the Basin originates as runoff from undeveloped tributary watersheds on the eastern slopes of the Santa Ana Mountains, wastewater treatment plant discharges, urban runoff within the Basin, flow in Temescal Wash, and flow in the Santa Ana River where it arrives at the Prado (flood control) Basin. Temescal Wash originates at Lake Elsinore, 17 miles upstream of the Basin and passes from south to north through the Bedford-Coldwater Subbasin and then through the Basin before discharging into the Prado Basin wetlands. This waterway is ephemeral and dry much of the year, flowing mainly during the winter. Tributary streams in the Santa Ana Mountains adjacent to the west side of the Basin flow primarily in response to rainstorm events, with limited base flow that enters groundwater where streams enter the Basin.

Figure 3-2 shows surface water features including rivers, streams, lakes, and ponds. The sub-watersheds that drain into and through the Basin are shown on **Figure 3-3**.

3.3. SOILS

Characteristics of soils are important factors in natural and managed groundwater infiltration (recharge) and are therefore an important component of a hydrogeologic system. Soil hydrologic group data from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (NRCS 2020) are shown on **Figure 3-4**. The soil hydrologic group is an assessment of soil infiltration rates determined by the water transmitting properties of the soil, which include hydraulic conductivity and percentage of clays in the soil, relative to sands and gravels. The groups are defined as:

- Group A – High Infiltration Rate: water is transmitted freely through the soil; soils typically less than 10 percent clay and more than 90 percent sand or gravel.
- Group B – Moderate Infiltration Rate: water transmission through the soil is unimpeded; soils typically have between 10 and 20 percent clay and 50 to 90 percent sand.
- Group C – Slow Infiltration Rate: water transmission through the soil is somewhat restricted; soils typically have between 20 and 40 percent clay and less than 50 percent sand.
- Group D – Very Slow Infiltration Rate: water movement through the soil is restricted or very restricted; soils typically have greater than 40 percent clay, less than 50 percent sand.

The hydrologic group of the soil generally correlates with the potential for infiltration of water to the subsurface. However, a correlation does not necessarily exist between the soils at the ground surface and underlying geology or hydrogeology.

3.4. GEOLOGIC SETTING

The Basin is located within one of the structural blocks of the Peninsular Ranges of Southern California. The Basin occurs in a linear low-lying block, referred to as the Elsinore-Temecula trough, between the Santa Ana Mountains on the west and the Perris Plain on the east (Todd and AKM 2008). The trough extends from the City of Corona (Corona) to the southeast some 30 miles and was formed along an extensive northwest-southeast trending fault zone including the Elsinore, Chino, and related faults. The Elsinore and Chino fault zones bound the Basin on the west and trend along the mountain fronts. The surficial geology and the surrounding area are shown on **Figure 3-5**.

The oldest rocks in the Basin crop out in the Santa Ana Mountains. These uplands are composed principally of volcanic (including the Santiago Peak Volcanics) and metamorphic rocks (including the Bedford Canyon Formation) of Jurassic and Cretaceous age. A thin rim of younger sedimentary units of Tertiary age crops out along the mountain front generally lying between the Elsinore and Chino faults. This zone of sedimentary units broadens to the north and contains numerous mapped formations of Cretaceous and Tertiary age. The northeastern side of the valley is flanked primarily by granitic rocks of Cretaceous age. Erosion of these units has filled in the trough over time resulting in quaternary-age alluvial fan, channel, and other deposits making up the permeable portions of the Basin (USGS 2004 and 2006).

The geologic map on **Figure 3-5** shows the distribution of these units in the Basin (USGS 2004 and 2006). The main surficial deposits on the floor of the Basin include younger and older alluvial fans deposited from the erosion of volcanic rocks and Bedford Canyon Formation to the west. These units prograde across the Basin to the northeast and are truncated by channel deposits along Temescal Wash.

3.5. FAULTS

The Basin was formed along an extensive northwest-southeast trending fault zone including the Elsinore, Chino, and related faults. The Elsinore and Chino fault zones bound the Basin on the west and trend along the mountain fronts. Fault locations and orientations are shown on **Figure 3-5.**

3.6. AQUIFERS

The basin-fill alluvial deposits and, to some extent, the underlying sedimentary units make up the aquifers in the Basin. However, these deposits do not fall neatly into two categories of permeability, such as bedrock and basin fill. Aquifer packages composed of various geologic units have been defined based on depositional environment, degree of consolidation, groundwater production, and location throughout the Basin.

Three aquifer packages provide water supply to wells in Basin: the Channel Aquifer, the Alluvial Fan aquifers, and, to a lesser extent, consolidated sandstone aquifers (Todd and AKM 2008). Of these three aquifers, only the Channel Aquifer is a principal aquifer as it is the most productive aquifer and provides most of the groundwater supply in the Basin. The

Alluvial Fan and consolidated sandstone are secondary aquifers with limited production capacity and historical use. These aquifers meet one another in multiple areas throughout the Basin along erosional and depositional contacts. These contacts are permeable, and the aquifers are hydraulically connected. The geometry of these aquifers within the Basin are shown in cross sections presented on **Figures 3-6** through **3-9**. The thicknesses of these units vary significantly across the Basin, as indicated in the cross sections.

3.6.1. Description of Principal Aquifer Units

The Channel Aquifer is the principal aquifer in the Basin. This aquifer is a package of relatively homogeneous and highly permeable sands up to 200 feet thick that have been encountered in many of the Corona wells in the northern half of Basin. This sand package is interpreted as channel deposits of an ancestral arm of the Santa Ana River and, as such, has been referred to as the Channel Aquifer (Todd and AKM 2008). The alignment of the aquifer suggests that an ancestral river channel had entered the Basin at Arlington Gap, eroding the sedimentary units and possibly older alluvial fan deposits in the area. Permeable channel sands were deposited in the eroded channel over time. From the Arlington Gap, the Channel Aquifer trends northwest toward Prado Dam.

The orientation of The Channel Aquifer is illustrated on cross sections A to A', B to B', and C to C' on **Figures 3-7, 3-8,** and **3-9**, respectively (Todd and AKM 2008). Cross Section A to A' extends from the Santa Ana Mountains to the northeast across Temescal Wash to the bedrock high in the northeast. As shown on the section, the Channel Aquifer occurs in the northeastern portion of the Basin and has a saturated thickness that ranges from 125 to 150 feet along this section. As illustrated on the section, Channel Aquifer sediments lie directly above granitic bedrock beneath Temescal Wash and above the Sandstone Aquifer in other areas (**Figure 3-7**).

The Channel Aquifer at Arlington Gap is shown on Cross Section B to B' (**Figure 3-8**). Here the saturated thickness is approximately 200 feet and well data indicate a thick and permeable sand package. The Channel Aquifer is underlain by the Sandstone Aquifer throughout most of this area.

Cross-section C to C' is located north of A-A' and extends from the Santa Ana Mountains through the Norco area (**Figure 3-9**). The Channel Aquifer is shown on the western side of the section southeast of the Prado Management Area. Similar to Cross Section A-A', the saturated thickness of the Channel Aquifer is about 100 to 150 feet thick. The cross section also shows the absence of the Channel Aquifer in the Norco area and illustrates the shallow depth to bedrock there (generally less than 100 feet). The saturated thickness of alluvial sediments in Norco is generally less than 50 feet. Also indicated on the section is a groundwater divide in the Norco area (near Well 53-499) indicating possible groundwater outflow from the Norco area to the Santa Ana River (**Figure 3-9**).

Figure 3-10 shows estimated values of hydraulic conductivity (K) derived from test data on driller's logs and/or Corona well aquifer testing data and the aerial extents of the Channel Aquifer. The K value is an indicator of the aquifer's permeability and is expressed in gallons per day per square foot (gpd/ft^2) or feet per day (ft/day). As shown on **Figure 3-10**, the wells

within the limits of the Channel Aquifer have the highest hydraulic conductivity values in the Basin. The lower K values shown within the extent of the Channel Aquifer area on **Figure 3-10** are generally from deeper wells tapping the underlying Sandstone Aquifer. The average K value of City of Corona production wells screened solely in the Channel Aquifer (Wells 7A, 8A, 9A, 17, 25, and 28) is 2,062 gpd/ft^2 (276 ft/day) (Todd and AKM 2008).

The Channel Aquifer adjoins the secondary aquifers described below as shown in the cross sections on **Figures 3-7** through **3-9** and the map on **Figure 3-10**. These adjoining aquifers do have hydraulic connection and there is groundwater flow between the aquifers where they meet.

3.6.1.1. Secondary Aquifers

The recent alluvial fan aquifers and sandstone aquifer are also present within the Basin and have historically been used to a lesser extent than the principal aquifer. These secondary aquifers are described below.

3.6.1.1.1. Alluvial Fan Aquifers

Both older and recent alluvial fans have been deposited through time along the mountain front on the western edge of the Basin. These fans have prograded across the Basin from west to east (**Figure 3-5**). Although these deposits are relatively thick, the entire unit is heterogeneous and cannot be considered one single aquifer. Rather, sand lenses within the deposits collectively form the Alluvial Fan Aquifers. Lithologic data from wells are insufficient to map out the extent of the aquifers or characterize the deposits. Limited data indicate relatively fine-grained textures throughout much of the area, especially with depth (Todd and AKM 2008).

The geometry of these units in the subsurface, including the contact with the Channel Aquifer, is illustrated on Cross Section A to A' on **Figure 3-7**. The section illustrates the alluvial fan deposits that have infilled the Basin. The fans have prograded across the Basin and a thin veneer of these deposits likely overlies the Channel Aquifer at the surface (not shown on the section). Wells that penetrate the entire thickness of the Channel Aquifer in the east do not appear to encounter alluvial fan deposits on top of the Sandstone Aquifer. The total thickness of the deposits is unknown but appears to exceed 1,400 feet in the central Basin.

Only limited data exist for estimating K values in the alluvial fan deposits of Basin. Sparse data from a few wells indicate a K value of generally less than 50 gpd/ft^2 in the Alluvial Fan Aquifers and in the Norco area (**Figure 3-10**). Specific capacity data from a City of Corona production well (Well 27) drilled in the Alluvial Fan, indicated a lower K value of about 7 ft/day (PBS&J 2004).

3.6.1.1.2. Sandstone Aquifer

Some of the sedimentary units underlying the alluvial Basin provide sufficient well yields to categorize them as aquifers. Although generally grouped with other bedrock units, the subsurface sedimentary rocks of Tertiary age in the northeast Basin area contain sandstone layers that are screened in several Corona wells. The estimated K value is 22 gpd/ft^2 (3 ft/day) for one Corona production well (Well 24) screened solely in the Sandstone Aquifer

(below the Channel Aquifer) (Todd and AKM 2008). Due to the limited production, small areal extent, increasing depths, and relatively low permeability in most areas, the Sandstone Aquifer is not considered a primary source of water supply.

3.6.2. Description of Lateral Boundaries

The lateral boundaries of the Basin are formed by contacts with bedrock units and borders with neighboring basins. The entire western Basin boundary and much of the eastern boundary of the Basin are contacts between Basin sedimentary units and upland bedrock outcrops. Along the north, the Basin is bounded by the contact with the Chino Subbasin, which is generally marked by the Santa Ana River and a series of low-lying hills in the Norco area. The boundary between the Basin and the Riverside-Arlington Subbasin is in the Arlington Gap and there is some flow into the Basin through this boundary. The southern boundary of the Basin is located at the Bedford Canyon where it connects with the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin.

Within the Basin the Channel Aquifer is bounded by its physical extents which are controlled by erosion and deposition. Near the Temescal Wash, an unnamed fault truncates the Channel Aquifer with an indeterminate amount of offset. The lateral extents of the Channel Aquifer are shown on **Figure 3-10**.

3.7. STRUCTURES AFFECTING GROUNDWATER

The Basin is defined by the lateral extents of the alluvial material described above. This material is bounded by bedrock in the Santa Ana Mountain on the west and the Peninsular Ranges to the east. The southern and northern boundaries of the Basin are formed by areas of thin alluvial material over shallow bedrock in narrow valleys (Todd and AKM 2008 and WEI 2015). A topographic rise in the subsurface bedrock appears to make a groundwater divided in the Norco area. The units in the Basin are also truncated by an inferred unnamed fault as part of the Elsinore and Chino fault zone along the base of the Santa Ana Mountains. The location and effect of the Elsinore and Chino fault zone on the units of the Basin are shown on cross sections on **Figures 3-6** through **3-9**.

3.8. DEFINABLE BASIN BOTTOM

The Basin bottom is defined by bedrock, which is shallow around the perimeter and deep in the center, as shown on **Figure 3-11**. Depth to bedrock ranges in depth from 10 feet to approximately over 1,000 feet (Todd and AKM 2008 and WEI 2015). The depth to the bottom of the alluvial materials in the Basin and the contact with the bedrock bottom of the Basin are shown in the contours presented in **Figure 3-11**.

The thickest portion of the alluvial Basin (the deepest depth to bedrock) occurs in the central-west portions of the Basin as seen on **Figure 3-7**. The formation of a trough along the Elsinore and Chino fault zone is indicated by the asymmetric basin geometry. Unconsolidated sediments are estimated to be more than 1,000 feet thick in this area.

Bedrock is much shallower in the eastern portion of the Basin, however there is a slight deepening near the Arlington Gap, as indicated on **Figure 3-8**. Here, unconsolidated sediments are approximately 250 feet thick. This area is interpreted to have been eroded by a branch of the ancestral Santa Ana River, accounting for the depth. Sediments throughout the northern portion of the Basin, including in the Norco area, are about 100 feet thick as shown on **Figure 3-8**. Outcropping bedrock in the northern and eastern portions of the Basin is further evidence of the thin alluvial sediments.

3.9. RECHARGE AND DISCHARGE AREAS

Recharge to the Basin occurs primarily from wastewater discharge and subsurface inflow from outside the Basin, and to a lesser extent from deep percolation of precipitation, urban return flows, and infiltration of agriculture irrigation runoff as shown in **Figure 3-12**.

Discharge from wastewater treatment and subsurface inflow are the largest inflows to the Basin. Recharge associated with wastewater occurs when treated wastewater is discharged to ponds. Subsurface inflow occurs along the Basin boundaries and is a significant source of recharge to the Basin (Todd and AKM 2008).

Deep percolation of precipitation is the process by which precipitation enters groundwater. Recharge to groundwater from deep percolation occurs throughout the Basin (Todd and AKM 2008). To a more limited extent, Basin recharge comes from the infiltration of runoff from precipitation in the Santa Ana Mountains west of the Basin and the Peninsular Ranges east of the Basin. Large amounts of runoff from the mountains flows into channels and the shallow subsurface at the edges of the Basin and then into and through the Basin. The amount of water available for recharge varies annually with changes in rainfall and runoff. Runoff into the Basin is subject to evapotranspiration, infiltration, and continued surface flow to and in the Temescal Wash. The watersheds contributing to the Basin include multiple drainages, all of which flow across the Basin in generally east-west orientations. Wet years generate large amounts of water that exceed the recharge capacity of the Basin (Todd and AKM 2008).

Return flows are those portions of applied water (e.g., landscape irrigation) that are not consumed by evapotranspiration and hence return to the groundwater system through deep percolation or infiltration. Return flows associated with urban, industrial, and agricultural water uses all have the potential to contribute to recharge to the Basin (Todd and AKM 2008).

Discharge from the Basin is primarily from groundwater pumping. A significant discharge also occurs to the Santa Ana River near the Prado Management Area (Todd and AKM 2008).

3.10. PRIMARY GROUNDWATER USES

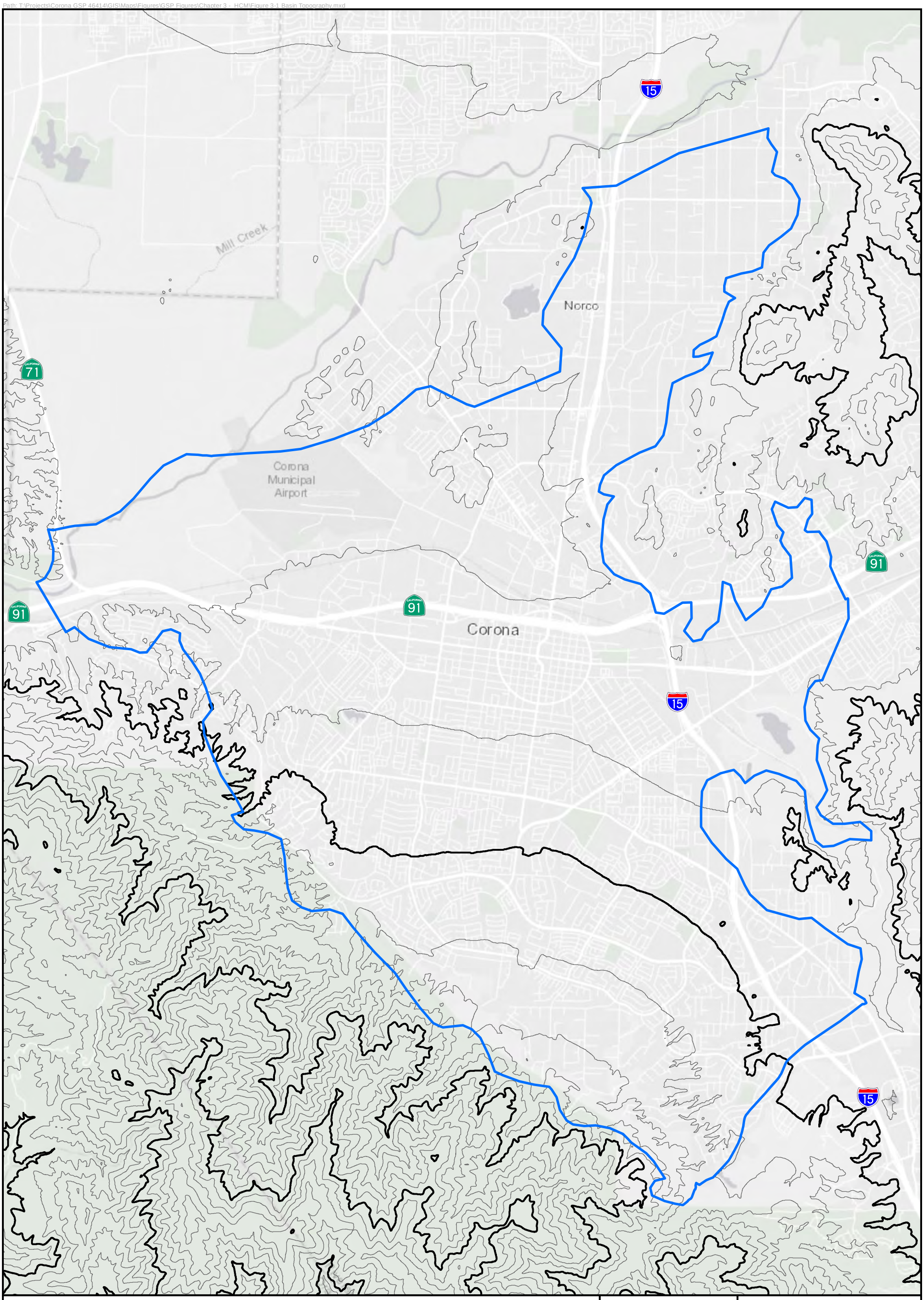
The primary groundwater uses from both the principal and secondary aquifers in the Basin include municipal, rural residential, small community water systems, and small commercial uses. Groundwater pumped from the Basin aquifers supplies water for urban, agricultural,

and industrial uses. Municipal uses account for most of this groundwater production. Groundwater pumping also represents most of the outflow from the Basin.

3.11. DATA GAPS IN THE HYDROGEOLOGIC CONCEPTUAL MODEL

The hydrogeologic conceptual model has not identified data gaps in available information.

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 3 - HCM\Figure 3-1 Basin Topography.mxd



200 foot Ground Surface Elevation Contour

1,000 foot Ground Surface Elevation Contour

Temescal Basin

N

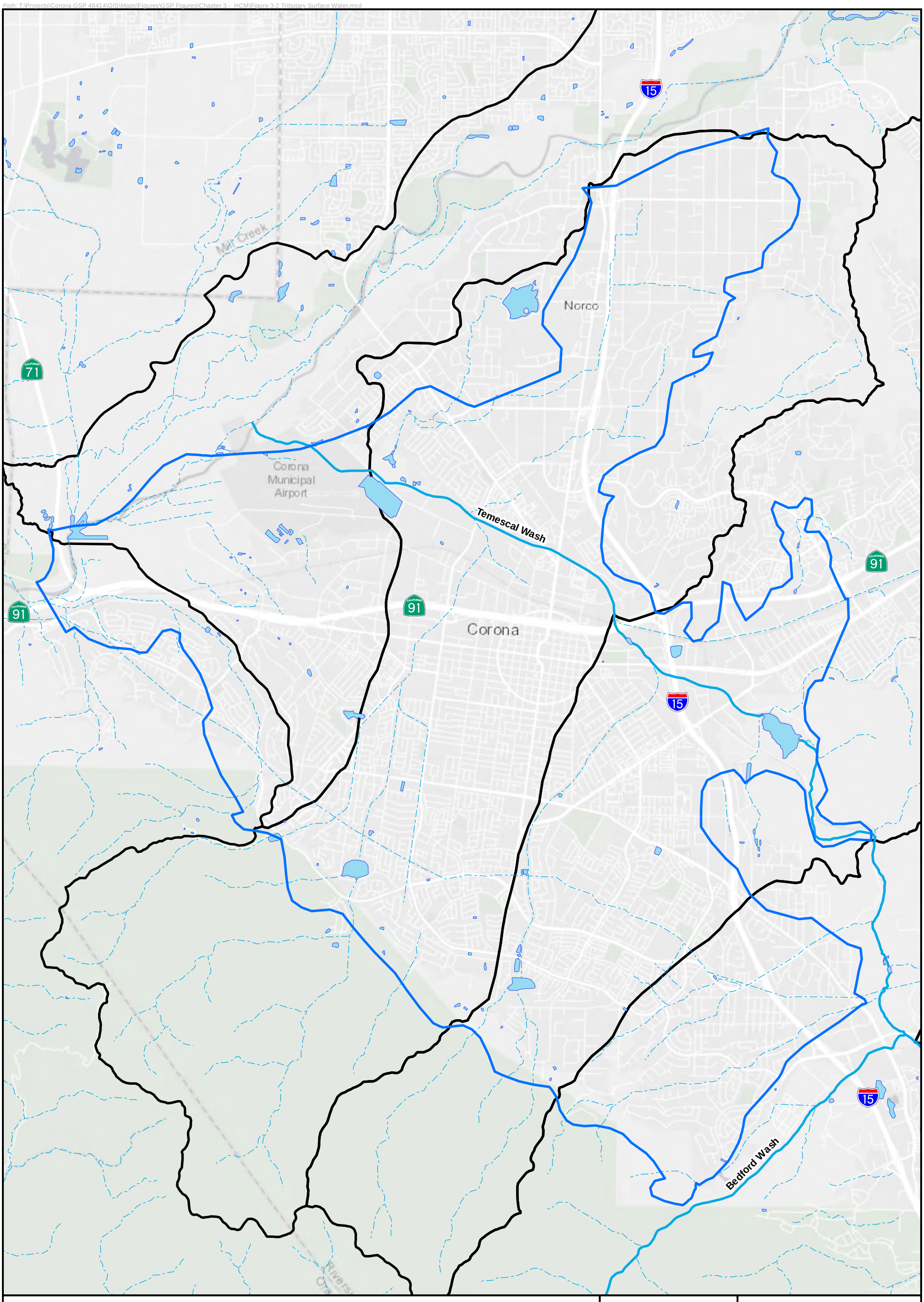
0 0.5 1

Miles

Figure 3-1
Basin Topography

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 3 - HCM\Figure 3-2 Tributary Surface Water.mxd



Minor Streams
Major Streams
Lake or Pond
Reservoir
Tributary Watershed Boundaries
Temescal Basin

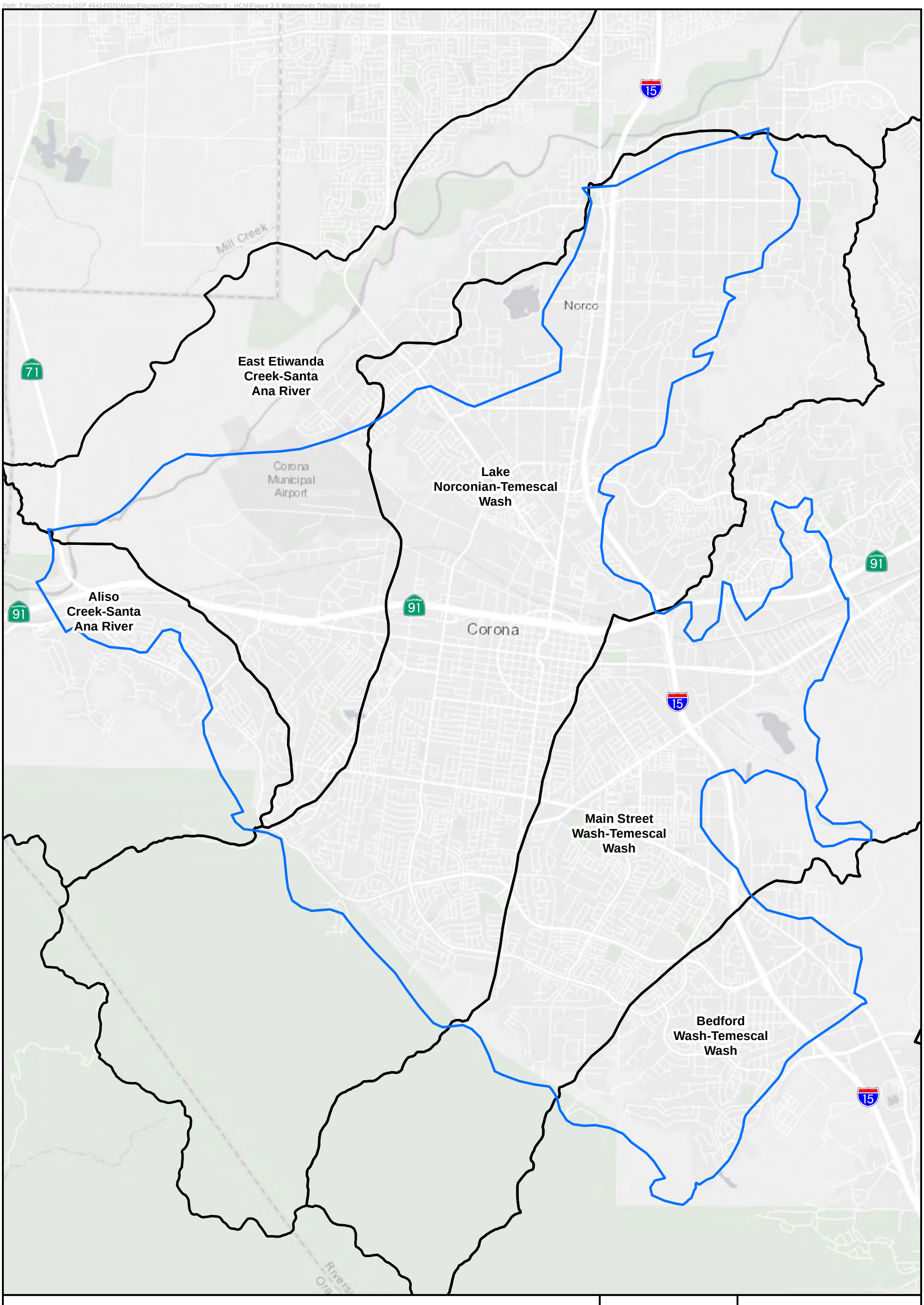
N

0 0.5 1
Miles

Figure 3-2
Tributary Surface Water in Basin

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 3 - HCM\Figure 3-3 Watersheds Tributary to Basin.mxd



Tributary Watershed Boundaries

Temescal Basin

N

0 0.5 1

Miles

Figure 3-3
Watersheds Tributary to Basin

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 3 - HCM\Figure 3-4 Basin Soil Hydrologic Properties.mxd



A: High Infiltration Rate
B: Moderate Infiltration Rate
C: Slow Infiltration Rate
D: Very Slow Infiltration Rate
No Data
Temescal Basin

N

0 0.5 1
Miles

Figure 3-4
Basin Soil
Hydrologic Properties

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 3 - HCM\Figure 3-5 Surficial Geology.mxd

Legend

- Fault Location, dashed where uncertain
- Temescal Basin

0 0.5 1 Miles

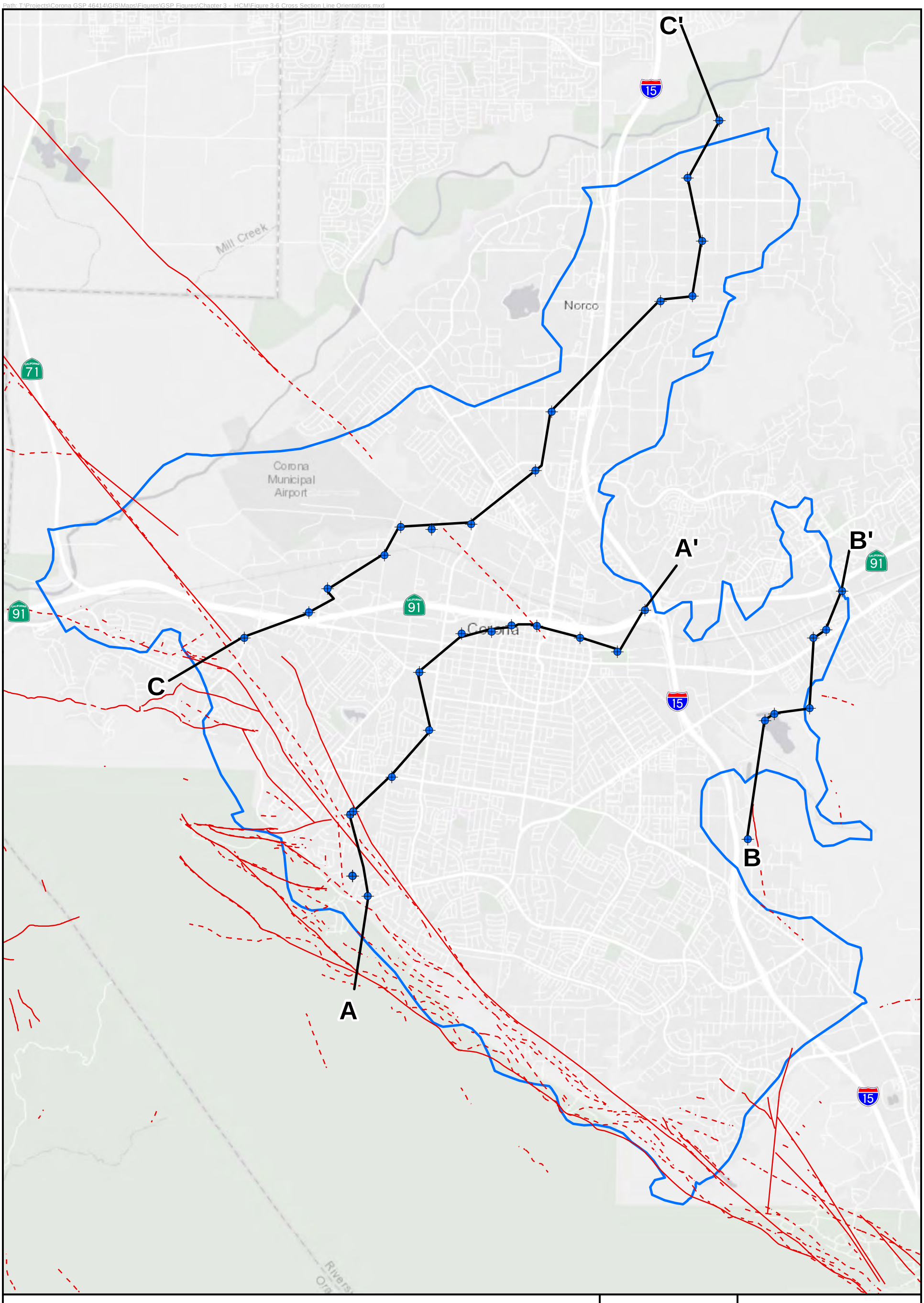
N

- Qaf, Artificial fill
- Qw, Very young wash deposits
- Qyw, Young wash deposits
- Qyf/Qyf1/Qyf3, Young alluvial-fan deposits; Qyf3
- Qya, Young axial-channel deposits
- Qyls, Young landslide deposits
- Qls/Qls, Landslide Deposit
- Qof, Old alluvial-fan deposits
- Qoa, Old axial-channel deposits
- Qow, Old wash deposits
- Qov, Old alluvial-valley deposits
- Qols, Old landslide deposits
- Qvof, Very old alluvial-fan deposits
- Qvoa, Very old axial-channel deposits
- QTc, Conglomerate of Riverside West 7.5 Quad
- QTt, Conglomerate of Temescal area
- QTn, Sedimentary rocks of Norco area
- QTs, Sedimentary rocks in Riverside and Corona areas
- Tch, Chino Hills, sandstone and conclomerate
- Tcga, Conglomerate of Arlington Mountain
- Tf, Fernando Formation
- Tns, Sandstone of Norco Area
- Tsa, Santiago Formation
- Tp/Tpsc/Tpsq/Tpy, Puente Formation; Tplv
- Tt, Topanga Group
- Tvs/Tvss, Vaqueros and Sespe Formations, undifferentiated
- Tsi, Silverado Formation
- Kc, Carbonate Silicate Rock
- Kcg/Kcgq/Kcto, Cajalco Pluton
- Kd, Diorite, undifferentiated
- Kgu, Granite, undifferentiated
- Kgb, Gabbro, undifferentiated
- Khg, Heterogeneous granitic rocks
- Kl/Klbc/Klhsc/Klhs, Ladd Formation
- Klst, La Sierra Tonalite
- Kmhg, Mount Hole Granodiorite
- Kmp/Kmpc, Micropegmatite
- Kqd, Quartz diorite
- Krg, Granite of Riverside area
- Ks, Serpentinite
- Kt, Tonalite, undifferentiated
- Ktr, Trabuco Formation
- Kvsp/Kvspi, Santiago Peak Volcanics
- Kvem/Kvs, Estelle Mountain volcanics of Herzig
- Kwl, Williams and Ladd Formations
- Kwps/Kwsr, Williams Formation
- Jbc, Bedford Canyon Formation
- Trmu, Rocks of Menifee Valley

Figure 3-5
Surficial Geology

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 3 - HCM\Figure 3-6 Cross Section Line Orientations.mxd



Wells on Cross Sections

Cross Section Line Orientation

Fault Location, dashed where uncertain

Temescal Basin

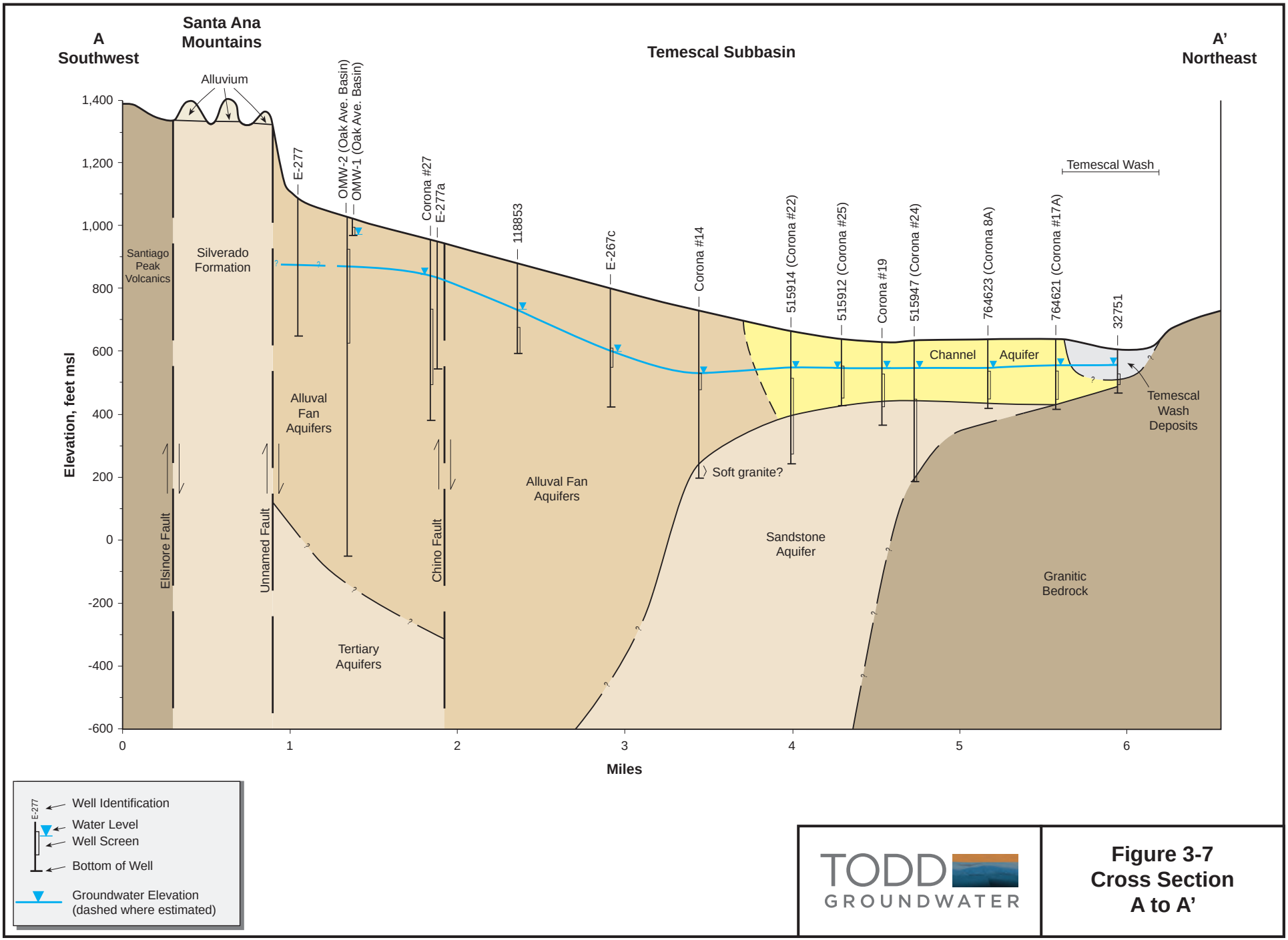
N

0 0.5 1

Miles

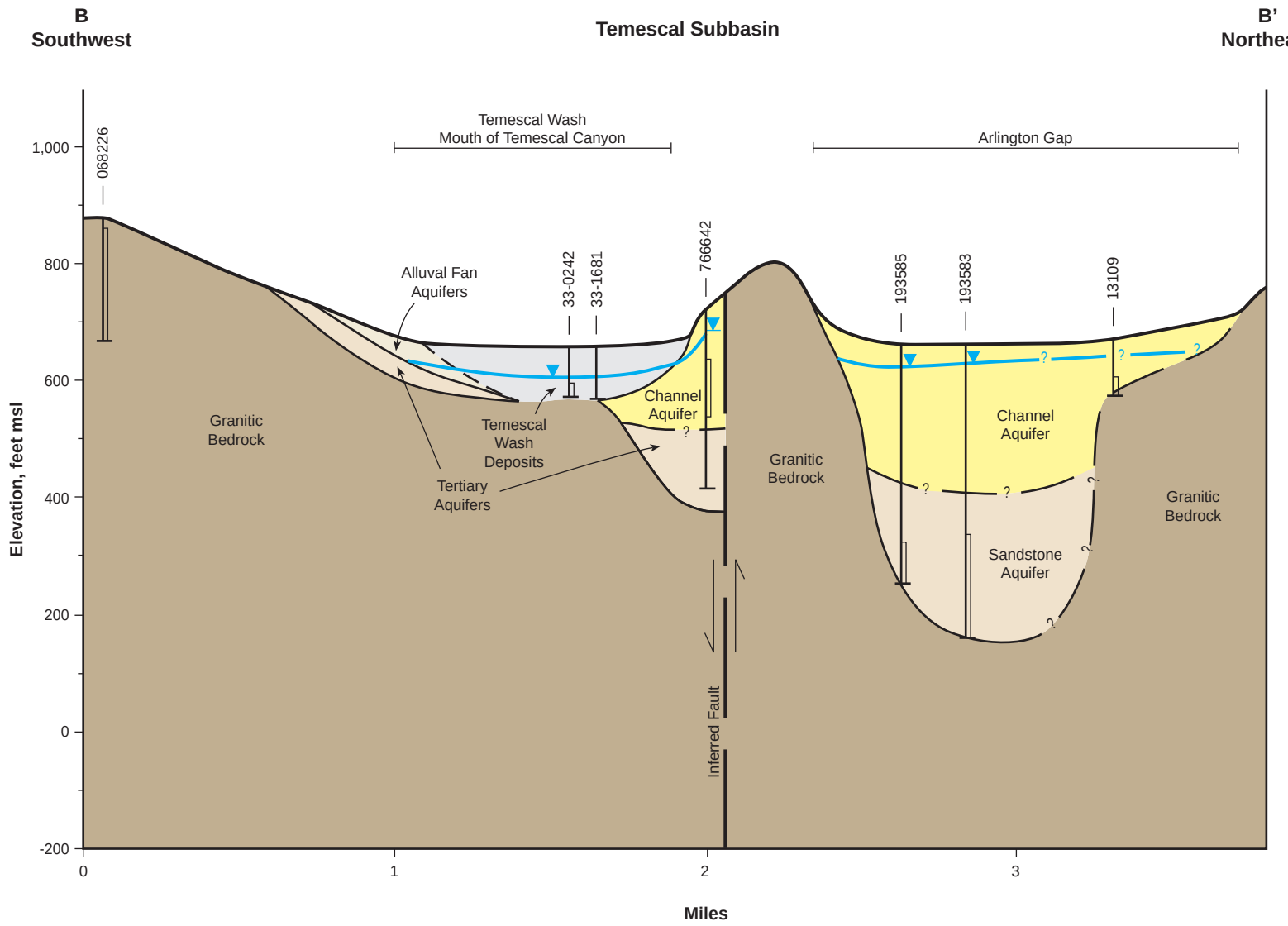
Figure 3-6
Cross Section
Line Orientation

TODD GROUNDWATER



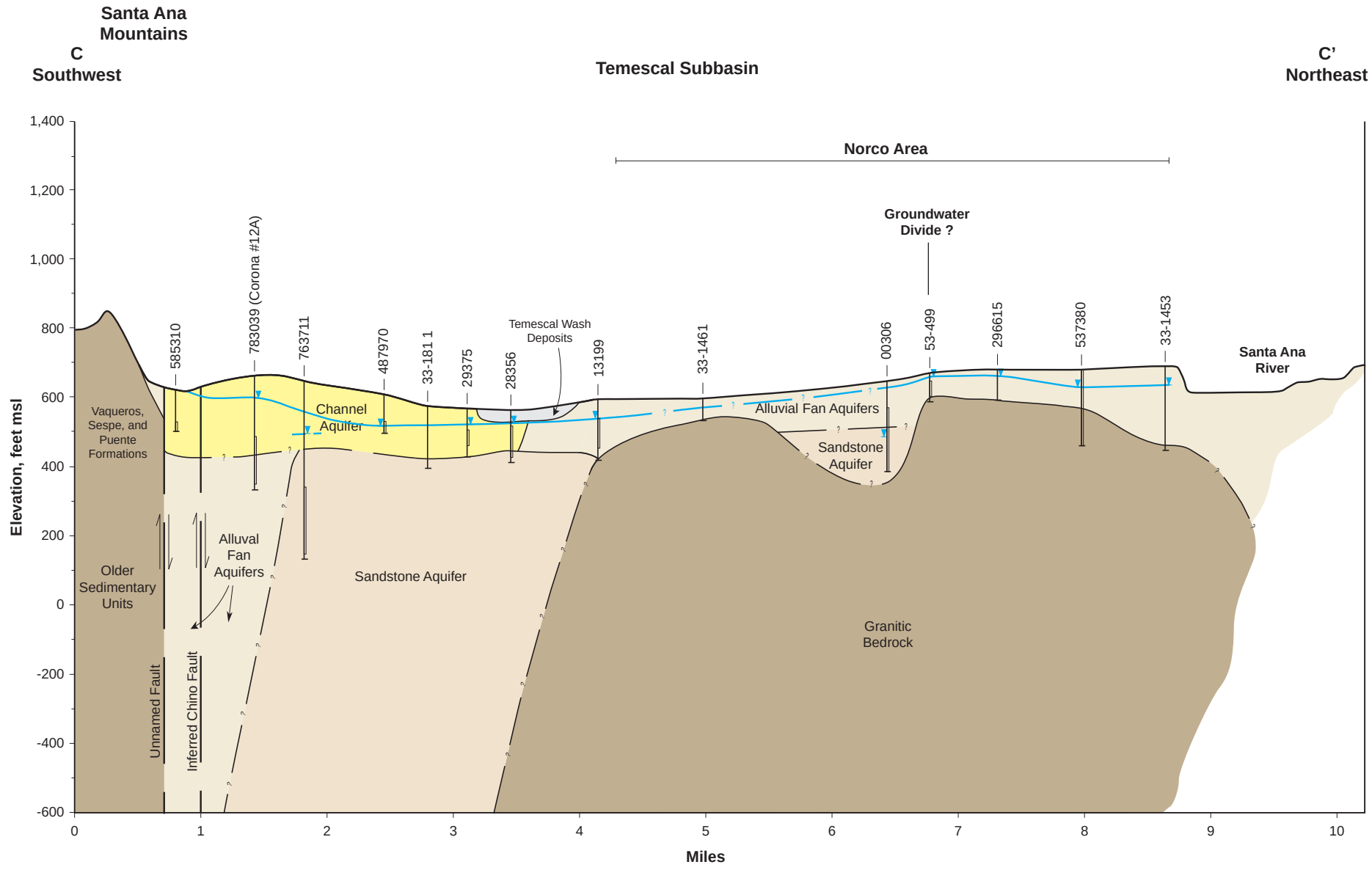
TODD GROUNDWATER

Figure 3-7
Cross Section
A to A'



TODD GROUNDWATER

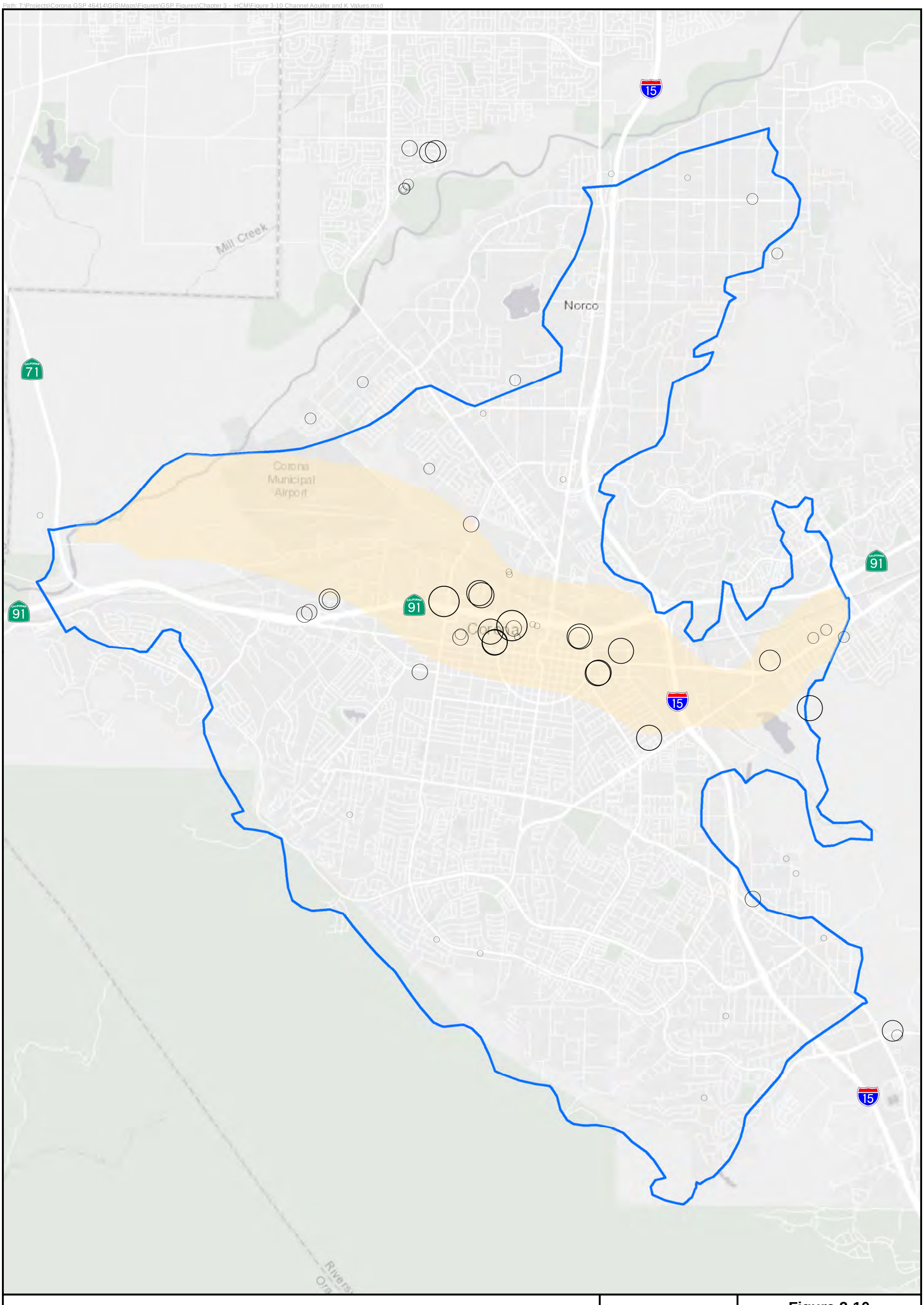
Figure 3-8
Cross Section
B to B'



TODD GROUNDWATER

Figure 3-9
Cross Section
C to C'

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 3 - HCM\Figure 3-10 Channel Aquifer and K Values.mxd



Hydraulic Conductivty

- 0 to 50 gpd/sq. ft
- 50 to 250 gpd/sq. ft
- 250 to 500 gpd/sq. ft
- 500 to 1,000 gpd/sq. ft
- 1,000 to 2,000 gpd/sq. ft
- 2,000 to 3,030 gpd/sq. ft
- Approximate Limit of Channel Aquifer
- Temescal Basin

N

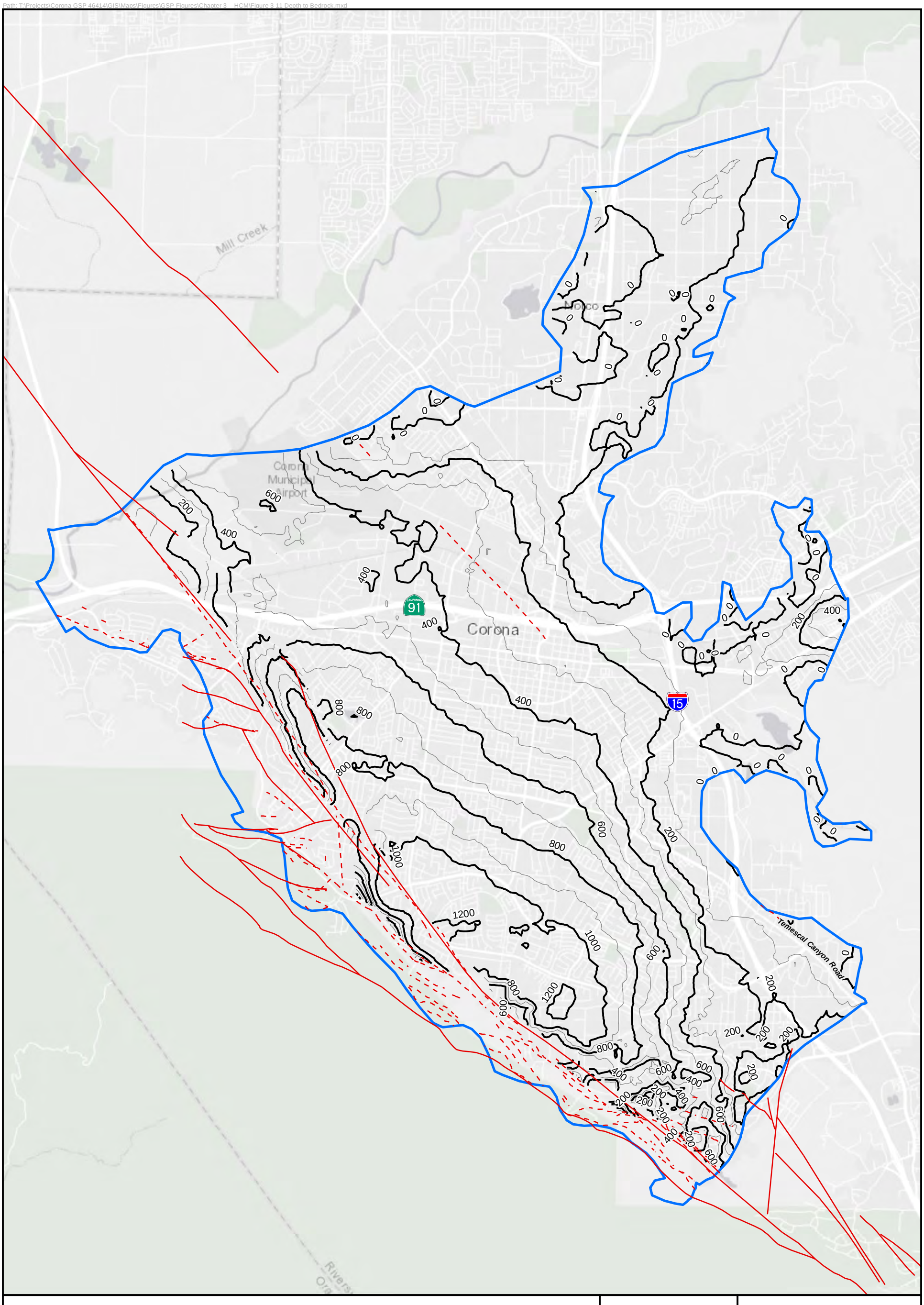
0 0.5 1

Miles

Figure 3-10
Channel Aquifer Extent and Hydraulic Conductivity

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 3 - HCM\Figure 3-11 Depth to Bedrock.mxd



50-foot Depth to Bedrock Contour

200-foot Depth to Bedrock Contour

Fault Location, dashed where uncertain

Temescal Basin

N

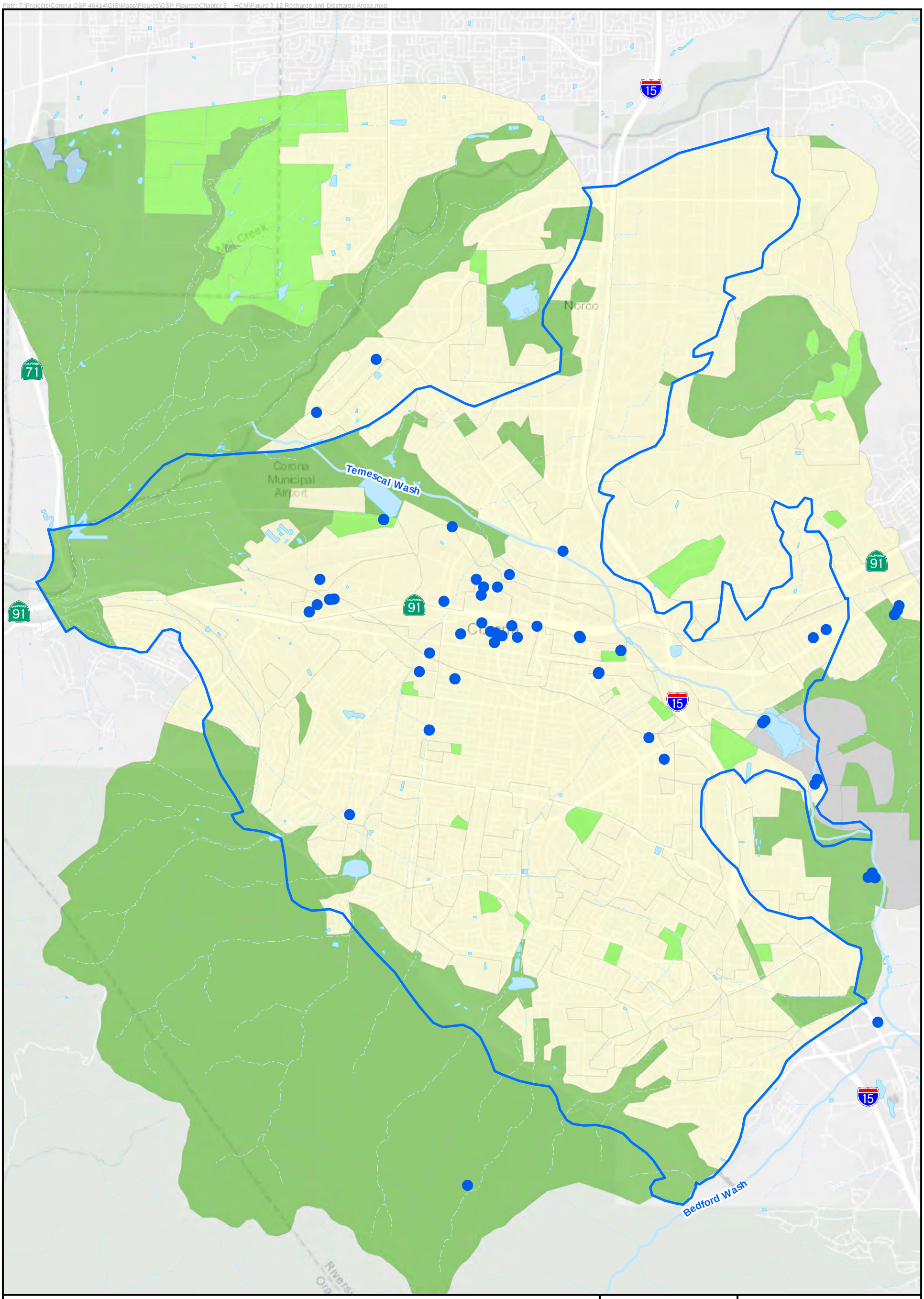
0 0.5 1

Miles

Figure 3-11
Depth to Bedrock

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 3 - HCM\Figure 3-12 Recharge and Discharge Areas.mxd



Known Production Wells
Lake or Pond
Major Streams
Minor Streams
Urban Recharge
Irrigated Area Recharge
Unirrigated Area Recharge
Quarries
Water
Temescal Basin

N

0 0.5 1
Miles

Figure 3-12
Groundwater Recharge and Discharge Areas

TODD GROUNDWATER

4. CURRENT AND HISTORICAL GROUNDWATER CONDITIONS

This chapter describes the current and historical groundwater conditions in the Basin. The Sustainable Groundwater Management Act (SGMA) requires definition of various study periods for current, historical, and projected future conditions. Current conditions, by SGMA definition, include those occurring after January 1, 2015 and accordingly, historical conditions occurred before that date. A historical period must include at least 10 years.

The study period 1990 through 2019 is based on the cumulative departure from mean precipitation at Riverside, Claremont-Pomona, and Lake Elsinore climate monitoring stations. This period is representative and includes droughts and wet periods, with an average annual rainfall of 9.34 inches, comparable to the long-term average of 9.48 inches (1961 to 2019). Accordingly, groundwater conditions over time are described through 2020.

Groundwater conditions are described in terms of the six sustainability indicators identified in SGMA; these include:

- Groundwater elevations
- Groundwater storage
- Potential subsidence
- Groundwater quality
- Seawater intrusion (which is not likely to occur in this inland basin)
- Interconnected surface water and groundwater dependent ecosystems.

4.1. GROUNDWATER ELEVATIONS

4.1.1. Available Data

Groundwater elevation records were collected from multiple sources, including the City of Corona, United States Geological Survey (USGS) National Water Information System (NWIS), California Department of Water Resources (DWR) California Statewide Groundwater Elevations Monitoring (CASGEM), and others. All wells with water level data are shown on **Figure 4-1**. Data from these sources were collected, reviewed, and compiled into a single unified groundwater elevation dataset (USGS 2020a and DWR 2010). Wells with groundwater level data are not distributed evenly throughout the Basin, and most measurement points are within Corona. Many wells have historical water level observations but have not been measured in recent years. In addition, there are temporal gaps in some of the data records and these are discussed in the data gaps section below.

4.1.2. Groundwater Occurrence

As summarized in Chapter 3, groundwater is present in one principal aquifer and two secondary aquifers and these aquifers are hydraulically connected. Groundwater in the Basin occurs under unconfined conditions and there are insufficient data to define vertical zones and to provide zone-specific groundwater elevation hydrographs or maps.

4.1.3. Groundwater Elevations and Trends

Hydrographs showing groundwater elevation trends over time were prepared for all 39 wells with regular water level measurements in the Basin (**Figure 4-1**); these hydrographs were reviewed to identify wells with long term data that could be used to present representative hydrographs. The selection of representative wells was based a quantitative approach that considered hydrographs with long records characteristic of an area and distribution of wells across the Basin. In brief, all available groundwater elevation data for these wells were plotted as hydrographs and well locations were plotted on a basin-scale map. All wells with water level data are shown in **Figure 4-1**. Representative wells with long term hydrographs were selected based the following criteria:

- Location – Wells were prioritized considering broad distribution across the Basin availability of other wells nearby.
- Ongoing and/or recent monitoring – Wells were selected that are part of the active monitoring network or have recent data.
- Trends – Each hydrograph was assessed for continuity of monitoring, representation of local or regional trends, and presence of outliers or unrealistic data.

Recent and historical water level data inconsistently identified groundwater level measurements that were recorded during or immediately after pumping. Most groundwater level records are not identified as either pumping or static measurements. Review of these data showed some records identified as pumping water levels to be closely related to water levels not correlated with pumping. As such, for this study all water levels excluding obvious reporting errors are shown to preserve the overall trends.

Hydrographs in **Figures 4-2** through **4-9** show groundwater level trends over time. In general, water levels correlate to wet and dry hydrologic. In general, water levels have been less responsive to wet and dry periods since 2000. Wells in some portions of the Basin show relatively stable groundwater levels over the past 20 years, while others show non-pumping water level changes during this period by up to 25 feet. The hydrographs do not show dramatic changes in historical water levels in the Basin. The range of historical non-pumping water levels in most wells is under 50 feet.

Figure 4-2 is the long-term hydrograph for Corona Well 15, showing water level changes in the Basin from 1953 to 2020. Since 1953, water levels in Well 15 have fluctuated a total of about 45 feet, from an elevation of 560 feet msl to about 515 feet msl (assuming the spikes below that level are influenced by local drawdown in the pumping well).

The highest water levels in wells with long-term data were measured in the early 1980s in response to a wet hydrologic cycle that began in 1978. These higher levels also correlate to a period of relatively low pumping in the Basin. During a later wet cycle from 1992 to 1998, water levels did not recover to 1980s levels, likely related to an increase in Basin pumping. Groundwater elevation responses to changes in pumping and precipitation patterns are discussed further in Chapter 5 – Water Budget.

The lowest groundwater levels generally correspond to dry periods and periods of increased pumping, though the responses throughout the Basin are not uniform. Hydrographs from most wells show lowering water levels during 2000 to 2004, a period that was not hydrologically dry but had increased pumping in Corona. In the long-term hydrograph from Corona Well 15 (**Figure 4-2**), within Corona, the lowest water levels occurred during the 2015 to 2017 period, after very low rainfall during 2011 through 2015. From 2010 to 2015, water levels declined 10 to 15 feet. Slight increases occurred in 2018 through 2019, likely the result of increased precipitation after 2015. Current levels are near record lows.

Overall, other wells in the Basin follow similar trends, although some wells have more variation in water levels in response to wet and dry periods. The westernmost hydrograph in the Basin is from Corona Well 11 and it shows very little groundwater level change from 2002 through 2020 (**Figure 4-3**). The wells further east in the Channel Aquifer show similar patterns, including Corona Well 22 (**Figure 4-4**), Corona 19 (**Figure 4-5**), Corona 17 A (**Figure 4-7**), and Corona 8a (**Figure 4-8**). Groundwater elevations in these wells were at their highest elevations in 2010 and declined at slow but steady rates through the most recent drought period of 2014 through 2016. Water level declines ranged from 10 to 20 feet from 2011 to 2015. Water levels in these four wells have remained stable or increased since 2018.

Corona Well 26 (**Figure 4-6**) is located on the northeastern part of the Channel Aquifer. Groundwater elevations in this well were also high in 2010, but then decreased sharply in 2013, perhaps due to increased local pumping. The pumping water level in this well is significantly lower than the static water level, which could indicate lower specific capacity on the edges of the Channel Aquifer. Since 2013, water levels have been stable or increasing in Corona Well 26.

Corona Well 13 (**Figure 4-9**), located on the southeastern part of the Channel aquifer shows little change in groundwater levels from 2014 through 2020

4.1.4. Groundwater Flow

Figures 4-10 and **4-11** are groundwater elevation contour maps constructed to examine current groundwater flow conditions using data from fall 2015 and spring 2017. These time periods were chosen to represent dry and wet conditions, respectively. Contours were developed based on available groundwater elevation data for all wells. The median water levels during each season were used. These contours were prepared assuming no barriers to horizontal groundwater flow, including local faults. Due to limited water level data in the southern portion of the Basin, there is a higher level of uncertainty in groundwater flow direction and gradient in the south. Contours in zones with a higher level of uncertainty are shown with dashed lines.

Groundwater flow in the Basin is generally from the surrounding uplands toward Temescal Wash and then north and northwest toward the groundwater and surface water discharge location at Prado Dam. The fall 2015 groundwater elevation contours (**Figure 4-10**) indicate flow from south to north in the Basin. The groundwater elevations in this period represent relatively dry conditions at the end of a drought period. A small depression is depicted in the northern portion of the Basin, most likely due to pumping.

Spring 2017 groundwater elevation contours (**Figure 4-11**) look very similar to groundwater conditions in fall 2015, indicating almost identical groundwater flow conditions. Spring 2017 was a wet period following the 2011 to 2015 dry period. This groundwater elevation surface also indicates flow generally south to north with a small depression in the Corona area. This period was selected because every well with water level data during fall 2015 also had data collected during spring 2017. In areas with similar data availability, spring 2018 groundwater elevation contours also look like the spring 2017 contours.

The similarities between these two groundwater elevation surfaces suggest that the groundwater levels and flow direction in the Basin are not entirely controlled by wet and dry periods and the groundwater flow conditions have been relatively constant in recent years. Several hydrographs support this, with many showing little change in water levels over the past five years.

4.1.5. Vertical Groundwater Gradients

The current monitoring network for groundwater elevations provides little information about vertical head (groundwater elevation) gradients within the Basin. Available data are almost entirely from water supply wells, which typically have long screened zones and are not appropriate for evaluating vertical groundwater gradients. The potentiometric head at the depth of the well screens can be different from the true water table, which is the first zone of saturation reached when drilling down from the ground surface.

Vertical head gradients are an important factor affecting the viability of riparian vegetation. As discussed in greater detail in Section 4.10.3, Riparian Vegetation, phreatophytic vegetation along streams generally survives droughts even when groundwater elevations are tens of feet below the ground surface for two or more years. This suggests that some shallow zones of saturation persist even when the water level in deep aquifers declines. This implies the presence of large vertical head gradients within the aquifer system.

4.2. CHANGES IN GROUNDWATER STORAGE

Change in storage estimates based on evaluation of groundwater elevation changes have not historically been completed for the Basin. Such storage change estimates are based on available groundwater elevation data that are limited geographically and temporally and thus include uncertainty. In addition, the storativity, or storage coefficient (the volume of water released from storage per unit decline in hydraulic head), is largely unknown across the Basin. The volume of groundwater storage change over time is sometimes calculated by multiplying the groundwater elevation changes during a period by the storage coefficient. Storage coefficient values and storage change estimates representing the Basin were developed for the numerical model, as described in **Appendix J**. The numerical model is the best tool for estimating groundwater storage changes. The resulting change in storage estimates are presented in the Water Budget chapter.

4.3. LAND SUBSIDENCE AND POTENTIAL FOR SUBSIDENCE

Land subsidence is the differential lowering of the ground surface, which can damage structures and facilities. This may be caused by regional tectonism or by declines in groundwater elevations due to pumping. The latter process is relevant to the GSP. In brief, as groundwater elevations decline in the subsurface, dewatering and compaction of predominantly fine-grained deposits (such as clay and silt) can cause the overlying ground surface to subside.

This process is illustrated by two conceptual diagrams shown on **Figure 4-12**. The upper diagram depicts an alluvial groundwater basin with a regional clay layer and numerous smaller discontinuous clay layers. Groundwater elevation declines associated with pumping cause a decrease in water pressure in the pore space (pore pressure) of the aquifer system. Because the water pressure in the pores helps support the weight of the overlying aquifer, the pore pressure decrease causes more weight of the overlying aquifer to be transferred to the grains within the structure of the sediment layer. If the weight borne by the sediment grains exceeds the structural strength of the sediment layer, then the aquifer system begins to deform. This deformation consists of re-arrangement and compaction of fine-grained units[1], as illustrated on the lower diagram of **Figure 4-12**. The tabular nature of the fine-grained sediments allows for preferred alignment and compaction. As the sediments compact, the ground surface can sink, as illustrated by the right-hand column on the lower diagram of **Figure 4-12**.

Land subsidence due to groundwater withdrawals can be temporary (elastic) or permanent (inelastic).

Elastic deformation occurs when sediments compress as pore pressures decrease but expand by an equal amount as pore pressures increase. A decrease in groundwater elevations from groundwater pumping causes a small elastic compaction in both coarse-and fine-grained sediments; however, this compaction recovers as the effective stress returns to its initial value. Because elastic deformation is relatively minor and fully recoverable, it is not considered an impact.

Inelastic deformation occurs when the magnitude of the greatest pressure that has acted on the clay layer since its deposition (preconsolidation stress) is exceeded. This occurs when groundwater elevations in the aquifer reach a historically low groundwater elevation. During inelastic deformation, or compaction, the sediment grains rearrange into a tighter configuration as pore pressures are reduced. This causes the volume of the sediment layer to reduce, which causes the land surface to subside. Inelastic deformation is permanent because it does not recover as pore pressures increase. Clay particles are often planar in form and more subject to permanent realignment (and inelastic subsidence). In general, coarse-grained deposits (e.g., sand and gravels) have sufficient intergranular strength and do not undergo inelastic deformation within the range of pore pressure changes

[1] Although extraction of groundwater by pumping wells causes a more complex deformation of the aquifer system than discussed herein, the simplistic concept of vertical compaction is often used to illustrate the land subsidence process (LSCE et al. 2014).

encountered from groundwater pumping. The volume of compaction is equal to the volume of groundwater that is expelled from the pore space, resulting in a loss of storage capacity. This loss of storage capacity is permanent but may not be substantial because clay layers do not typically store significant amounts of usable groundwater. Inelastic compaction, however, may decrease the vertical permeability of the clay resulting in minor changes in vertical flow.

The following potential impacts can be associated with land subsidence due to groundwater withdrawals (modified from LSCE et al. 2014):

- Damage to infrastructure including foundations, roads, bridges, or pipelines;
- Loss of conveyance in canals, streams, or channels;
- Diminished effectiveness of levees;
- Collapsed or damaged well casings; and
- Land fissures.

Inelastic subsidence has not been a known issue in the Basin.

4.3.1. Interferometric Synthetic Aperture Radar (InSAR)

InSAR data are provided by DWR on its SGMA Data Viewer (DWR 2020) and document vertical displacement of the land surface across a broad area of California from June 13, 2015 to September 19, 2019. The TRE Altamira InSAR data, shown on **Figure 4-13**, shows land surface deformation between 2015 and 2019.

The TRE Altamira InSAR data indicates effectively no change in ground surface elevation within the Basin (**Figure 4-13**). Further review of the TRE Altamira InSAR data shows that ground surface elevations in the Basin rose by up to 0.08 feet (0.96 inches) between June 2015 and September 2019, with most of the Basin rising by about 0.02 feet (0.24 inches). A few small areas within the Basin subsided by up to 0.08 feet (0.96 inches). Given this data and the understanding of the hydrogeological conceptual model, there is no issue with subsidence at this time.

4.4. GROUNDWATER QUALITY

The natural quality (chemistry) of groundwater is generally controlled by interactions between rainwater and rocks/soil in the vadose zone and aquifer (Drever 1988). As rainfall infiltrates the soil column, anions and cations from sediments are dissolved into the water. These changes are influenced by soil and rock properties, weathering, organic matter, and geochemical processes occurring in the subsurface. Once in the groundwater system, changing geochemical environments continue to alter groundwater quality. A long contact time between the water and sediments may allow for more dissolution and overall higher salinity level in groundwater (Drever 1988). The natural groundwater quality in a basin is the net result of these complex subsurface processes that have occurred over time. Under natural conditions, older, deeper groundwater often has higher salinity than shallow groundwater because of a longer residence time.

Human processes can increase soil salinity and introduce higher levels of nitrate, inorganic chemicals, and organic compounds to soils in the vadose zone. When recharging water flows through saline soils, ions are dissolved into the infiltrating water and the salinity of shallow groundwater increases.

Most of the groundwater pumped in Temescal Subbasin (Basin) by the City of Corona is treated at the Temescal Desalter, a reverse osmosis membrane treatment facility. The facility treats nitrates, per-fluorinated compounds, 1,2,3-Trichloropropane (1,2,3-TCP), perchlorates, and suspended and dissolved solids. The remaining groundwater is treated at the City Park Ion Exchange Treatment Plant which utilizes two different types of resin, the first treats for perchlorates and the second for nitrates. Water delivered to municipal users is tested regularly to ensure all drinking water standards are met (Corona 2019). There are no other active domestic users of groundwater in the Basin, see Sections 2.3.2.1 and 6.2. The City of Corona recognizes the human right to water and is committed to providing safe drinking water to City residents and has expanded service to the Home Gardens County Water District (HGCWD) service area.

The water quality of the groundwater discussed in this section is the ambient water quality of Basin and does not reflect the treated water delivered to customers by Corona.

Groundwater quality data for this study were sourced from the California Water Boards Groundwater Ambient Monitoring and Assessment (SWRCB 2020a) datasets (which includes data collected by Division of Drinking Water, USGS, DWR, and Regional Water Quality Control Board). In addition, water quality data collected by Corona were included in the analysis. **Figure 4-14** shows the location and data source of the 113 wells with water quality data since 2010 that are in the Basin. The distribution of wells within the Basin is not uniform. Water quality data are primarily available for the Corona wells in the north-central portion of the Basin. In total, 22 wells with recent water quality data were used to assess water quality in the Basin.

Additional monitoring wells for facilities regulated by the Regional Water Quality Control Board do exist in several clusters within the Basin, but these wells were excluded from this groundwater quality assessment. The Regional Water Quality Control Board wells monitor facilities with point source contamination, and their measurements may not be representative of the ambient water quality in the Basin.

A 2008 analysis of the inorganic water quality in the Basin showed that water quality is primarily a sodium/calcium-bicarbonate water type (Todd and AKM 2008). However, the major ion concentration ratios can vary by region. By analyzing the ion ratio characteristics of different areas, the 2008 Corona Groundwater Management Plan identified regions with groundwater mixing and supported the groundwater flow paths identified in the conceptual model. The inorganic major ion analyses identified the following regional trends:

- Groundwater in the Bedford Canyon portion of Temescal Wash or Temescal Canyon has a higher ratio of calcium-to-sodium and sulfate-to-chloride than wells located in Arlington Gap. Groundwater in the Temescal Wash area upgradient of the Norco area has relative cation concentrations that are most like that of the Arlington Gap

groundwater. However, the relative cation concentrations do suggest some mixing with waters from the Temescal Canyon area.

- Groundwater in wells located in the Norco area have a lower ratio of calcium-to-sodium and sulfate/bicarbonate-to-chloride than most other areas.
- Groundwater in wells located in the southwestern alluvial fan have the highest ratio of calcium-to-sodium and sulfate-to-chloride/bicarbonate compared to groundwater in other areas. The water type in the alluvial fan may result from geochemical interaction between rainfall runoff and the outcropping Santiago Peak volcanics in the western catchment area of Basin prior to aquifer recharge along the base of the mountains.
- Cation concentrations indicate that groundwater in wells located in Temescal Wash downgradient of the Norco area appear to be mixtures of groundwater from three sources: Temescal Wash upgradient of the Norco area, Arlington Gap, and the western alluvial fan.

This water quality assessment indicates the major sources of water by analyzing the blending of different water quality from different areas. Identifying major areas of inflow and outflow is critical to developing a strong conceptual model of the aquifer. These results are particularly useful given the sparse water level data available in the southern part of the Basin. Based on water quality type, the groundwater in the Channel Aquifer appears to be derived mainly from Arlington Gap and to lesser extent Temescal Wash. In addition to these sources, the western Channel Aquifer also receives inflow from the Alluvial Fan.

4.5. KEY CONSTITUENTS OF CONCERN

The review of available water quality data indicates that total dissolved solids (TDS) and nitrate are the primary constituents of concern (COCs) in the Basin. Other substances known to contribute to poor groundwater quality were reviewed and are discussed later in this chapter.

Elevated TDS concentrations in groundwater are common, resulting from dissolution of minerals from soil and rocks. TDS in groundwater can also be an indicator of anthropogenic impacts from sources such as urban runoff, agricultural return flows, and wastewater disposal. TDS data are available for both inflows and outflows from the Basin.

Nitrate is the primary form of nitrogen detected in groundwater. While natural nitrate levels in groundwater are generally very low, elevated concentrations of nitrate in groundwater are associated with agricultural activities, septic systems, landscape fertilization, and wastewater treatment facility discharges.

Recent water quality results indicate average TDS concentrations of 785 milligrams per liter (mg/L) and nitrate concentrations of 42.8 mg/L (All nitrate concentrations are reported in terms of nitrate as NO_3). These values represent the average concentrations of these constituents from the most recent water quality data for all drinking water and ambient groundwater monitoring events between water year 2010 and water year 2019. Water

quality samples from regulated facilities were not included in the analysis. These average conditions serve as a snapshot of water quality conditions within the Basin.

4.5.1. Total Dissolved Solids (TDS)

Groundwater in the Basin is somewhat mineralized, with high TDS concentrations in many monitored wells. The recent average TDS concentrations in the Basin referenced previously are above the 500 mg/L lower secondary maximum contaminant level (SMCL) for drinking water, but below the upper SMCL of 1,000 mg/L. The SMCLs are based on aesthetic considerations (such as taste) and are not health-based.

Most of the recent maximum TDS concentrations from monitored wells in the Basin were above the 500 mg/L SMCL, as indicated on **Figure 4-15**. In total, all but two of the 20 wells with data have TDS concentrations over 500 mg/L, and most of the recent TDS measurements were similar to the median and mean TDS concentrations reported for the respective wells in the 2000 to 2019 period. The highest TDS concentrations on **Figure 4-15** are in wells near the City of Corona, where concentrations from several wells exceed 1,000 mg/L. A total of three wells in the Basin have median TDS concentrations over 1,000 mg/L.

TDS concentrations in some wells have fluctuated by several hundred mg/L during the 2010 to 2019 period. The two wells on **Figure 4-15** with TDS concentrations less than 250 mg/L, Corona Wells 11A and 13, have only shown low TDS concentrations in recent years. Prior to 2016, TDS measurements in these wells were generally greater than 700 mg/L.

4.5.2. Nitrate as Nitrate (NO_3)

Elevated nitrate concentrations have been documented in the Basin since at least the 1950s. Recent data indicate that the average nitrate concentration in the Basin is 42.8 mg/L. The maximum contaminant level (MCL) for nitrate as NO_3 in drinking water is 45 mg/L.

The most recently reported nitrate as NO_3 concentrations for wells in the Basin are shown on **Figure 4-16**. Water quality data indicate nitrate concentrations ranging from less than 1 mg/L to 100 mg/L. Nine wells in the Basin have recent median nitrate concentrations greater than 45 mg/L. The highest nitrate concentrations are those associated with wells at the Arlington Gap. Eight water supply wells in the Basin have had nitrate concentrations exceeding the MCL and have required treatment and/or blending to meet regulatory requirements.

Nitrate contamination in groundwater is commonly related to activities at the ground surface (e.g., fertilizer application, septic systems), and as a result, shallow groundwater typically has higher concentrations than deep groundwater. The wide range of nitrate concentrations in wells in the Basin could be due to vertical variations in nitrate concentrations, but well construction information for monitored wells are limited so it is not possible to adequately assess nitrate concentration variation with depth.

4.6. OTHER CONSTITUENTS

While recent water quality data are limited, available data do not indicate that other constituents of concern pose a significant threat to beneficial uses of groundwater in the Basin. The ambient water quality is discussed in Section 4.4 but this does not reflect on the quality of available drinking water. As noted, groundwater pumped from the Basin for domestic and municipal use is treated at the Temescal Desalter or the City Park Treatment facility prior to distribution by Corona. There are no other domestic groundwater users, either public or private, in the Basin. Nonetheless, these and other naturally occurring and emerging anthropogenic constituents will continue to be monitored and analyzed.

4.6.1. Naturally Occurring Contaminants

Arsenic, uranium, fluoride, and hexavalent chromium are chemicals that can naturally occur at elevated concentrations in groundwater. These contaminants originate in the eroded rocks that make up aquifer sediments and enter groundwater through reactions between groundwater and the sediments. In general, the occurrence of arsenic, uranium, fluoride, and hexavalent chromium depend on regional geology and local groundwater conditions. As documented in this section, no naturally occurring contaminants were identified as widespread constituents of concern in the Basin. However, continued monitoring of these chemicals is recommended.

4.6.1.1. Arsenic

Arsenic in a known carcinogen with a MCL of 10 micrograms per liter (µg/L). Elevated arsenic concentrations occur in groundwater throughout the United States, often in aquifers with low-oxygen (reducing) conditions or high pH levels (USGS 2020b). In the Basin, groundwater in all but one well recorded arsenic concentrations under 5 µg/L. The one well showing groundwater with high arsenic concentrations (32 µg/L) is located near the Arlington Gap (HGCWD Well 5) and it is near a well with arsenic concentrations less than 2 µg/L. This suggests that arsenic may be depth-dependent in the Arlington Gap, but the depths of both wells are unknown.

4.6.1.2. Uranium

Uranium in California groundwater is often derived from eroded granite, such as the Mesozoic granites east of the Basin (Jurgens et al. 2010). The MCL for uranium is 20 picocuries per liter (pCi/L), equivalent to about 30 µg/L. At this concentration, the effect of radiation is negligible, but the chemical properties of uranium can cause kidney damage. Uranium often occurs in shallow, oxygen-rich groundwater (Jurgens et al. 2010). Uranium has been measured in 18 wells in the Basin since 2010. Groundwater in two wells, one in the Arlington Gap region (34 pCi/L) (HGCWD Well 5) and one in Corona (20.8 pCi/L) (Corona Well 19), indicate uranium concentrations greater than the 20 pCi/L MCL. The well with high uranium concentrations in the Arlington Gap is adjacent to a well with groundwater with a uranium concentration of 12.7 pCi/L.

4.6.1.3. Fluoride

Fluoride is a necessary component of a healthy diet to prevent dental cavities, and a fluoride concentration of 0.7 mg/L in drinking water is recommended by the United States Department of Health and Human Services (USDHHS 2015). At extremely high concentrations, however, fluoride can cause mottling of teeth and damage bones. Groundwater in aquifers with sediment originating from igneous rocks can often have fluoride concentrations above the 2 mg/L MCL for fluoride. One well in the Basin had a recent fluoride concentration above the MCL, with a recent concentration of 2.7 mg/L (Corona 26).

4.6.1.4. Hexavalent Chromium

Hexavalent chromium, the oxidized form of the metal chromium, occurs in oxygen-rich groundwater in western California, near chromium-bearing rocks. Hexavalent chromium in California drinking water is currently regulated along with total chromium; the MCL for total chromium is 50 µg/L. In 2014, California adopted a 10 µg/L MCL for hexavalent chromium, but this was overturned in 2017 due to a ruling that the California Department of Public Health had failed to consider the economic feasibility of complying with the MCL (SWRCB 2020c). All 18 wells recently monitored for hexavalent chromium showed groundwater concentrations under 4 µg/L, far below the 50 µg/L MCL.

4.6.2. 1,2,3- Trichloropropane

1,2,3- Trichloropropane (1,2,3- TCP) is a human-made chemical used in pesticide products and as a cleaning and degreasing solvent. It has a high chemical stability and can remain in groundwater for long periods of time (SWRCB 2020d). 1,2,3-TCP has been shown to cause cancer to laboratory animals and is believed to be carcinogenic to humans. California OEHHA established a 0.0007 ug/L public health goal (PHG) for 1,2,3-TCP in 2009. The notification level of 1,2,3-TCP is 0.005 ug/L. In total, 24 wells in the Basin have been tested for 1,2,3-TCP. Seven wells have detected 1,2,3-TCP above the notification level and public health goal. These wells are located near or in the City of Corona in the central part of the Basin.

Water pumped from wells with high concentrations of 1,2,3- TCP have been identified and all water produced by these wells is treated using RO technology at the Temescal Desalter before delivery to customers (Corona 2019). There are no active domestic wells in the Basin and no future domestic pumping is expected. Corona will continue to treat groundwater for 123-TCP and other constituents and provide the and HGCWD with safe drinking water.

4.6.3. Per- and Polyfluoroalkyl Substances (PFAS)

Per- and polyfluoroalkyl substances (PFAS) are a group of emerging contaminants that may pose a danger to reproductive, developmental, immunological, and renal health in humans. Contaminants of emerging concern, or emerging contaminants, are chemicals that have only recently been identified as being present in soil and groundwater or were not previously monitored or detected but pose a risk to human health (USEPA 2019). The two most common PFAS are perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). Currently, California has a drinking water response level of 10 parts per trillion (ppt) for

PFOA and 40 ppt for PFOS. PFAS have been used in products including firefighting foams, nonstick cookware, and stain- and water-repellant fabrics for many decades. PFAS contamination of groundwater often occurs near firefighting training facilities or landfills.

The California State Water Resources Control Board has undertaken PFAS monitoring throughout the state, measuring PFAS concentrations in groundwater and identifying point sources of PFAS contamination (SWRCB 2020e). A study of PFAS in the Santa Ana River Watershed has identified elevated PFAS concentrations in groundwater and contamination sources within the Basin (Behrooz 2020). Because of the emerging nature of PFAS, these studies are ongoing. Additionally, the state is still developing guidelines and regulatory limits for PFAS in water supplies.

4.6.4. Monitoring Networks

City of Corona
The Corona water system includes water supply wells in the Basin that are actively monitored for water quality. Since 2010, Corona has routinely collected water quality data from 19 active and inactive wells in the Basin.

Division of Drinking Water
Public drinking water systems in the Basin report water quality data to the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW). Each system monitors and reports water quality parameters to DDW and is required to participate in the Drinking Water Source Water Assessment Program (DWSAP) to assure wells are not subject to local contamination. While most of the public supply well water quality data was received directly from Corona, some additional data are available from DDW.

Orange County Water District (OCWD)
OCWD also monitors groundwater quality near Temescal Basin in the Prado area. OCWD is currently installing more than a dozen shallow monitoring wells in the Prado area to provide more information on shallow groundwater conditions. These wells will provide additional data on impacts interconnected surface water and groundwater dependent ecosystems in the Prado Area.

Other Agencies
The Santa Ana Regional Water Quality Control Board (RWQCB) monitors clean-up sites throughout the Basin. Water quality data from 91 wells in this system have been collected. However, data from these wells are not used in this analysis because they often represent point source contamination and cannot accurately capture the ambient water quality in the Basin.

Wells with water quality data from all available sources are shown on **Figure 4-14**.

4.7. THREATS TO WATER QUALITY

4.7.1. Regulated Facilities

The Santa Ana Regional Water Quality Control Board (RWQCB) regulates thirteen cleanup sites in the Basin. These sites include a military site, leaking underground storage tanks, and dry cleaning facilities. Since 2010, 91 wells at regulated facilities have been monitored for chemical constituents.

4.7.2. Septic Systems

Limited areas of the Basin are not served by municipal sewers and rely on on-site wastewater treatment (OWTS or septic systems). These represent sources of TDS and nitrate loading to groundwater, as well as potential sources of other contaminants. Riverside County Department of Environmental Health is the permitting agency for septic systems and wells in the County. The Riverside County Department of Environmental Health maintains an inventory of septic system installations. While it is unclear how many of these septic systems still exist, it is assumed minimal because most of the Groundwater Sustainability Agency (GSA) area is served by municipal wastewater collection systems.

4.7.3. Non-point Sources

Nonpoint source (NPS) pollution is defined by the SWRCB as contamination that *does not originate from regulated point sources and comes from many diffuse sources*. NPS could occur when rainfall carries contaminants to surface waterways or percolates contaminants to groundwater. One example is loading to groundwater of nitrate from agricultural or landscaping land applications. While groundwater may have natural salinity, increasing TDS concentrations from soil salinization is another common non-point source pollution.

4.8. VERTICAL VARIATIONS IN WATER QUALITY

Water quality monitoring programs in the Basin do not show a distinct difference of water quality in depth, in part because most of the ambient monitoring wells have long screened intervals or are collected from wells with unknown construction.

4.9. SEAWATER INTRUSION CONDITIONS

The Basin is located approximately 25 miles inland from the Pacific Ocean and the lowest elevation at the northwestern boundary of the Basin is about 450 feet above sea level. No risk of seawater intrusion exists in the Basin given its location.

4.10. INTERCONNECTION OF SURFACE WATER AND GROUNDWATER

Interconnection of groundwater and surface water occurs wherever the water table intersects the land surface and groundwater discharges into a stream channel or spring. These stream reaches gain flow from groundwater and are classified as gaining reaches. Conversely, connection can occur along stream reaches where water percolates from the

stream into the groundwater system (losing reaches), provided that the regional water table is close enough to the stream bed elevation that the subsurface materials are fully saturated along the flow path.

Groundwater pumping near interconnected surface waterways or springs can decrease surface flow by increasing the rate of percolation from the stream or intercepting groundwater that would have discharged to the stream or spring. If a gaining stream is the natural discharge point for a groundwater basin, pumping anywhere in the Basin can potentially decrease the outflow, particularly over long time periods such as multi-year droughts.

Because of the long dry season that characterizes the Mediterranean climate in Riverside County, vegetation exploits any near-surface water sources, including the water table along perennial stream channels, the wet soil areas around springs, and areas where the water table is within the rooting depth of the plants. Plants that draw water directly from the water table are called phreatophytes. They are able to continue growing vigorously during the dry season and typically stand out in summer and fall aerial photographs as patches of vegetation that are denser, taller and brighter green than the adjacent vegetation.

4.10.1. Stream Flow Measurements

Stream flow in the Basin includes runoff from undeveloped tributary watersheds on the eastern slopes of the Santa Ana Mountains, wastewater treatment plant discharges, urban runoff within the Basin, flow in Temescal Wash, and flow in the Santa Ana River where it arrives at the Prado (flood control) Basin. The flow regimes in these waterways are quite different. The locations of surface water features mentioned in this discussion are shown in **Figure 4-17**. Tributary streams in the Santa Ana Mountains adjacent to the west side of the Basin flow primarily in response to rainstorm events, but accretions of groundwater from fractured bedrock create a small, more persistent base flow. These small flows rapidly percolate where the creek enters the Basin and generally do not reach Temescal Wash. None of the local tributaries is gaged, but a gage was installed in 2018 on Coldwater Canyon Creek about five miles south of the Basin, and its watershed is similar to those of the Basin tributaries. Daily flows at that gage and two Temescal Wash gages during water years 2013 through 2020 are shown in **Figure 4-18**.

Temescal Wash originates at Lake Elsinore, 17 miles upstream of Basin. It passes from south to north through the Bedford-Coldwater Subbasin and then through Basin before discharging into the Prado Basin wetlands. There are two stream gages on Temescal Wash, one below Lee Lake at the upstream end of the Bedford-Coldwater Subbasin (Temescal Wash at Corona Lake; USGS 11071900) and one at Main Street downstream of the wastewater treatment plant in Corona (Temescal Creek above Main Street at Corona; USGS 11072100). The flow regime at the outlet of Lee Lake is probably similar to the flow regime at the upstream end of Basin. Surface flow occurs primarily during and immediately following rainstorm events. No flow was recorded for three consecutive years during the recent drought.

Reduction in wastewater treatment plant discharges to Temescal Wash over the preceding 10 to 20 years is thought to have contributed to the exceptionally low flows during the drought (Russell 2020). A comparison of total flow in Temescal Wash with recycled water discharges entering the wash confirms that base flow did decrease after 2012 but by only a small amount relative to total flows entering the Prado Wetlands. **Figure 4-19** shows monthly average flows at the gauge above Main Street in Corona and monthly recycled water discharges to Temescal Wash from three water reclamation facilities. Gaged flows above Main Street experienced many more peak flow events than seen at gages farther upstream. Most of these additional flow events probably derive from impervious runoff in the surrounding urban area. Base flow closely tracks the discharge from Corona Wastewater Reclamation Facility 1 (WRF-1), which is located less than 1 mile upstream of the gage on the concrete-line Temescal Wash channel. There might be additional contributions of so-called nuisance water (for example, sprinkler overspray onto paving, or pipe leaks). Average discharges from WRF-1 decreased by about 2 cubic feet per second (cfs) following a SWRCB decision approving the City of Corona's petition to decrease minimum discharges from 4.57 cfs to 2.25 cfs (SWRCB 2012). In December 2012, the RWQCB issued Order R8-2012-0028, which allowed the Temescal Valley Water District (TVWD) to recycle or percolate all reclaimed water at the Lee Lake WRF and cease all discharges to Temescal Wash. That WRF is located 4 miles upstream of Temescal Basin. Those discharges had already been decreasing and were less than 1 cfs during 2010 to 2012, which means they would have been consumed entirely by percolation and evapotranspiration before reaching Temescal Basin. The decrease in Lee Lake WRF discharges would not have affected Temescal Wash inflow to the Prado Wetlands. By the same token, discharges from the City of Corona WRF-3 (located 2.2 miles upstream of the Temescal Basin) were also too small to affect inflow to Prado Wetlands. For comparison, median annual outflow from Prado Dam decreased by 129 cfs, or fifty times more than the decrease in Temescal Wash base flow at the Main Street gage in Corona.

A review of 27 high-resolution aerial photographs (Google Earth 2021) between 1994 and 2020 revealed localized flowing or ponded reaches of Temescal Wash along a 2-mile reach where the Wash traverses bedrock between the Bedford-Coldwater Subbasin and the Basin. The location of this reach along with vegetation and estimated depth to groundwater in spring 2017 are shown in **Figure 4-20**. Open water was also visible in the Wash channel in some of the air photos from the Minnesota Road bridge down to Temescal Wash Lake, a 33-acre lake that is a former gravel mining pit. The greater resistance of bedrock to subsurface flow appears to force groundwater into the creek channel and/or riparian root zone as it crosses the bedrock. Upon entering the Basin a short distance downstream of the Minnesota Road bridge, surface flow percolates back into the ground. Groundwater levels are probably far below the creek bed in that area, however, sufficient surface flow reaches Temescal Wash Lake to make it a perennial water body. For 3.4 miles below Temescal Wash Lake, the creek flows in a cement-lined culvert, finally discharging into the outer fringes of Prado Basin at North Lincoln Avenue.

Aerial photographs from 1967 show almost no riparian vegetation along the bedrock reach of Temescal Wash between the Bedford-Coldwater Subbasin and Temescal Basin. Precipitation had been consistently below-average since 1947 and pumping along Temescal

Wash in the Bedford-Coldwater Subbasin during that period was 167 percent of recent pumping (WEI 2015). Thus, dense riparian vegetation has not been a constant feature of Temescal Wash but has waxed and waned over the past several decades in response to changes in surface flow and groundwater levels.

4.10.2. Depth to Groundwater

Depth to groundwater provides a general indication of locations where gaining streams and riparian vegetation are likely to be present. However, available data are of limited use for this purpose due to insufficient vertical and geographic coverage. Available data are almost entirely from water supply wells, which are typically screened far below the water table. The groundwater elevation (potentiometric head) at the depth of the well screen can be different from the true water table, which is the first zone of saturation reached when drilling down from the ground surface. Because recharge occurs at the land surface and pumping occurs at depth, deep alluvial basins such as this one typically have large downward head gradients within the aquifer system. Thus, water level information from wells can potentially underestimate the locations where the water table is shallow enough to support phreatophytic riparian vegetation. Conversely, in areas where groundwater discharges into streams or wetlands—such as in the Prado Basin—vertical water-level gradients are typically upward.

The geographic coverage of water-level data for the Basin is limited because the wells with data are clustered near the north-central part of the Basin. The closest well to Temescal Wash is about 0.5 mile away. The error associated with extrapolating water levels to Temescal Wash could easily be greater than 10 feet. Horizontal water table gradients can be high near losing streams. Creeks and rivers that lose water commonly form a mound in the water table near the creek. The height and width of the mound depends on the transmissivity of the shallowest aquifer. For example, groundwater elevations in a shallow well adjacent to the Arroyo Seco in the Salinas Valley rose 5 to 10 feet more than groundwater elevations in wells 1,000 feet away when the river started flowing (Feeney 1994). A groundwater ridge up to 12 feet high develops beneath Putah Creek in Yolo County during the flow season, but the width of this ridge was estimated to be only a few hundred feet (Thomasson et al. 1960). These examples suggest that shallow wells within 100 to 200 feet of a stream channel would be needed to confirm the presence of hydraulic connection between surface water and groundwater.

Groundwater does not discharge into streams unless the water table is equal to or higher than the elevation of the stream bed. In addition, the water table does not provide water to phreatophytic vegetation unless it is at least as high as the base of the root zone. The depth of the root zone is uncertain, partly because the relatively few studies of rooting depth have produced inconsistent results and partly because rooting depth for some riparian species is facultative. This means that the plants will grow deeper roots if the water table declines. Many species (including cottonwood and willow) germinate on moist soils along the edge of a creek in spring. As the stream surface recedes during the first summer, the seedlings survive if the roots grow at the same rate as the water-level decline. Over a period of years, roots grow deeper as the land surface accretes from sediment deposition and/or the creek

channel meanders away from the young tree or shrub. For screening purposes, a depth to water of less than 30 feet in water supply wells near streams was selected as a threshold for identifying possible phreatophyte areas. This depth allows for 10 to 15 feet of root depth, 5 feet of elevation difference between the water level in the well and the overlying true water table, and 15 feet of topographic elevation difference between well heads and the bottoms of nearby creek channels where the vegetation is located.

In spite of these accuracy limitations, contours of depth to water measured in wells—in combination with depth to water data for the downstream end of the Bedford-Coldwater Subbasin (also shown in **Figure 4-20**)—indicates that there are only two areas in or near the Basin where depth to water is likely shallow enough to be within the root zone of vegetation or possibly discharge into stream channels or wetlands (**Figure 4-20**). One of the areas is the 2-mile bedrock reach of Temescal Wash between the Bedford-Coldwater Subbasin and Basin, and the other is the Prado Wetlands, where contouring suggests groundwater discharges into the wetlands. Depth to water in spring of 2017 was less than 20 feet downstream of about North Lincoln Avenue.

Depth to water in the Corona area was incorrectly characterized in a shallow groundwater and evapotranspiration assessment competed for the Upper Santa Ana River Integrated Model summary report (Ballau 2018). The map of shallow groundwater areas in slide 8 of Appendix E of that report shows shallow groundwater conditions extending up Temescal Wash from Prado Basin to the center of Corona. Shallow groundwater conditions were inferred from the presence of perennial flow in the Wash, as shown on the National Hydrography Dataset map. There is perennial flow, but it consists almost entirely of wastewater discharges from the Corona WRF-1 treatment plant, which is located about 1 mile upstream of the Main Street gage. All wells in that area—including deep supply wells and shallow monitoring wells at cleanup sites—have water levels generally more than 70 feet below the ground surface. Furthermore, the reach of Temescal Wash that is perennial is lined with concrete and not suitable for riparian habitat.

4.10.3. Riparian Vegetation

Vegetation data provides evidence that the water table near some reaches of Temescal Wash is shallow enough to supply water to phreatophytes. Where tree and shrub roots are able to reach the water table, riparian vegetation is typically denser and greener than along reaches where vegetation is supplied only by stream flow or residual soil moisture from the preceding wet season. Patches of dense riparian vegetation are visible in multiple historical photographs and are indicated by a crosshatch pattern in **Figure 4-21**. The figure also shows the distribution of vegetation classified as Natural Communities Commonly Associated with Groundwater (NCCAG) by the Nature Conservancy. Based on multiple historical vegetation surveys, the Nature Conservancy prepared detailed statewide mapping of NCCAG vegetation that is accessible on-line (DWR et al. 2020). Note that the NCCAG map does not include the corridor of dense riparian trees and shrubs along the bedrock reach of Temescal Wash between the Bedford-Coldwater Subbasin and the Basin. It does include 44 acres of red willow and 12 acres of cottonwood between Minnesota Road and Temescal Wash Lake, which is a reach where surface flow and shallow groundwater are probably leaking

downward to a deeper regional water table. Red willow is a facultative phreatophyte, which means it will exploit a water table if it is within a reachable depth but otherwise survive on soil moisture (typically with smaller stature and greater spacing between plants).

Another waterway mapped as supporting riparian vegetation in the NCCAG database is the lower reach of Wardlow Wash, which drains the northwest corner of the Basin to the Santa Ana River. Most of the mapped vegetation is facultative phreatophytes (mainly sycamore), but one polygon of Fremont cottonwood (an obligate phreatophyte) is mapped about 0.5 mile from the southern edge of the Prado Wetlands, in an area where shallow depth to water is plausible.

An additional test for groundwater dependence of riparian vegetation was to compare changes in groundwater elevation with changes in vegetation health during the recent drought. Vegetation health can be detected by changes in the way the plant canopy absorbs and reflects light. The spectral characteristics of satellite imagery can be processed to obtain two metrics commonly used to characterize vegetation health: the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Moisture Index (NDMI). Both are calculated as ratios of selected visible and infrared light wavelengths. The Nature Conservancy developed a second on-line mapping tool called GDE Pulse that provides annual dry-season averages of NDVI and NDMI for each mapped NCCAG polygon for 1985-2018 to assist with the identification of groundwater dependent ecosystems (GDEs) (TNC 2020). For the Fremont cottonwood polygon, NDVI and NDMI declined by 0.25 and 0.26, respectively, from 2012 to 2017, and for the red willow areas, the metrics declined by 0.15 and 0.16. These fairly substantial declines were clearly related to the drought. Field observations of riparian vegetation documented riparian tree mortality of approximately 80 percent between 2014 and 2016 along the downstream end of Bedford-Coldwater Subbasin, the bedrock reach, and the Basin reach down to Temescal Wash Lake (Russell 2020 and Google Earth 2021). The question is whether the cause of the moisture stress was reduced rainfall, reduced streamflow or lower groundwater levels. After the relatively wet winters of 2019 and 2020, the stands of riparian trees are now recovering.

In summary, riparian vegetation along the bedrock reach of Temescal Wash is very likely phreatophytic and therefore affected by groundwater levels in the thin ribbon of channel deposits along the Wash. Once the Wash enters the Basin, however, the regional water table is far below the channel. The depth to water in the three wells with historical water level data closest to the Temescal Wash vegetation (south of well Corona 13 in Figure 4-1) was historically 50 to 150 feet below the ground surface. Depth to water increases from the center of the Channel Aquifer area toward the margins of the Basin because the ground slope (0.04-0.13 ft/ft from Figure 3-1) is four or more times steeper than the water table slope (about 0.01 ft/ft from Figures 4-10 and 4-11). Thus, the depth to water at the Temescal Wash riparian vegetation is likely greater than the 50 to 150 foot range of the three wells farther north. Groundwater elevations at the vegetation location is not considered a data gap because available data indicate that the regional water table could not plausibly be less than 30 ft below the ground surface. The riparian vegetation along that reach is probably supported by perched groundwater along the channel sustained by percolation of surface flow in Temescal Wash as it exits the bedrock reach.

4.10.4. Wetlands and Interconnected Surface Water

The north end of the Basin is beneath the Santa Ana River and surrounding Prado Wetlands, which is a managed wetland maintained by operation of Prado Dam. Prado Dam impounds the river to regulate flood flows in winter and sustain a perennial wetland. In some previous reports, the impoundment area was referred to as the Prado Flood Control Basin. "Basin" in this case refers to a surface water feature. The RWQCB Basin Plan designates the area behind Prado Dam up to an elevation of 566 feet as the "Prado Basin Management Zone". This GSP refers to the dense wetland and riparian vegetation within that area as the Prado Wetlands. Surface water behind the dam is maintained at a specified elevation, which currently is 505 feet. The extent of wetland vegetation has increased from 1.8 square miles (mi^2) in 1960 to about 6.8 mi^2 today, with most of the increase occurring prior to 1985 (WEI 2020). Approximately 1.4 mi^2 of the total is within the Basin.

Evapotranspiration is higher in wetland and riparian vegetation areas where plant roots can access the water table than in areas where the water table is too deep to be accessed by roots. Thus, maps of remotely-sensed evapotranspiration (ET) show where the water table is shallow and being utilized by plants. Color-coded ET maps based on spectral analysis of Landsat imagery are available annually, and the maps from 1986 through 2016 consistently show a very sharp and stable boundary between high- and low-ET regions defining the southern edge of the Prado Wetlands (Ballau 2018). Temescal Basin along the lower reach of Temescal Wash between the wetlands and downtown Corona did not exhibit high ET between 1986 and 2016. This further confirms that the assumption of shallow groundwater in that region based on perennial flow in the channel was erroneous, as discussed earlier.

A systematic comparison of factors potentially related to groundwater levels in the Prado Wetlands was completed for this GSP. The Prado Basin Habitat Sustainability Program includes monitoring of groundwater levels and quality in scores of wells in and north of the Prado Wetlands, including 18 monitoring wells constructed specifically to detect changes in the shallow water table elevation within the wetlands (WEI 2020). It was found that wetland vegetation and riparian vegetation along the lower reaches of two north-side tributary creeks were associated with depths to water of 15 feet or less. **Figure 4-22** compares water levels in shallow wells in Prado Wetlands with water levels to the north and south of the wetlands. For the wells in and to the north of the wetlands, the wells show the maximum depth to water between 2010 and 2020. In the central part of the wetlands, the maximum depth to water was 13 feet or less at all wells, which is shallow enough to be accessible to roots of established riparian vegetation. The most common species mapped in that area is red willow. In contrast, the minimum depths to water in wells in Temescal Basin south of the wetlands were all greater than 40 feet (beyond the reach of vegetation roots) except for the well closest to the wetlands, where it was 23 feet (within the possible rooting depth range of some riparian tree species). Those water levels are from water supply wells, which are relatively deep. To check for the possible presence of a shallow aquifer with higher water levels, data for shallow monitoring wells at groundwater contamination sites were obtained from the SWRCB Geotracker database and reviewed (SWRCB 2021). GeoTracker has

information for six sites in the central part of Corona, and in all cases the depths to water were 42 to 172 feet, which is roughly consistent with the water supply wells and beyond the reach of vegetation roots. Thus, somewhere near the southern edge of the Prado Wetlands there is an abrupt transition to deeper water levels.

Various factors that could potentially affect shallow groundwater levels in the Prado Wetlands were evaluated for this GSP by comparing their variations over time between 2000 and 2019. **Figure 4-23** shows depth to water hydrographs for four Prado Wetland wells, annual pumping at the Chino Basin desalter wells and in all wells in the Temescal Basin, water levels in several wells in the Temescal Basin, annual discharge in the Santa Ana River below Prado Dam and annual precipitation in Riverside. The 2012 through 2016 period is highlighted in the figure for discussion purposes. The Prado wells all show water-level declines from 2012 to 2015 followed by a rise in 2016. If groundwater pumping caused the declines during 2012 to 2015, it would have been above average during that period. However, pumping at the Chino desalter wells (locations shown in **Figure 4-22**) was relatively constant during that period, and Temescal Basin pumping actually declined. Furthermore, the large step increase in desalter pumping from 2005 to 2007 was not associated with a corresponding decrease in Prado Wetland groundwater levels.

Groundwater elevation trends in the Temescal Basin also show no correlation with shallow groundwater levels in the Prado Wetlands. The most common trend was a steady decline of 10 to 20 feet during 2012 through 2016. This is counterintuitive given the decrease in Temescal Basin pumping during that period. It suggests that sources of recharge—primarily percolation from Temescal Wash and stormwater retention basins on other streams—decreased during the drought by a total amount greater than the decrease in pumping.

A variable that does correlate with Prado Wetland groundwater levels is annual discharge in the Santa Ana River at the gage below Prado Dam. The flow at that location is a direct measure of the amount of surface water flowing through the wetlands. Annual discharge declined during 2011 through 2015, increased slightly in 2016 and even more in 2017. Median and average annual discharge are shown in the figure and exhibit similar patterns. Median discharge emphasizes moderate, steady flows such as discharges from wastewater treatment plants. Average discharge also includes the effects of runoff during large storm events. In wetter years such as 2011 and 2017 the average flow is considerably larger than the median flow. Annual precipitation at Riverside also correlates with the Prado groundwater trends. Precipitation was high in 2010 through 2011 and 2017 and low during 2012 through 2016.

The correlation of precipitation and river flow with Prado groundwater levels and the lack of correlation with groundwater pumping north and south of the wetlands indicates that the wetlands are primarily sustained by surface inflows.

Another evaluation of factors potentially correlated with changes in NDVI in the Prado Wetlands was presented in the 2019 annual report of the Prado Basin Habitat Sustainability Committee (WEI 2020). Using a spatially and temporally detailed statistical analysis of trends in time series plots for 1984 through 2019, no correlation was found between NDVI and groundwater levels. However, in some years changes in NDVI correlated with annual

precipitation, growing-season average maximum and minimum temperatures, wastewater discharges, vegetation management activities or wildfires. These results are consistent with those presented above and support a conclusion that the wetlands are now primarily supported by surface inflows including storm runoff and reclaimed water discharges.

Prado Dam operation also strongly influences water availability in the wetlands because the impounded pool of water is more perennial than it would be in a natural condition.

Modeling completed for other studies projected large water-level declines in the Temescal Basin, with an implication that groundwater is being over-exploited and potentially impacting Prado Wetlands. However, actual water-level data from Temescal Basin show that the simulated declines are incorrect. The simulated declines were first presented in the Prado Basin Adaptive Management Plan (WEI 2016; see Figure 1-4 of that report). The same results were presented again in the 2019 Annual Report of the Prado Basin Habitat Sustainability Committee (WEI 2020; see Figure 1-3). The simulations indicated 20 feet of cumulative water level decline from 2005 to 2030 near the southern edge of the Prado Wetlands, increasing to 60 feet near downtown Corona. In reality, water levels in the Temescal Basin have shown no net increase or decrease from 2005 to 2020 (see, for example, **Figure 4-23**). It is possible that the groundwater model used for those simulations included the southward propagation of drawdown from the Chino desalter wells but did not fully include recharge from Temescal Wash and small streams in the Temescal Basin.

The low importance of groundwater as a factor in managing Prado Wetlands is also implicit in the Upper Santa Ana River Habitat Conservation Plan (HCP) (ICF 2020). Groundwater modeling completed for the HCP projected declining groundwater levels for the region surrounding the Prado Wetlands. However, none of the management actions in the HCP target groundwater pumping or levels beyond simply monitoring them. The actions focus on establishing an HCP Preserve, enhancing channel morphology, substrate, and in a few places flow to improve habitat quality. The thirty-three “avoidance and mitigation measures” listed in the HCP deal exclusively with land and vegetation disturbance and related construction activities. Most of the proposed actions are along the mainstem of the Santa Ana River. The surface hydrology model, for example, extended only about 2 miles up Temescal Wash—a reach that is concrete-lined, has no habitat value and is not connected to groundwater.

Small wetlands might be present outside of the Prado Wetlands. The Nature Conservancy NCCAG mapping includes a wetland layer separate from the riparian vegetation layer. It indicates the locations of possible wetlands outside of the Prado Wetlands area. Along Temescal Wash, the largest mapped polygons are within the riparian vegetation polygons between Minnesota Road and Temescal Wash Lake. Additional small polygons are shown along the shore of the lake. As stated earlier, water levels in wells are thought to be far below the creekbed and lake at that location, which would indicate that the wetlands and lake are sustained by surface discharges, not groundwater. The mapping also shows two strips of wetland in the channelized reach of the Wash downstream of the lake. The channel has a cement bottom, so wetlands are not likely present (i.e., there is a mapping error). The mapping shows no off-channel wetlands in the Basin, which is not surprising given its largely urban land cover.

The Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) was reviewed for additional information regarding plant species that might be affected by groundwater (RCRCA 2020). Two large regions mapped as *narrow endemic plants* and *criteria area species* partially overlap the Basin. However, those categories together contain 16 upland plant species that are unaffected by groundwater.

4.10.5. Animals and Interconnected Surface Water

Animals that depend on groundwater include fish and other aquatic organisms that rely on groundwater-supported stream flow, amphibious or terrestrial animals that lay their eggs in water and birds that inhabit riparian vegetation. Management of habitat for animals typically focuses on species that are listed as threatened or endangered under the state or federal Endangered Species Acts. That convention is followed here. Flow in Temescal Wash is too ephemeral to support migration of anadromous fish, although the population of rainbow trout in Coldwater Canyon Creek above the Bedford-Coldwater Subbasin is thought to be the remnant of a steelhead trout population present as recently as the 1930s (Russell 2020). No native fish species presently inhabit Temescal Wash. Resident fish are nonnatives such as bass, bullhead, sunfish, and carp. Arroyo chub (*Gila orcuttii*) is a native fish listed as a species of special concern that is present in Prado Wetlands and could potentially inhabit some reaches of Temescal Wash. The Riverside-Corona Resource Conservation District implemented the Temescal Wash Native Fish Restoration Project during 2007 through 2009. The focus of that effort was on eradication of nonnative plants and animals, particularly arroyo chub predators. Modifying flow conditions was not part of the project. No habitat areas for arroyo toad or red-legged frog are mapped within the Basin.

The Upper Santa Ana River HCP documents historical sightings and current potentially suitable habitat for a number of listed species, including six at various locations along Temescal Wash between Lake Elsinore and the Prado Wetlands: Arroyo chub, California glossy snake (*Arizona elegans occidentalis*), southwestern pond turtle (*Emys pallida*), yellow-breasted chat (*Icteria virens*), least Bell's vireo (*Vireo bellii pusillus*), and southwestern willow flycatcher (*Empidonax traillii extimus*). In all cases there were either a number of historical sightings but little suitable habitat or vice versa. Apparently, habitat restoration opportunities are richer along the Santa Ana River than along Temescal Wash, and this led to the HCP's focus on the former.

Two bird species that inhabit the Prado Wetlands are federally listed as endangered: least Bell's vireo and southwestern willow flycatcher. Critical habitat areas have been delineated by the U.S. Fish and Wildlife Service for many listed species. Critical habitat maps for three species are shown in **Figure 4-21**. Critical habitat for the least Bell's vireo and southwestern willow flycatcher in the Temescal Basin region more or less coincide with the extent of the Prado Wetlands. Critical habitat for the coastal California gnatcatcher (*polioptila californica californica*) includes areas on the eastern slopes of the Santa Ana Mountains that very slightly overlap the western edge of the Temescal Basin. The only vegetation in those areas that might utilize groundwater would be along tributary streams, where a small amount of base flow is sustained by groundwater discharging at a low rate from fractured bedrock. That discharge would not be affected by pumping and water levels in the Basin, so Basin

management would not impact the extent or health of vegetation along streams in the mapped habitat areas.

In summary, groundwater management is unlikely to impact habitat in the Prado Wetlands and along Temescal Wash with possible minor exceptions where Temescal Wash first enters the Basin from the bedrock reach and along the southern edge of the Prado Wetlands. Additional data are needed regarding the presence of a shallow water table in those locations to reach a more definitive conclusion.

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-1 Historically Monitored Wells.mxd

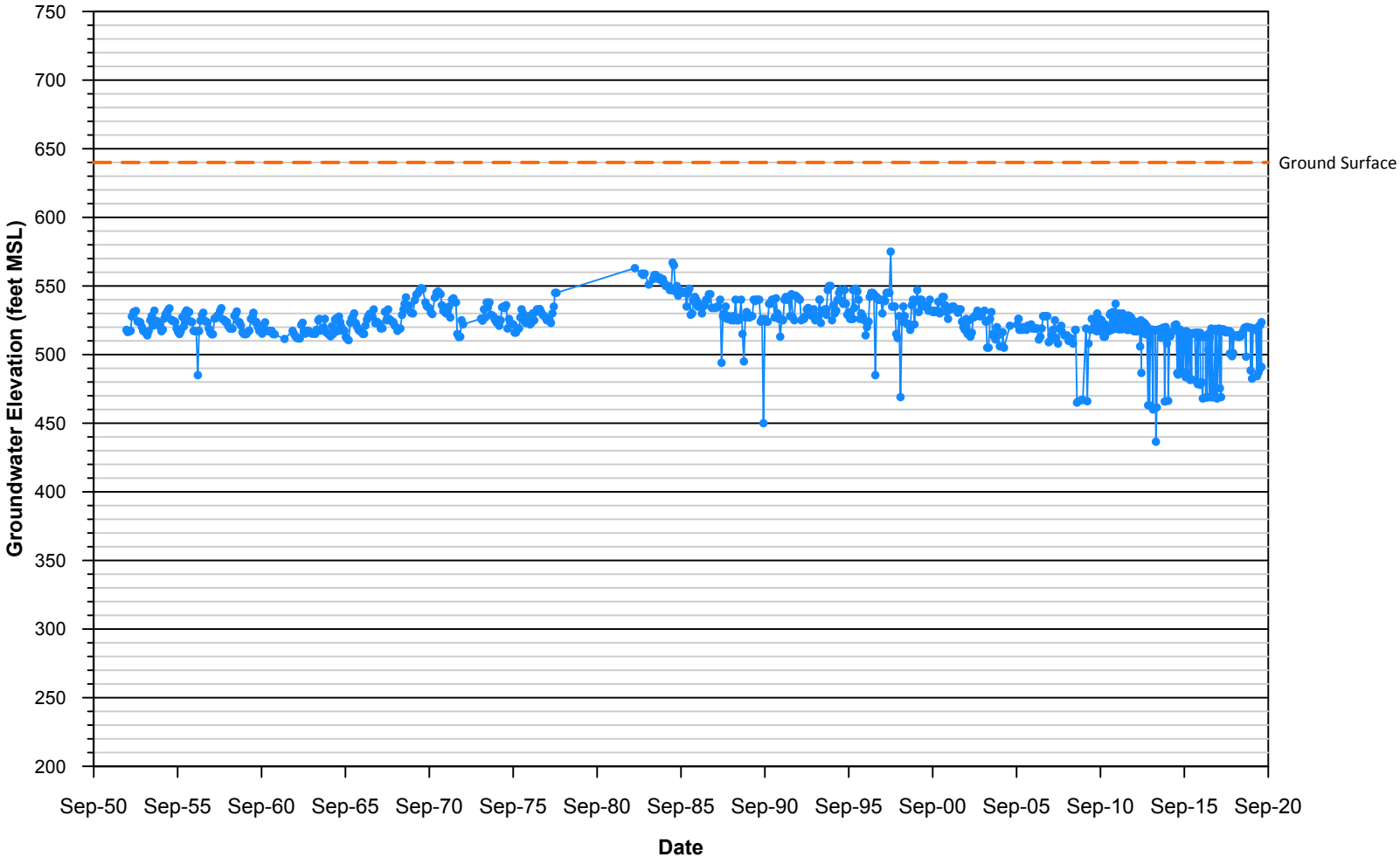
Mill Creek
Norco
Corona Municipal Airport
Corona
Corona 11A
Corona 11
Corona 29
Corona 26
Corona 15
Corona 31
Corona 19
Corona 22
Corona 8A
Corona 17A
Corona 13
15
91
71

Wells with Regular Monitoring
Wells with Representative Hydrographs (labeled)
Other Historically Monitored Wellls
Temescal Basin

N
0 0.5 1
Miles

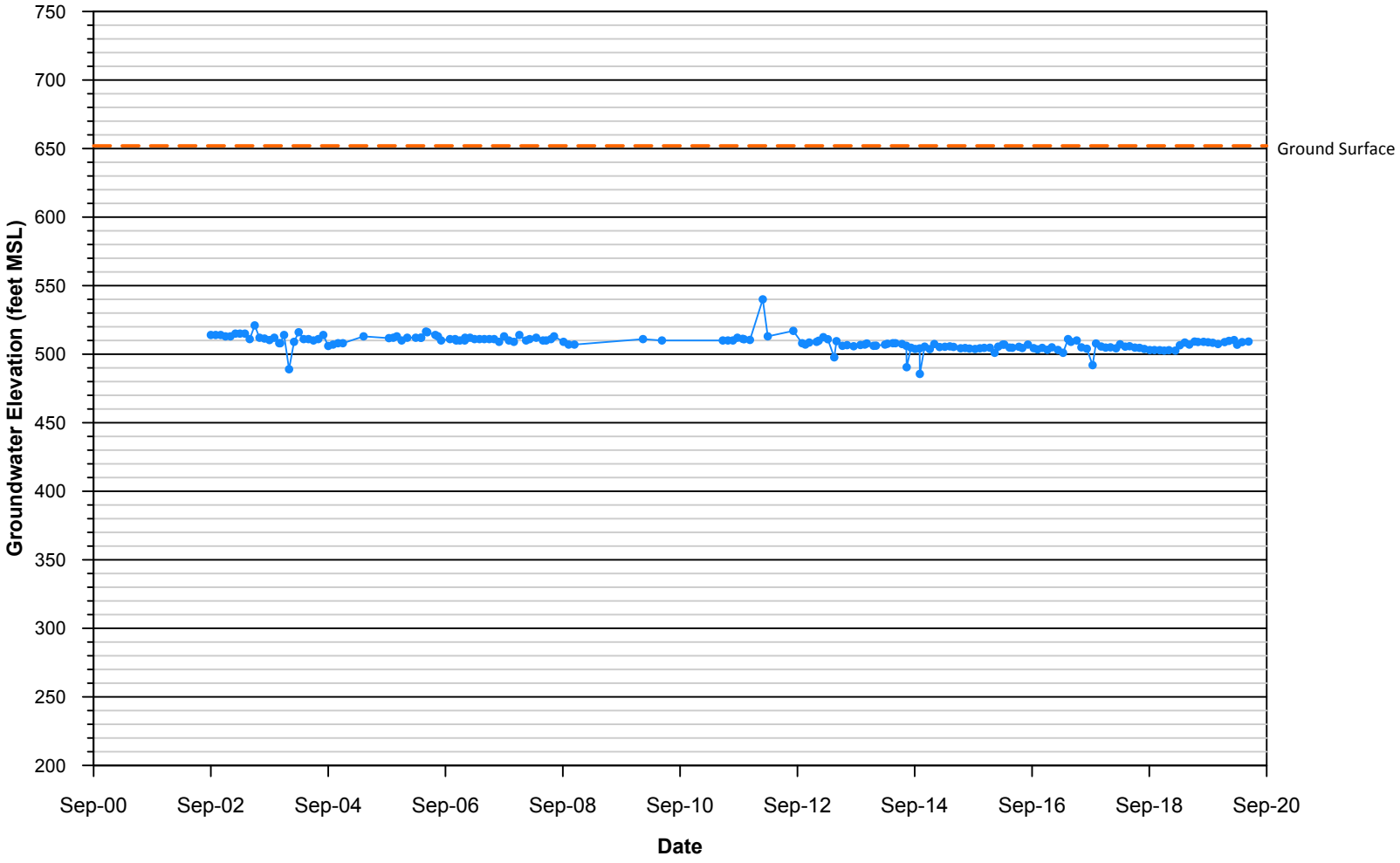
Figure 4-1
Historically Monitored Wells

TODD GROUNDWATER



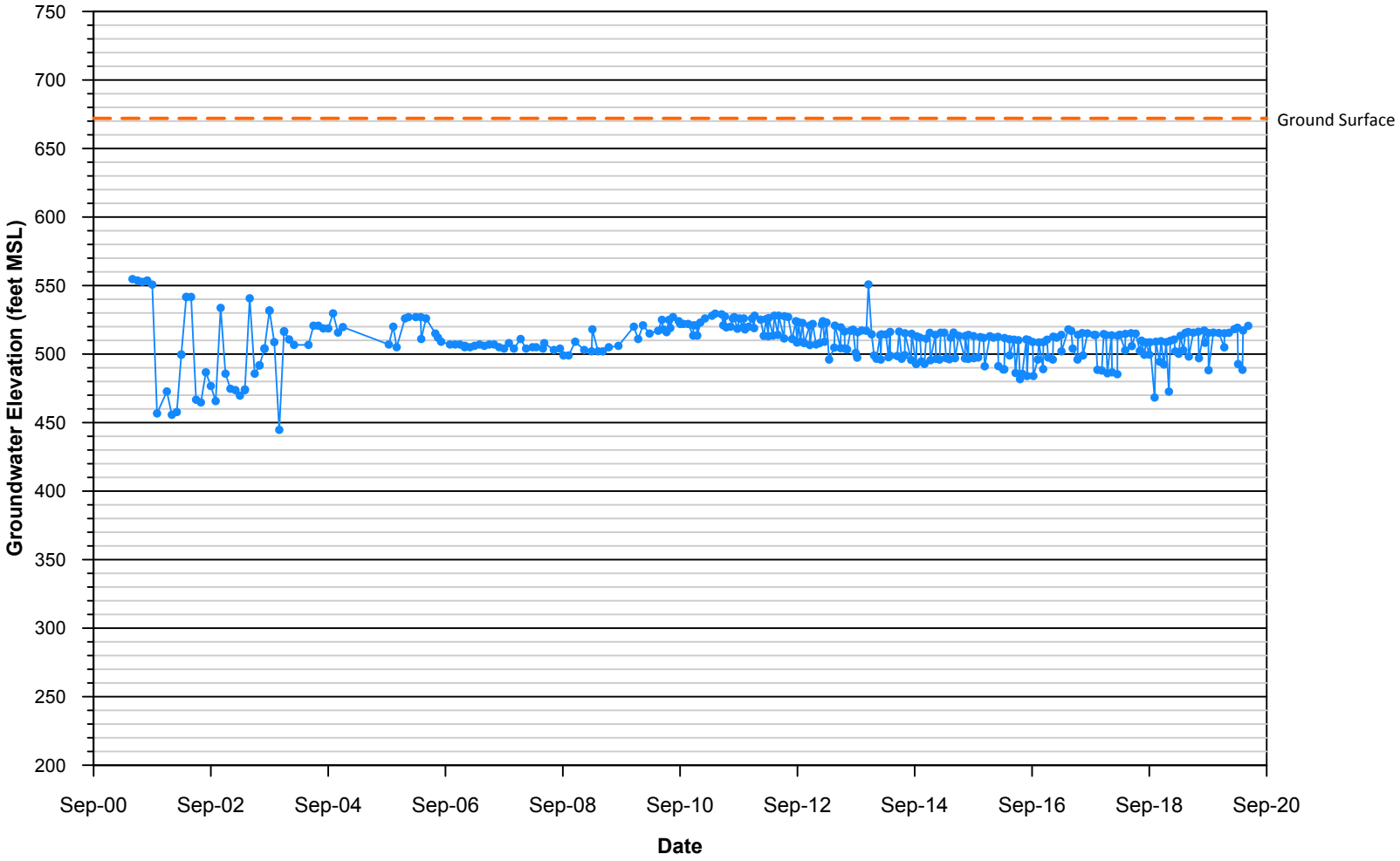
TODD GROUNDWATER

Figure 4-2
Representative Hydrographs
Corona Well 15



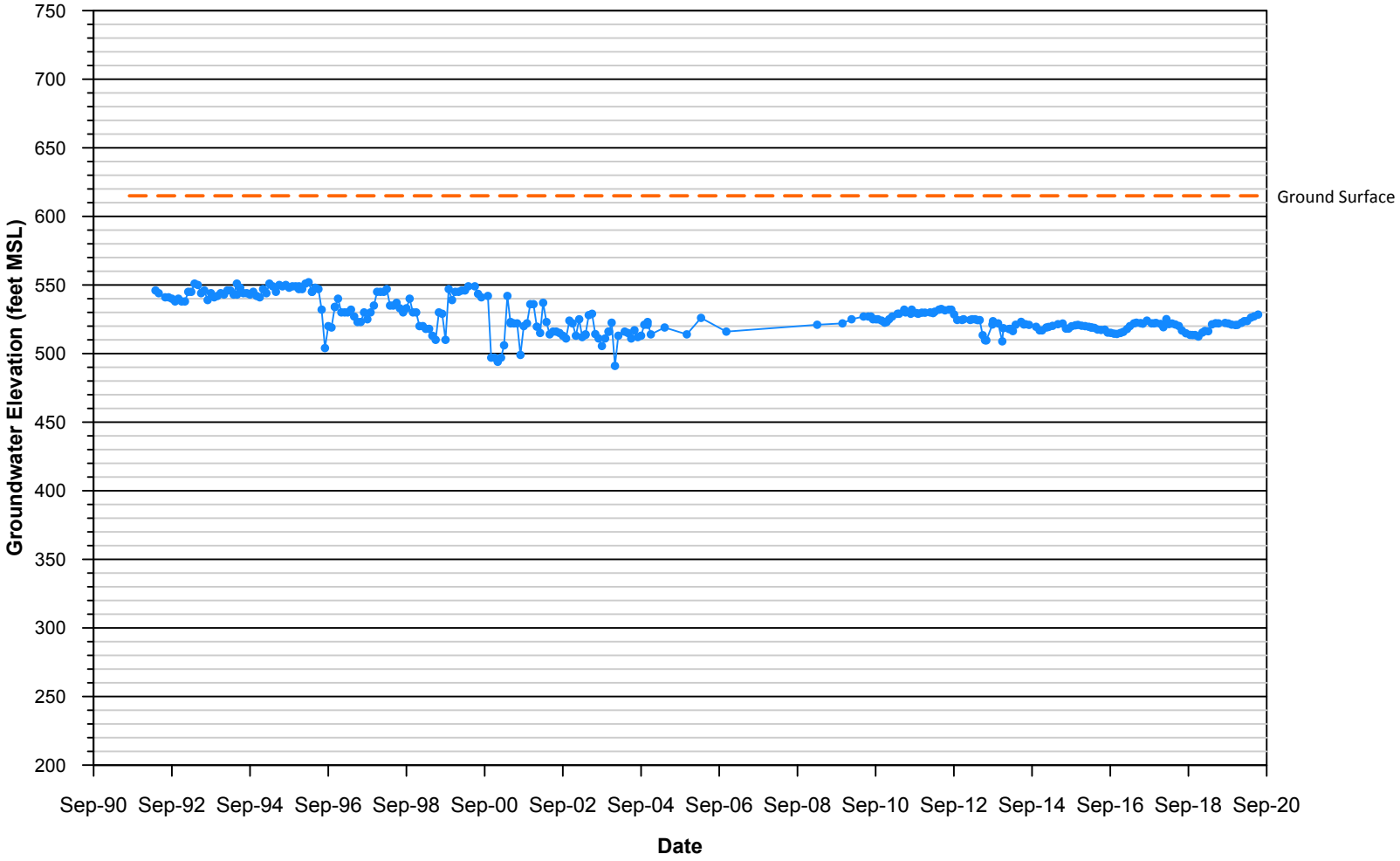
TODD GROUNDWATER

Figure 4-3
Representative Hydrographs
Corona Well 11



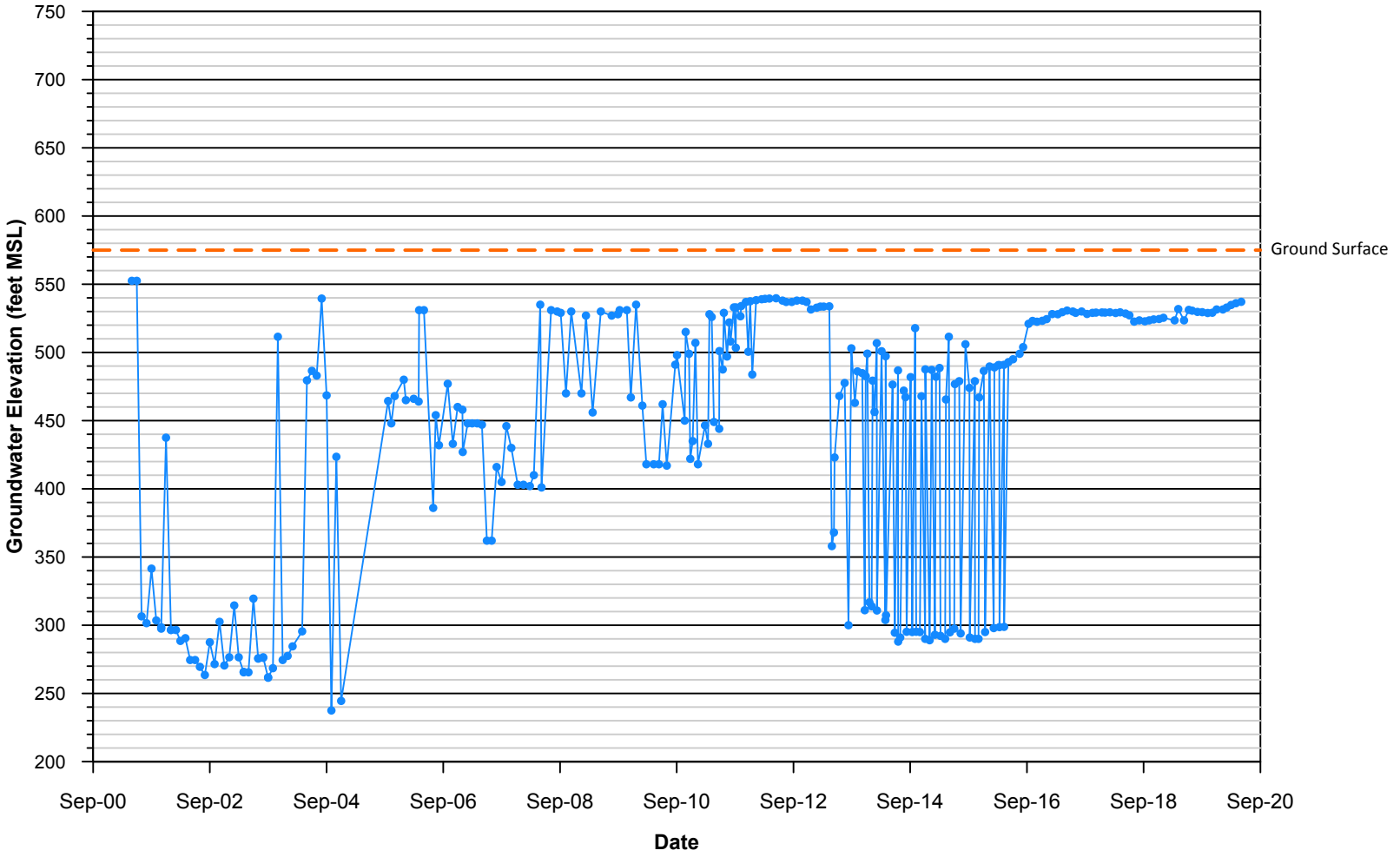
TODD GROUNDWATER

Figure 4-4
Representative Hydrographs
Corona Well 22



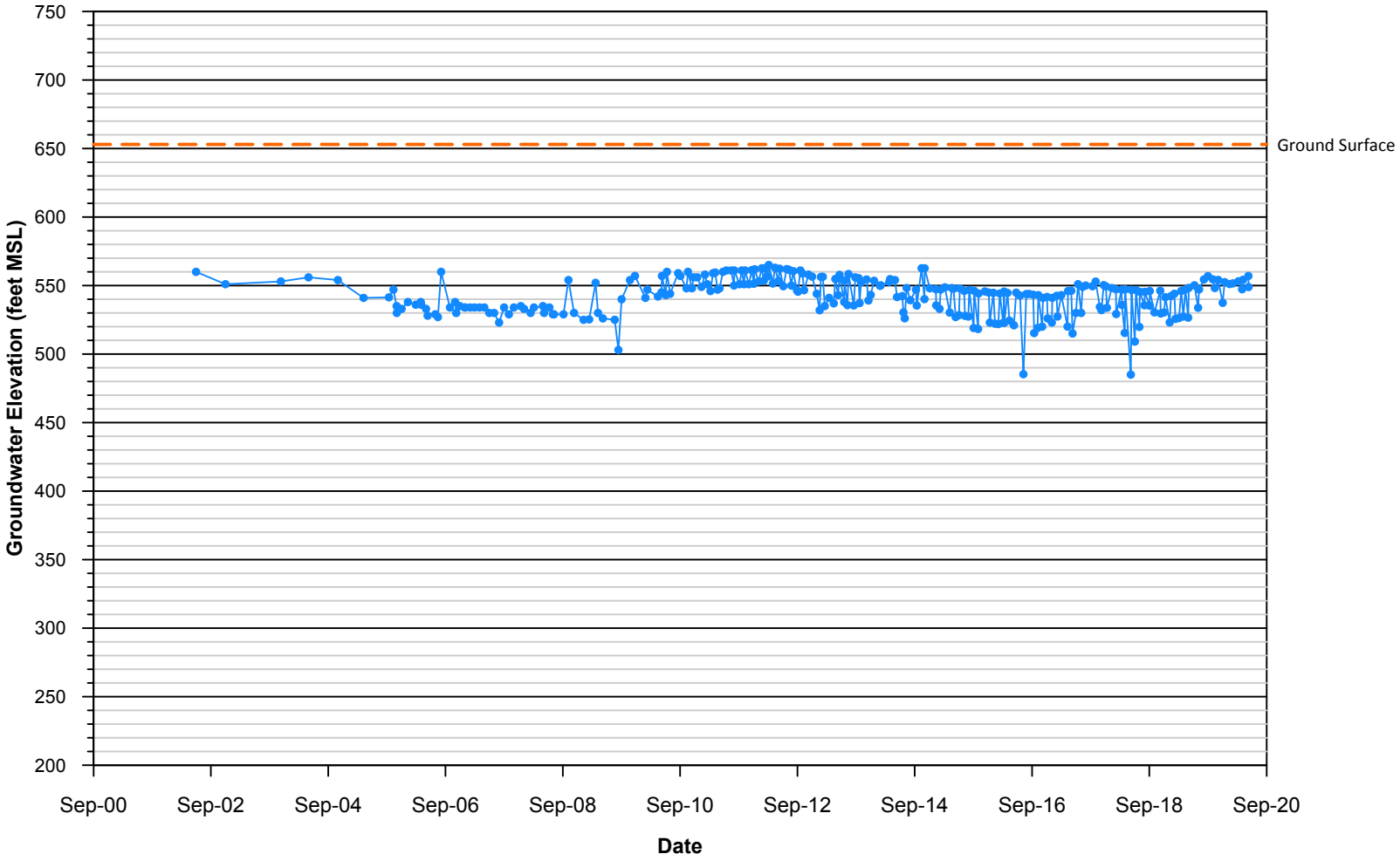
TODD GROUNDWATER

Figure 4-5
Representative Hydrographs
Corona Well 19



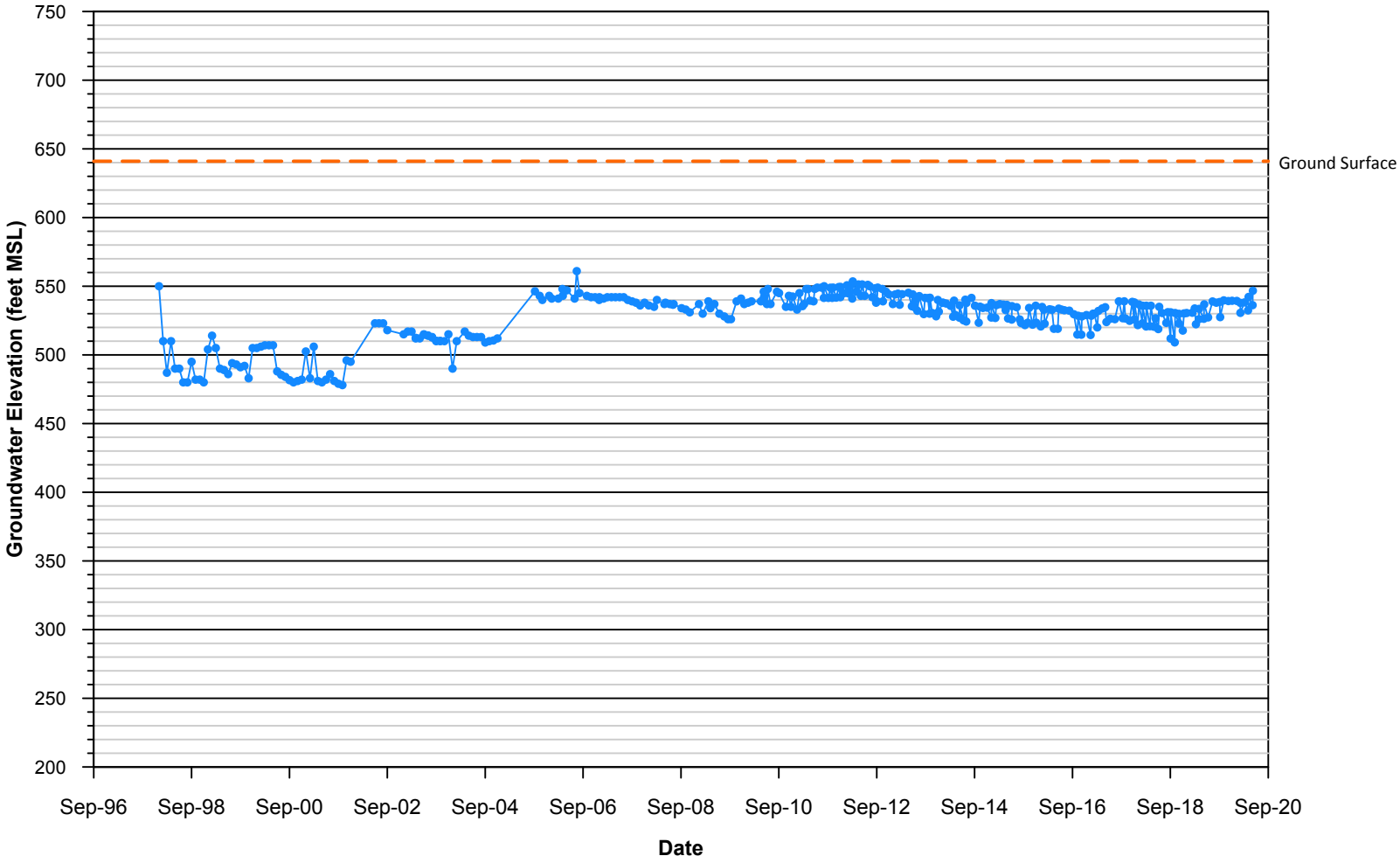
TODD GROUNDWATER

Figure 4-6
Representative Hydrographs
Corona Well 26



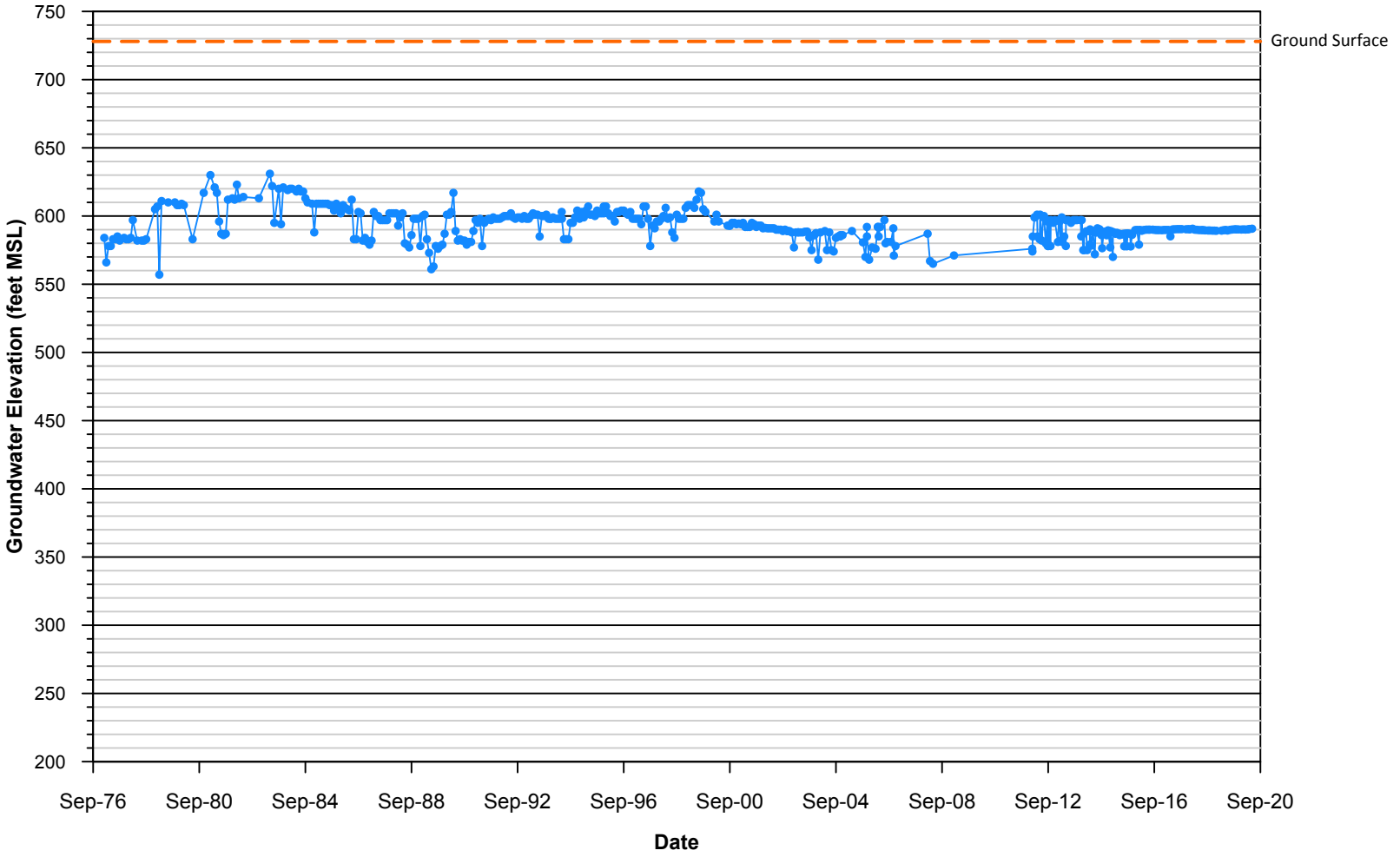
TODD GROUNDWATER

Figure 4-7
Representative Hydrographs
Corona Well 17A



TODD GROUNDWATER

Figure 4-8
Representative Hydrographs
Corona Well 8A



TODD GROUNDWATER

Figure 4-9
Representative Hydrographs
Corona Well 13

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-10 Groundwater Elevation Contours Fall 2015.mxd

Well Monitored Fall 2015

Groundwater Elevation Contour - feet above mean sea level, Fall 2015 (dashed where inferred)

Temescal Basin

N

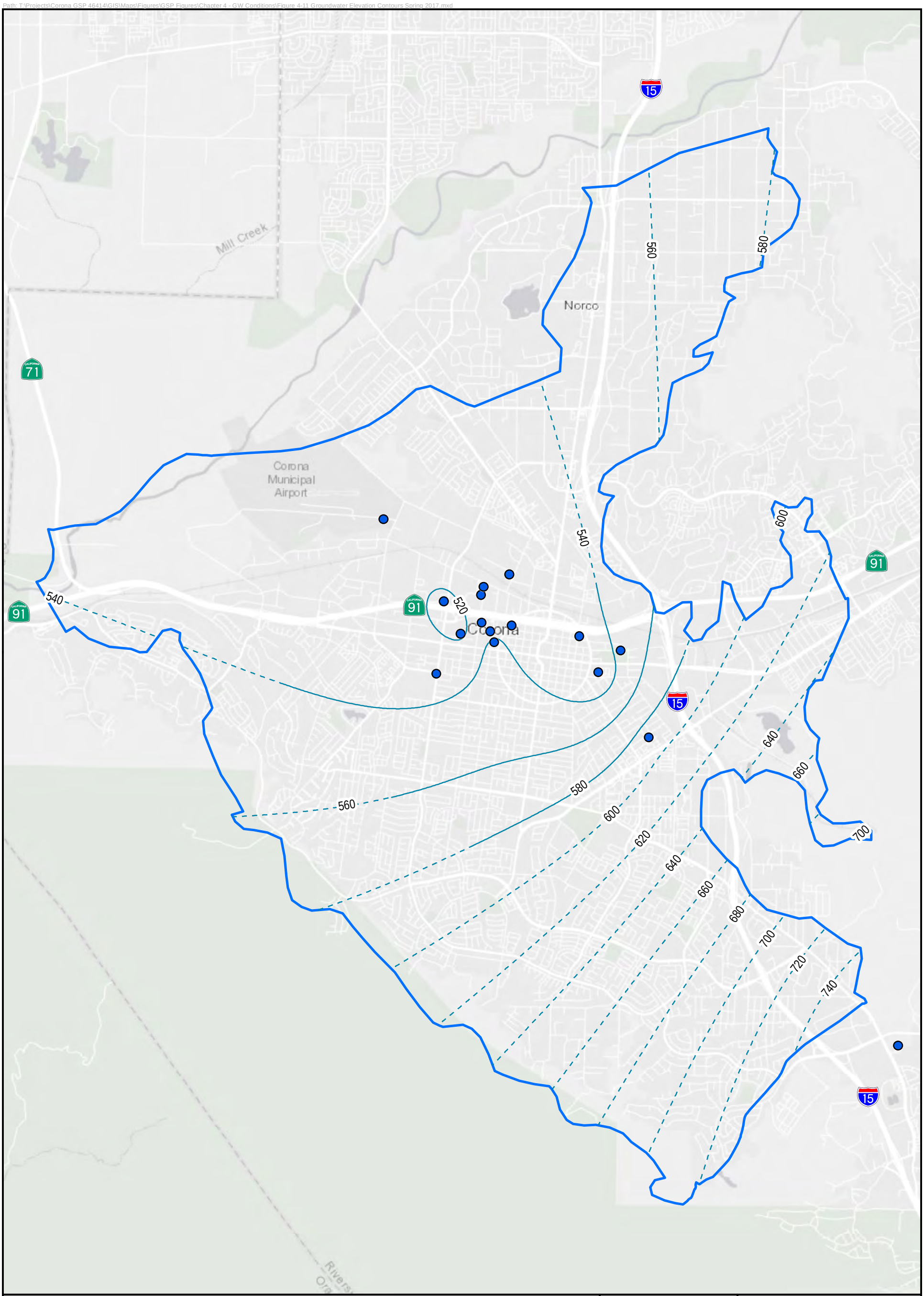
0 0.5 1

Miles

Figure 4-10
Groundwater Elevation Contours Fall 2015

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-11 Groundwater Elevation Contours Spring 2017.mxd



Well Monitored Spring 2017

Groundwater Elevation Contour - feet above mean sea level, Spring 2017 (dashed where inferred)

Temescal Basin

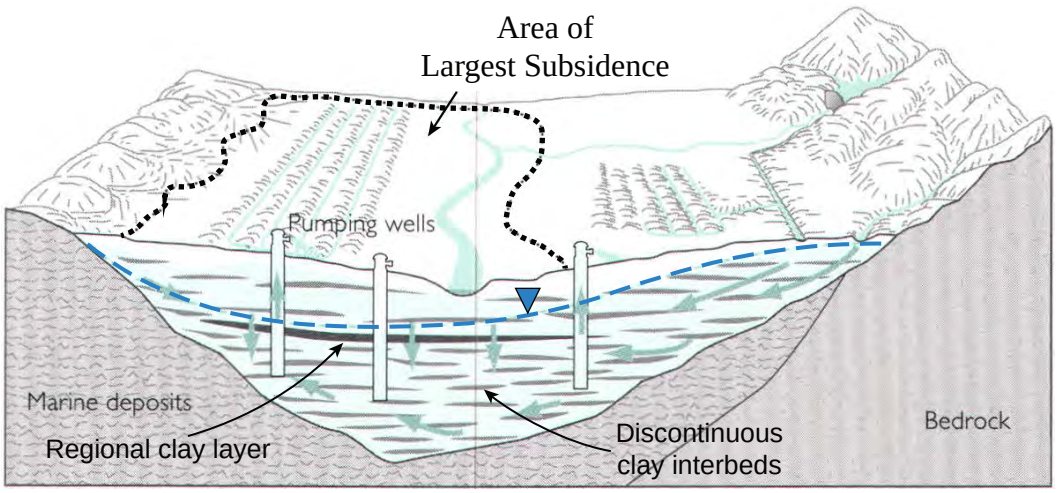
N

0 0.5 1

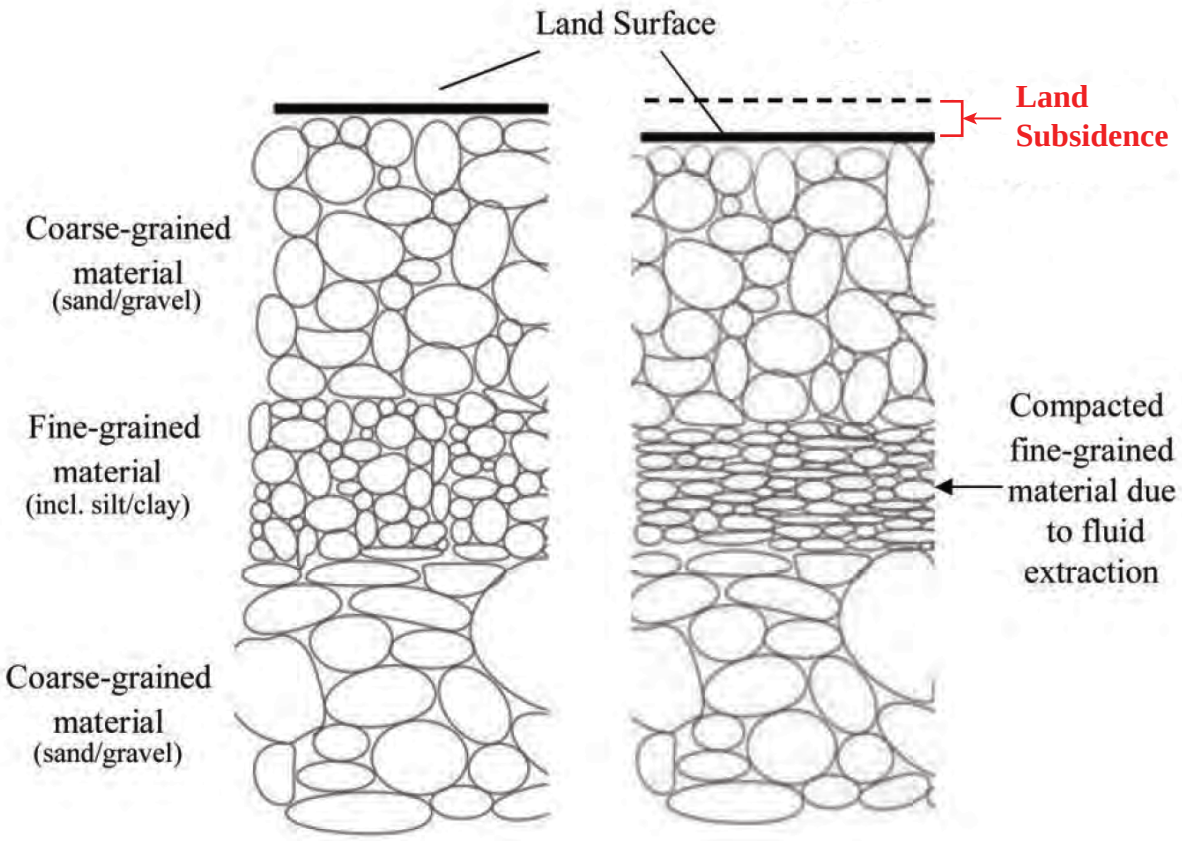
Miles

Figure 4-11
Groundwater Elevation Contours Spring 2017

TODD GROUNDWATER



Source: Galloway et al., 1999.

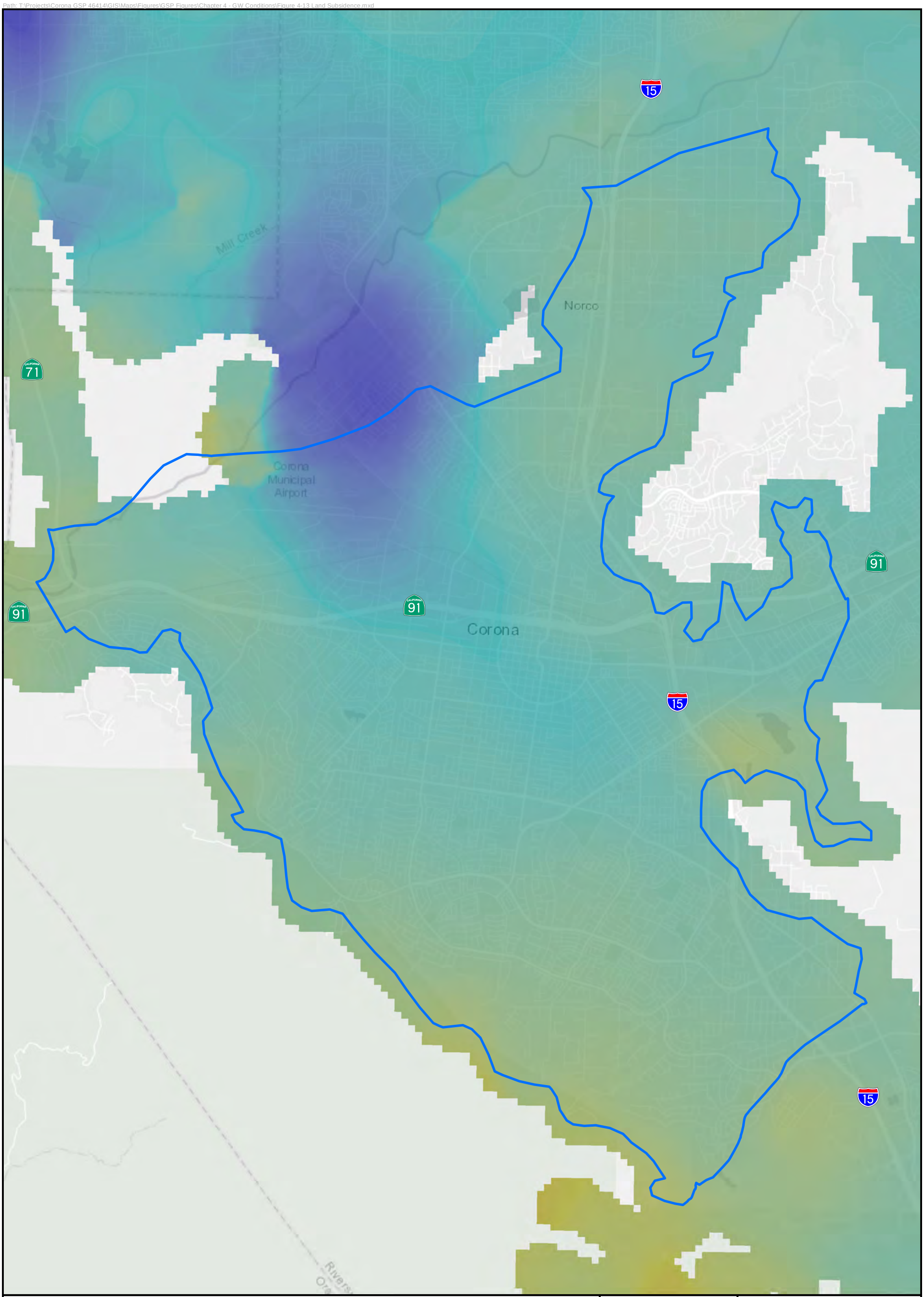


After LSCE et al., 2014.

TODD GROUNDWATER

Figure 4-12
Concepts of
Land Subsidence

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-13 Land Subsidence.mxd



Ground Surface Vertical Displacement (feet)

High : 0.08

Low : -0.08

Temescal Basin

Data Source:
Subsidence estimates from satellite measurements provided by the TRE ALTAMIRA InSAR provided by the California Department of Water Resources, June 13 2015 to September 19 2019 (downloaded July 31 2020).
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2019_Total_Since_20150613_20190919/ImageServer

N

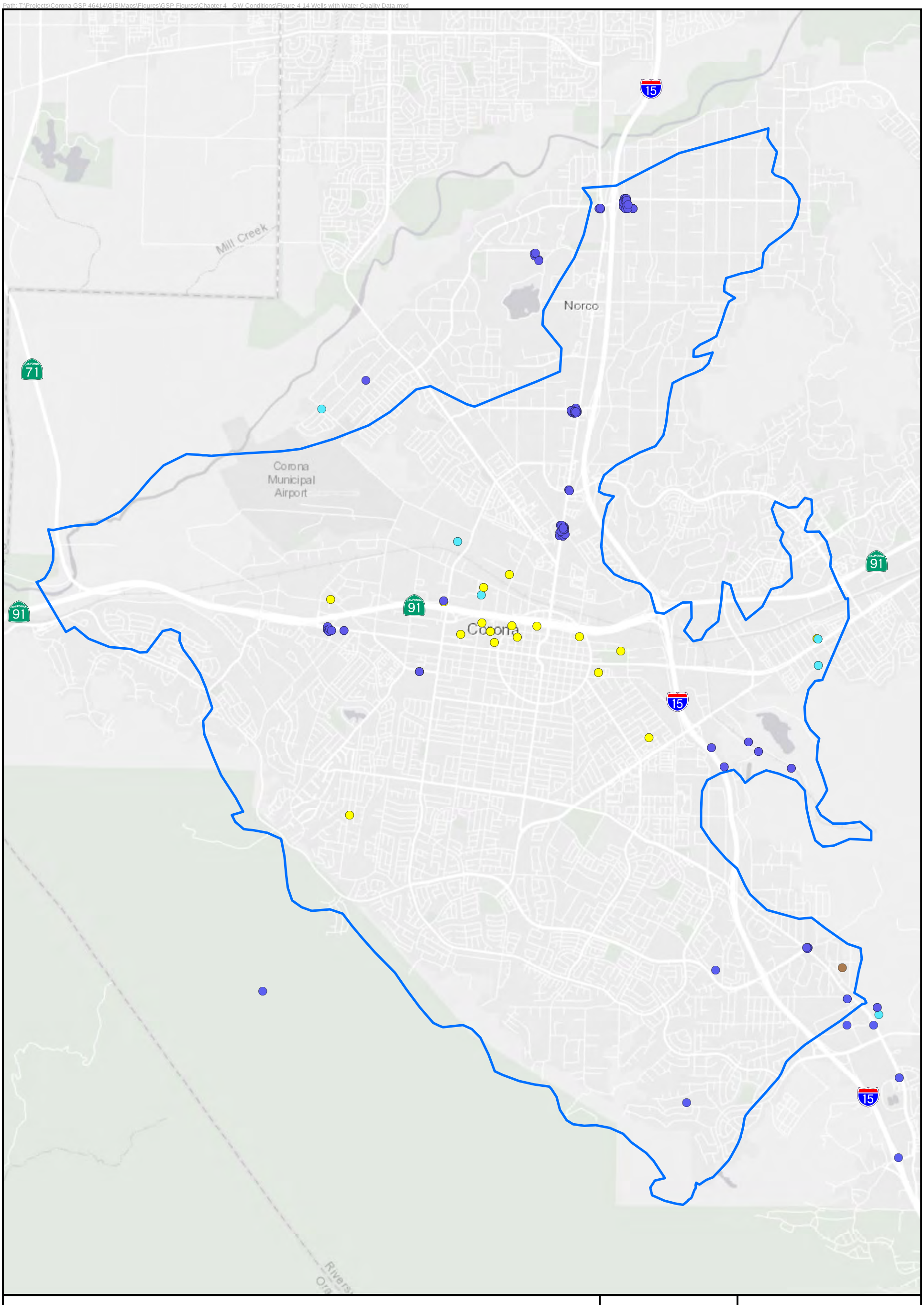
0 0.5 1

Miles

Figure 4-13
Basin-Wide Subsidence Estimates from Satellite Measurements

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-14 Wells with Water Quality Data.mxd



- Well with Water Quality Data from the City of Corona
- Well with Water Quality Data from State Water Resources Control Board Division of Drinking Water
- Well with Water Quality Data from Regional Water Quality Control Board
- Well with Water Quality Data from United States Geologic Survey
- Temescal Basin

N

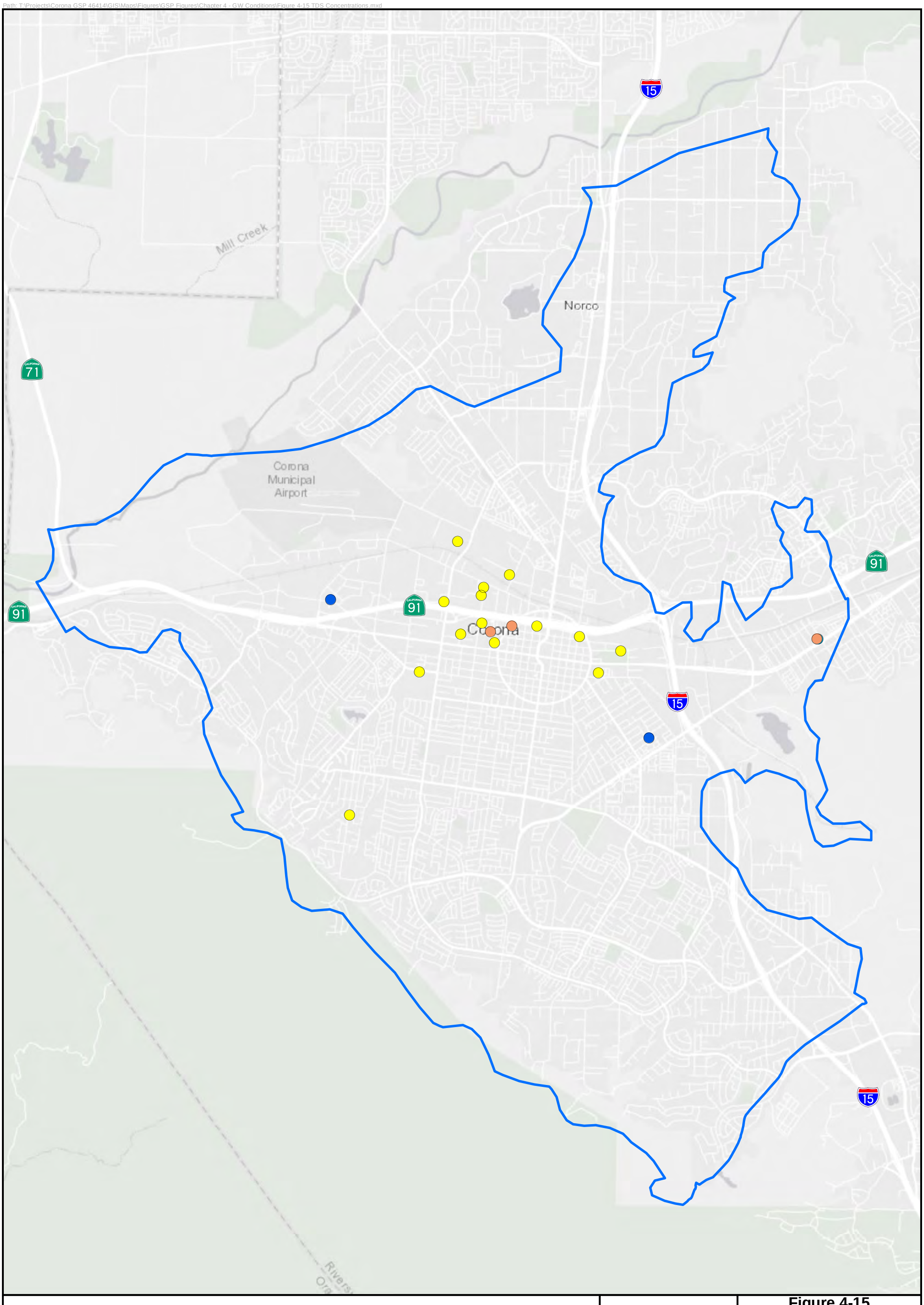
0 0.5 1

Miles

Figure 4-14
Wells with
Water Quality Data

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-15 TDS Concentrations.mxd



Recent Average Total Dissolved Solids Concentration in Wells

- <250 mg/L
- 250 - 500 mg/L
- 500 - 1 000 mg/L
- 1,000 - 1,500 mg/L
- >1,500 mg/L
- Temescal Basin

N

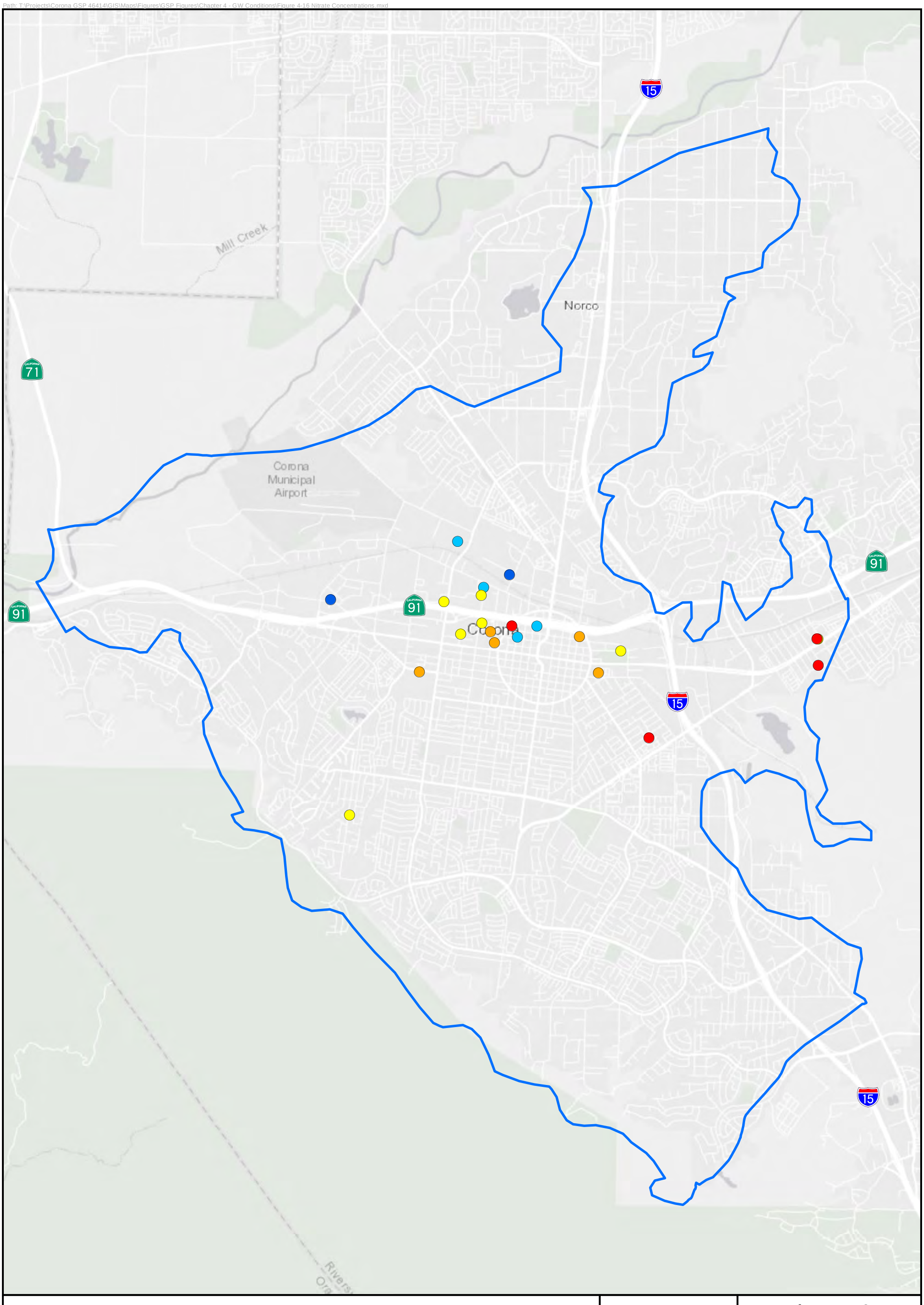
0 0.5 1

Miles

Figure 4-15
Total Dissolved Solids Concentrations in Wells
Water Years 2010 through 2019

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-16 Nitrate Concentrations.mxd



Recent Average Nitrate as Nitrate (NO3) Concentration in Wells

- 0 - 2
- 3 - 10
- 11 - 45
- 46 - 75
- 76 - 150
- Temescal Basin

N

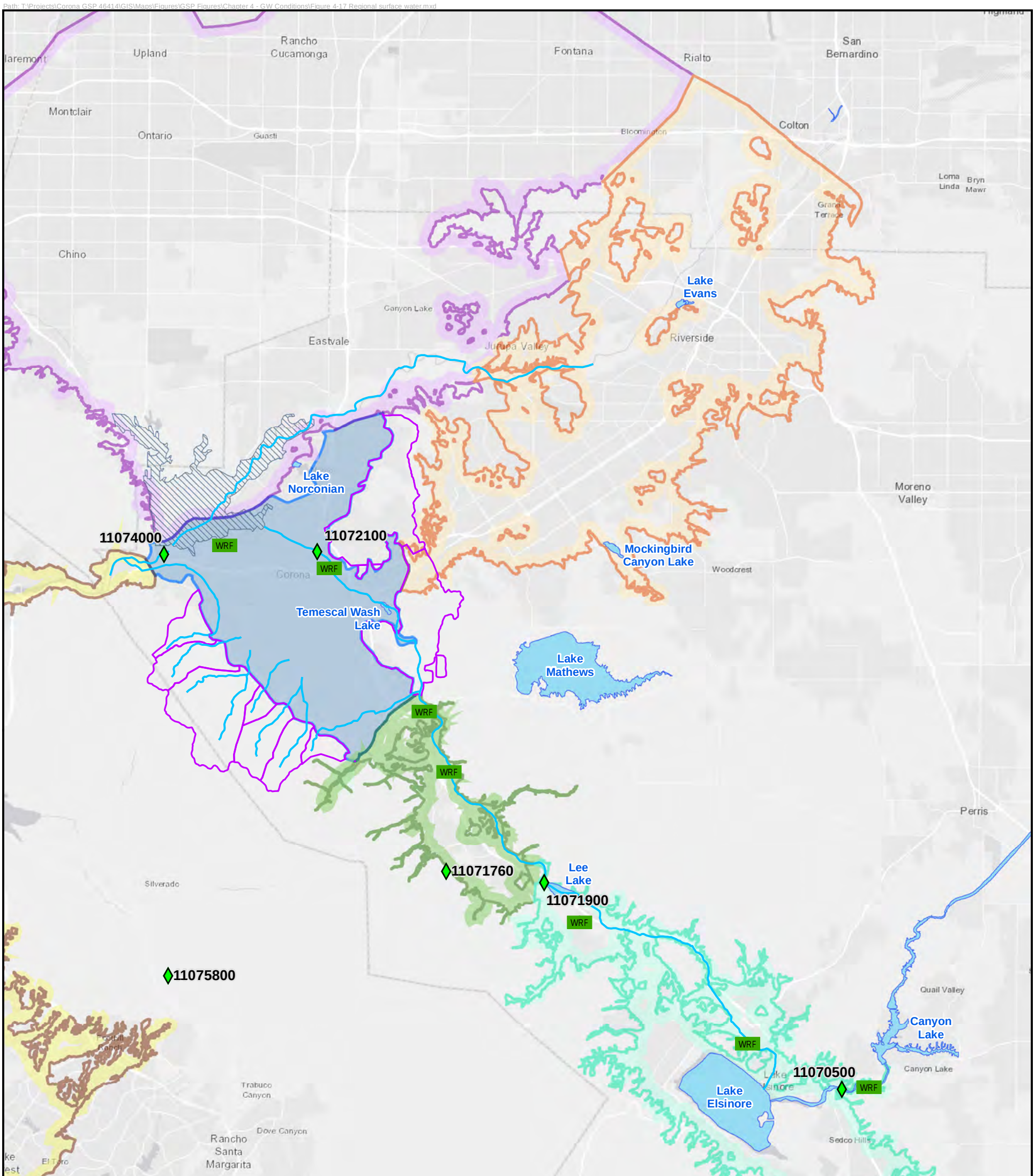
0 0.5 1

Miles

Figure 4-16
Nitrate Concentrations in Wells, Water Years 2010 through 2019

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-17 Regional surface water.mxd



USGS Station Number	USGS Station Name	Drainage Area (mi^2)
11042700	MURRIETA C NR MURRIETA CA	30
11042800	WARM SPRINGS C NR MURRIETA CA	55.5
11070500	SAN JACINTO R NR ELSINORE CA	723
11072100	TEMESCAL C AB MAIN ST A CORONA CA	224
11071760	COLDWATER CANYON C NR CORONA CA	4.2
11071900	TEMESCAL C A CORONA LK NR CORONA CA	57.9
11074000	SANTA ANA R BL PRADO DAM CA	1,490

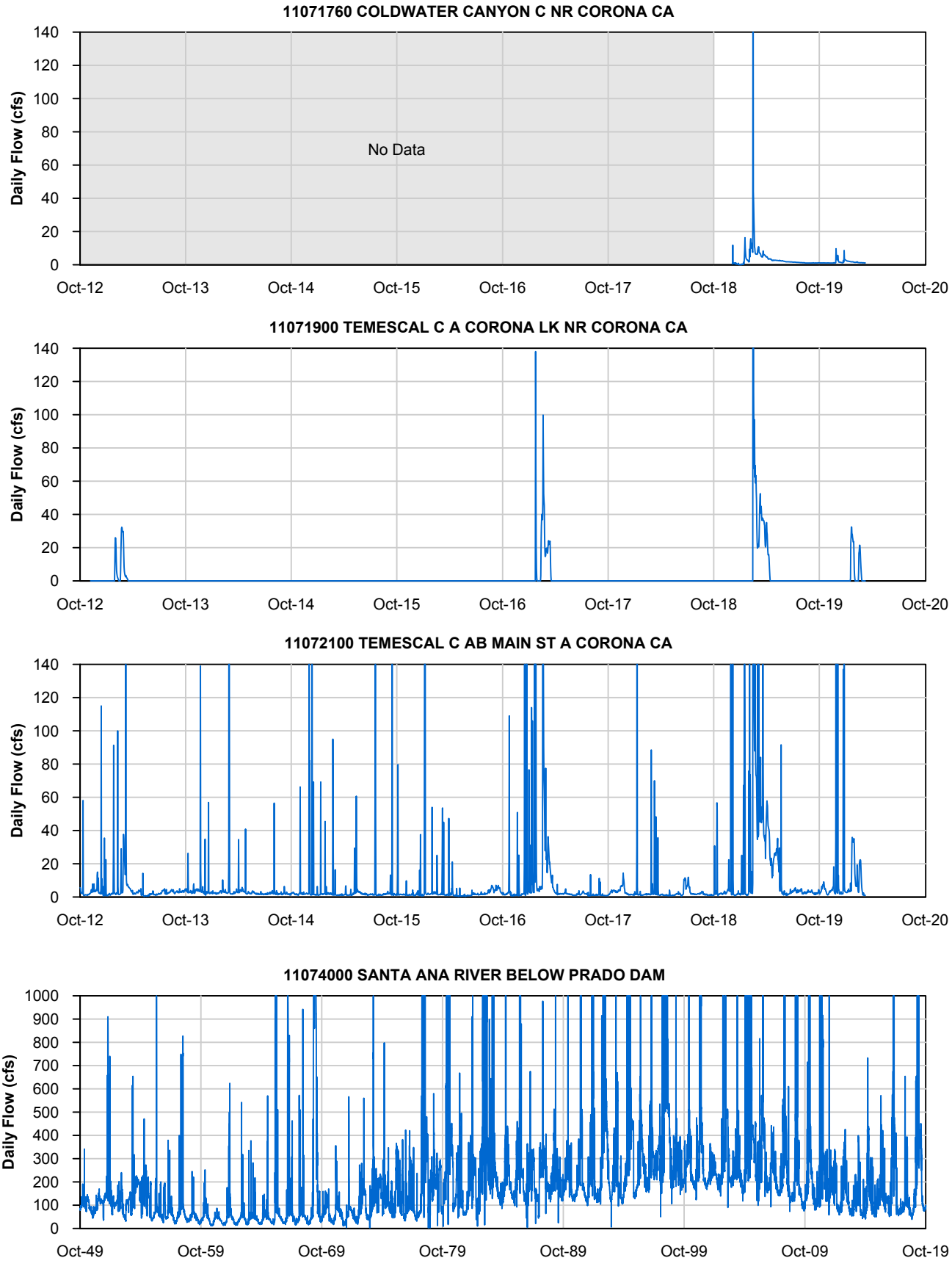
WRF Water Reclamation Facility
Stream Gauge
Stream
Tributary Watersheds
Prado Wetlands
Coastal Plain of Orange County Basin
Bedford-Coldwater Subbasin
Chino Subbasin
Elsinore Valley Subbasin
Riverside-Arlington Subbasin
Temescal Basin

N

0 1.5 3
Miles

Figure 4-17
Regional Surface Water Features

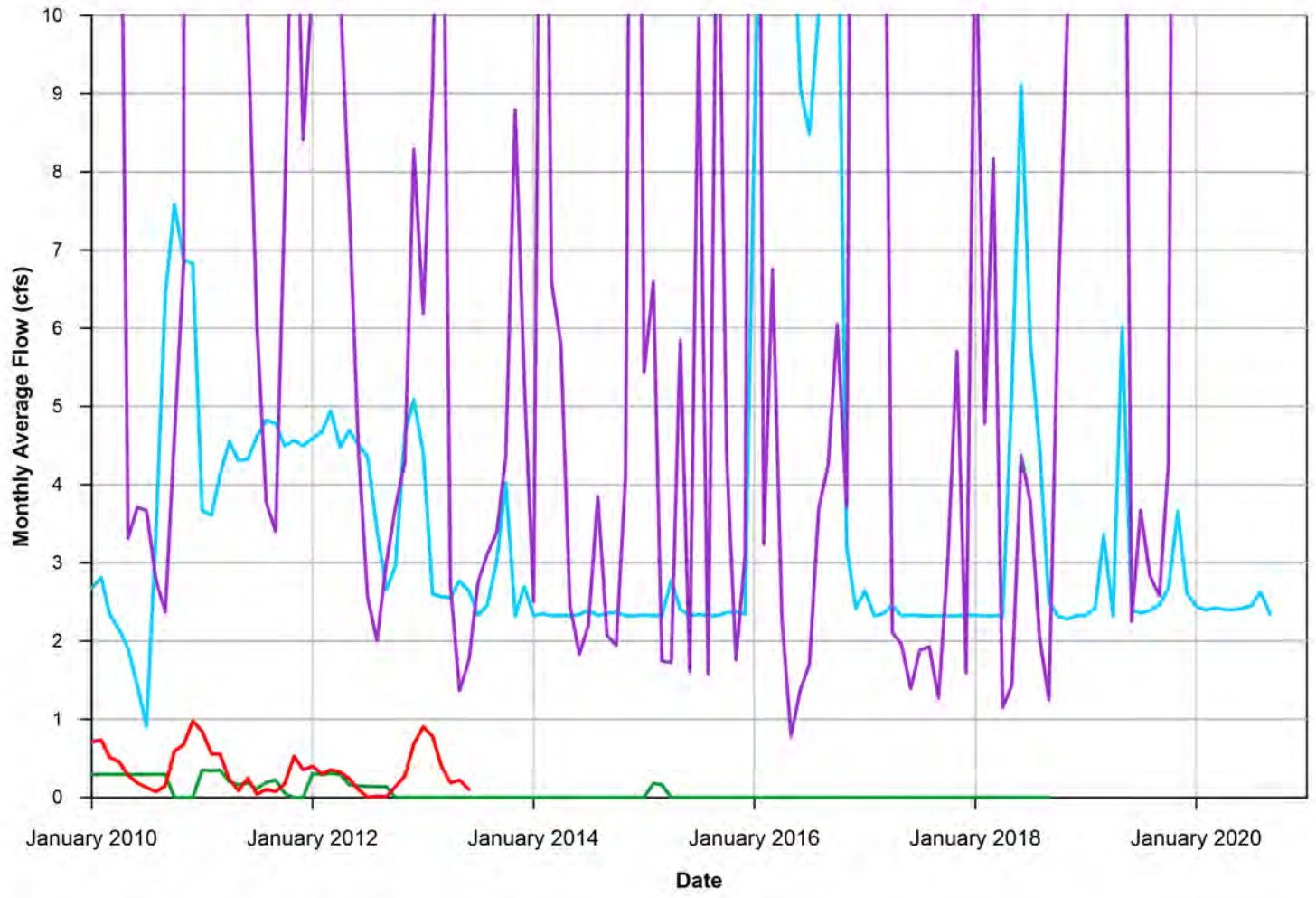
TODD GROUNDWATER



TODD GROUNDWATER

Figure 4-18
Stream Flow at Four Gages

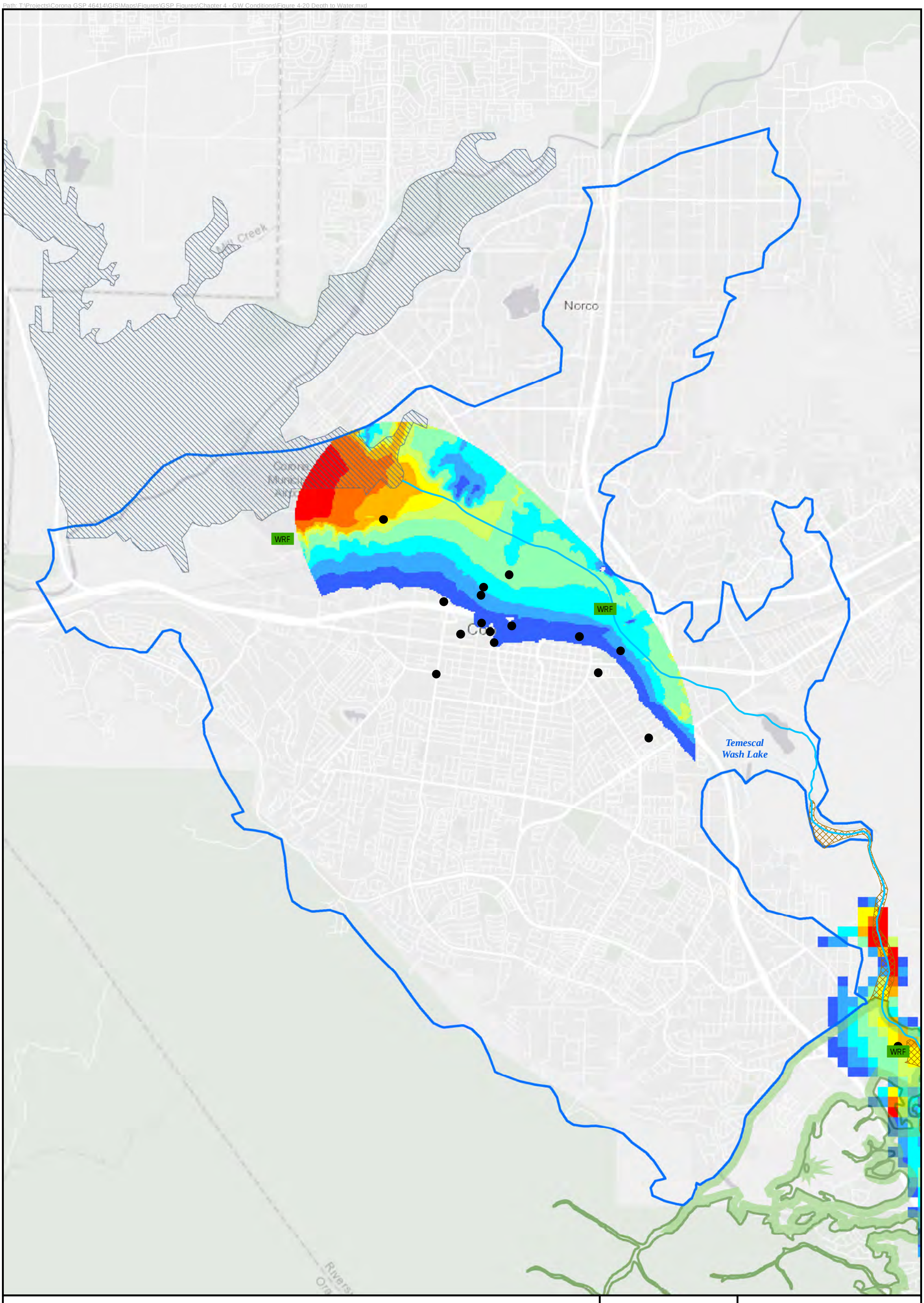
Path: C:\Projects\Corona GSP 46414\GRAPHICS\Figure 4-18.ggp



TODD GROUNDWATER

Figure 4-19
Temescal Wash Flow and Reclaimed Water Discharge

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-20 Depth to Water.mxd



WRF Water Reclamation Facility

Spring 2017 Water Level Wells

Depth To Water, Spring 2017

- < 0 feet
- 0 to 10 feet
- 10 to 20 feet
- 20 to 30 feet
- 30 to 40 feet
- 40 to 60 feet
- 60 to 80 feet
- 80 to 100 feet
- 100 to 120 feet
- > 120 feet

Dense Riparian Vegetation

Prado Wetlands

Bedford-Coldwater Subbasin

Temescal Basin

N

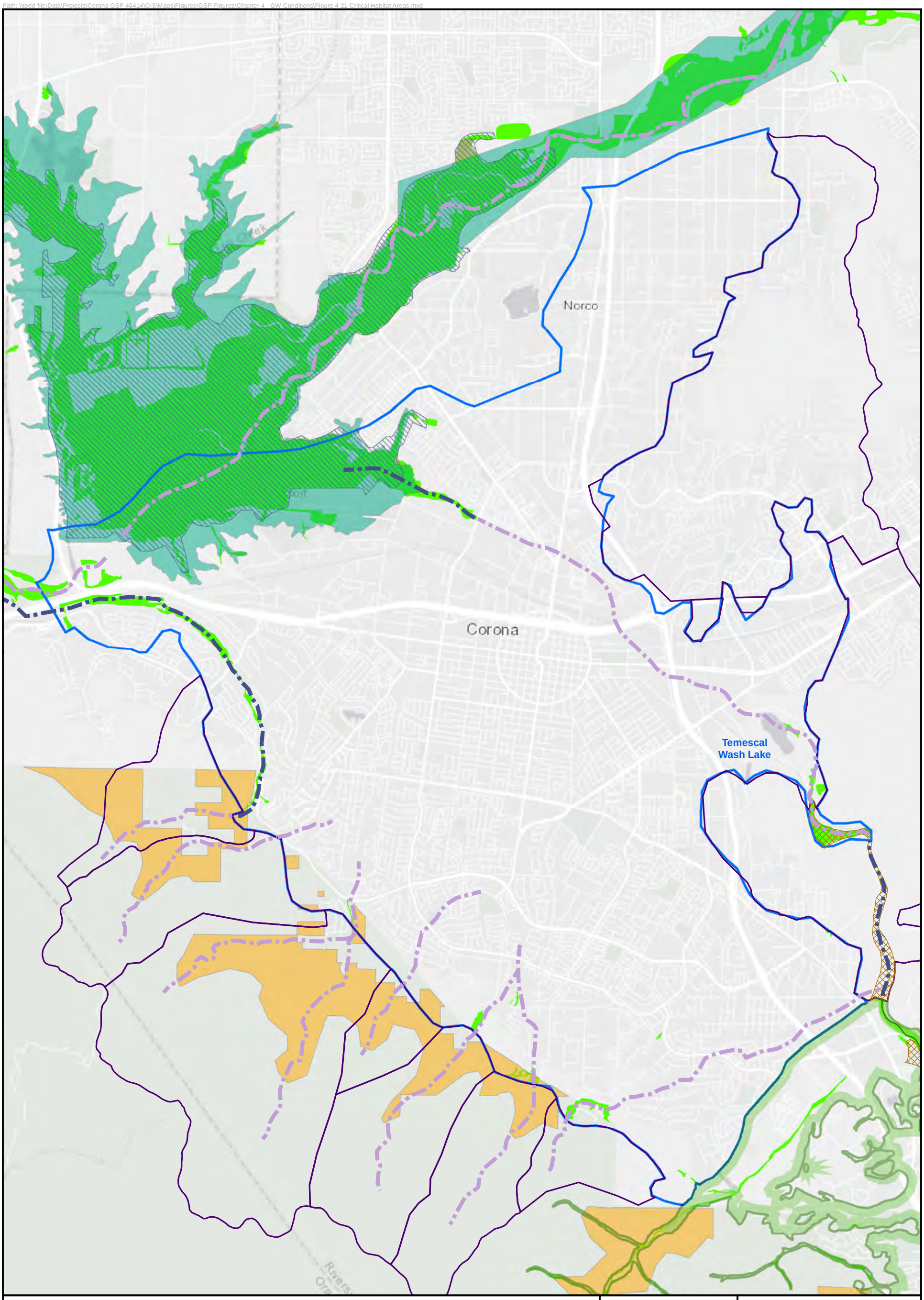
0 0.5 1

Miles

Figure 4-20
Depth to Water
Spring 2017

TODD GROUNDWATER

Path: \\todd-file\Data\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-21 Critical Habitat Areas.mxd



Dense Riparian Vegetation
Tributary Watershed
Temescal Basin
Prado Wetlands
Bedford-Coldwater Subbasin
Southwestern Willow Flycatcher
Coastal California Gnatcatcher
Least Bell's Vireo
NCCAG riparian vegetation
Connection with Groundwater
Disconnected
Mostly interconnected

N
0 0.5 1
Miles

Figure 4-21
Critical Habitat Areas

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 4 - GW Conditions\Figure 4-22 Depth to Water Near Prado.mxd

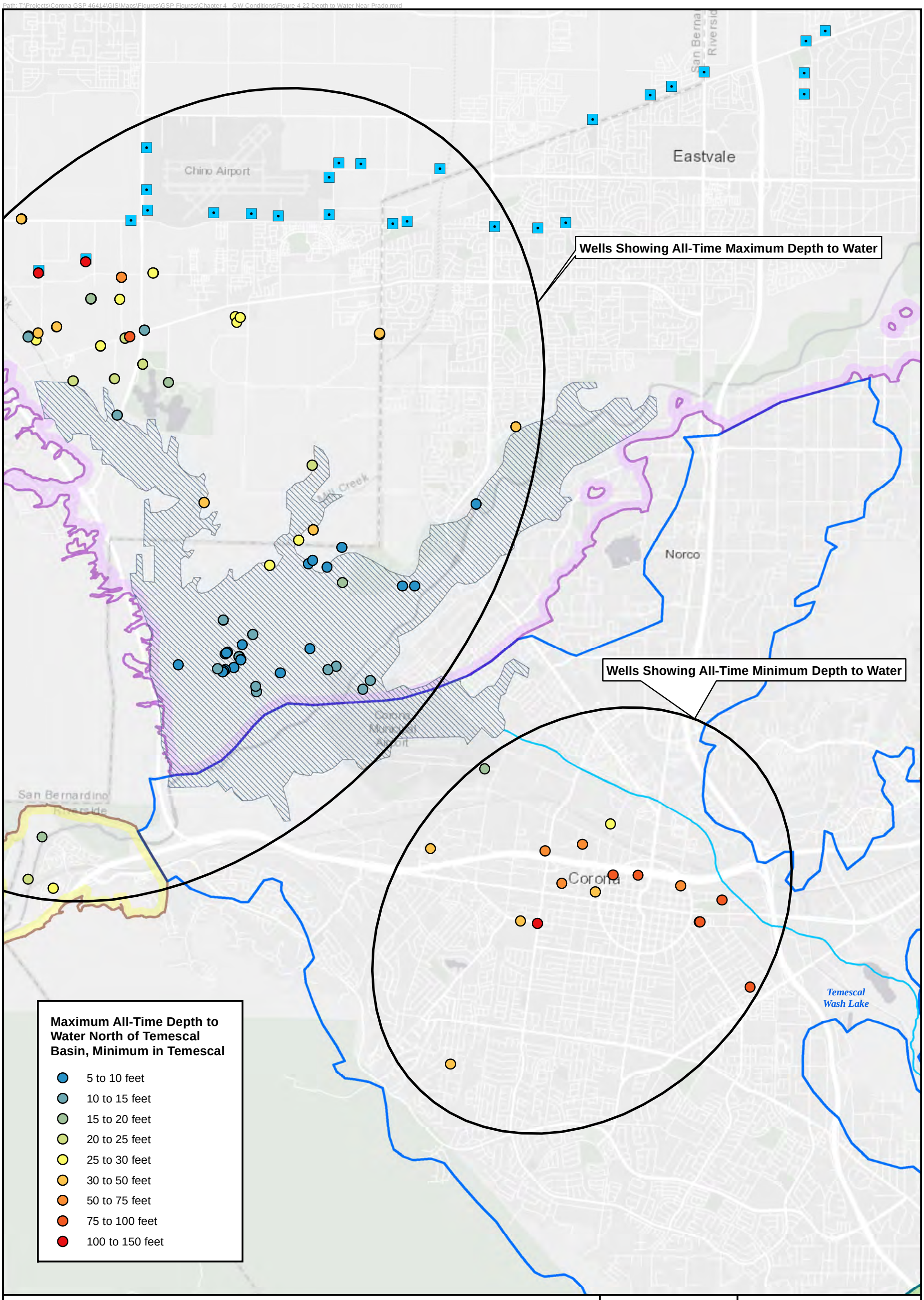
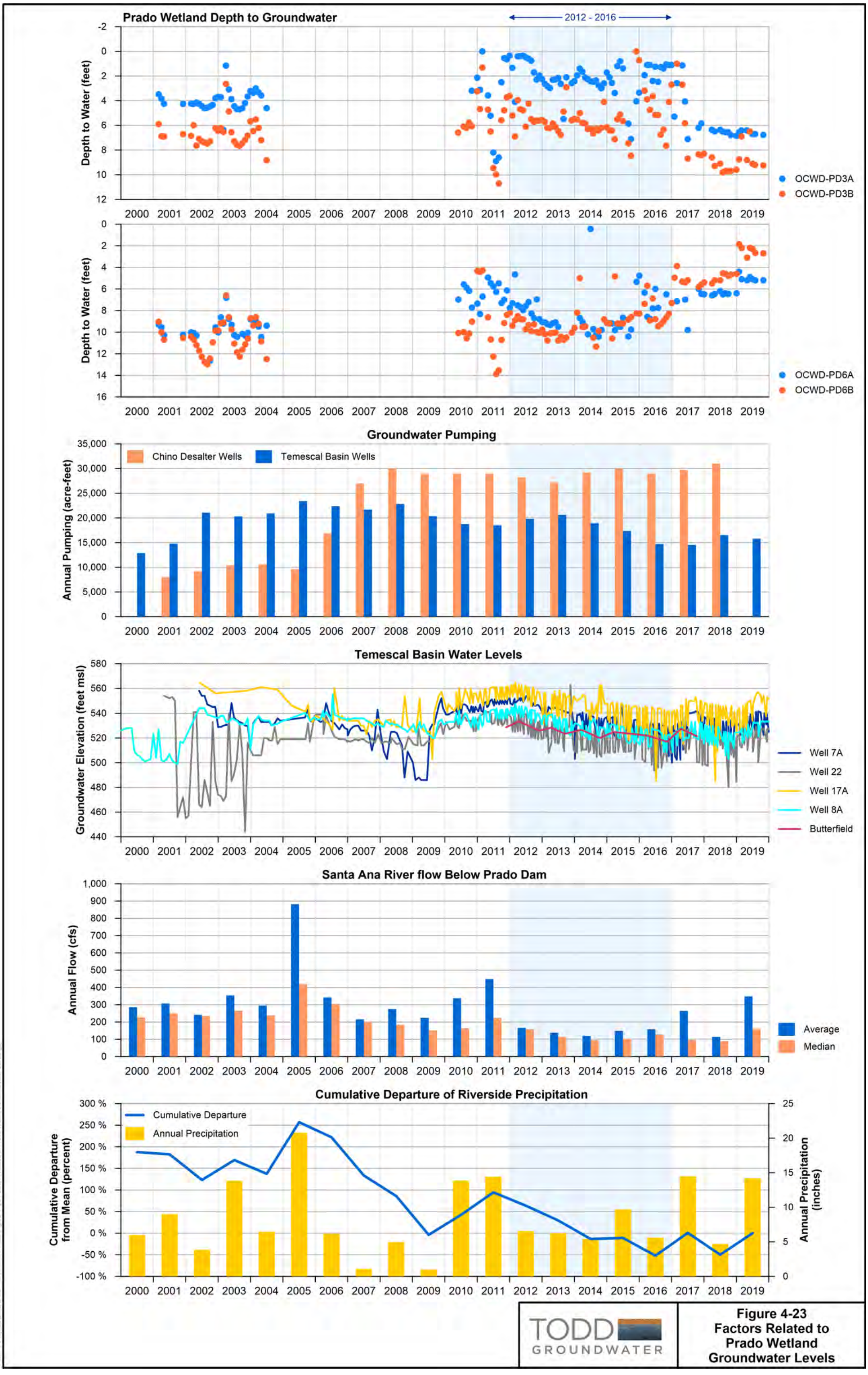


Figure 4-22
Historical Maximum Depth to Water Near Prado Wetlands

TODD GROUNDWATER



TODD GROUNDWATER

Figure 4-23
Factors Related to Prado Wetland Groundwater Levels

5. WATER BUDGET

A water balance (or water budget) is a quantitative tabulation of all inflows, outflows, and storage change of a hydrologic system. The Sustainable Groundwater Management Act (SGMA) requires that water balances be prepared for the groundwater system and surface water system of a basin. If a basin contains multiple management areas, separate balances must be developed for each of them. Management areas have not been defined for the Temescal Subbasin (Basin). Furthermore, water budgets must be developed for time periods representing historical, current, future no project (baseline), and future growth plus climate change (growth plus climate change) conditions.

This chapter presents the basis for selecting the water budget analysis periods for the Basin, describes modeling tools used to estimate some water budget items, and presents the surface water and groundwater budgets.

5.1. WATER BUDGET METHODOLOGY

Annual balances were developed for water years 1990 through 2018, the period simulated by the numerical groundwater model. The model is described in **Appendix J** and provides estimates for several items in the water balance for which direct measurements are not available: flows between groundwater and surface water bodies, flows to and from adjacent basins, evapotranspiration of riparian vegetation, and storage change. The numerical model allows a dynamic and comprehensive quantification of the water balance wherein all estimated water balance elements fit together and are calibrated to groundwater level changes over time. Accordingly, the numerical model is the best tool to quantify those water balance items. It will be updated regularly through the Groundwater Sustainability Plan (GSP) process, providing a better understanding of the surface water-groundwater system and a tool to evaluate future conditions and management actions.

5.2. DRY AND WET PERIODS

Dry and wet periods in historical hydrology can be identified on the basis of individual years or sequences of dry and wet years. GSP Regulations require that each year during the water budget analysis period be assigned a water year type, which is a classification based on the amount of annual precipitation. **Figure 5-1** shows annual precipitation at Elsinore (National Oceanic and Atmospheric Administration (NOAA) Station GHCND:USC00042805) for water years 1899 through 2020. Water year types are also indicated and are assigned to five categories corresponding to quintiles of annual precipitation. The categories used here (dry, below normal, normal, above normal, and wet) accurately describe the quintiles but differ from the categories commonly used in the Central Valley (critical, dry, below normal, above normal, and wet). Those categories do not accurately describe quintiles and are based on the Sacramento River Index, which has little relevance to conditions in the Basin. The quintile divisions for precipitation during 1899 to 2020 at the Lake Elsinore station are shown in **Table 5-1**.

Table 5-1. Water Year Type Classification

Water Year Type		Range as Percent of Mean	Precipitation Range (inches)
Wet	W	>139	> 16.5
Above Normal	AN	101 to 139	12.0 to 16.5
Normal	N	75 to 101	8.9 to 12.0
Below Normal	BN	56 to 75	6.6 to 8.9
Dry	D	<56	< 6.6

Average precipitation for 1899 to 2020 was 11.89inches per year

Individual wet and dry years are not particularly useful for groundwater management in basins where groundwater storage greatly exceeds annual pumping and recharge, which is the case in the Basin. In those basins, multi-year droughts and sequences of wet years are more relevant, because they relate to the amount of operable groundwater storage needed to support sustainable groundwater management. Multi-year wet and dry periods can be identified from a plot of cumulative departure of annual precipitation, which is also shown on **Figure 5-1**. Wet periods appear as upward-trending segments of the cumulative departure curve, and droughts appear as declining segments. By far the largest climatic deviations in this record were the sustained wet conditions from 1937 to 1944 and dry conditions from 1946 to 1965. These events pre-dated the most recent 30 years, which is the period the California Department of Water Resources (DWR) states should be used for determining year types (DWR 2016c). They also pre-date the period simulated by the groundwater model. However, large wet and dry events like those could recur in the future, and it is prudent to consider climate uncertainty in planning for groundwater sustainability.

5.3. WATER BALANCE ANALYSIS PERIODS

GSP regulations require evaluation of the water balances over historical, current, and future periods. The historical period must include at least 10 years, and the future period must include exactly 50 years. The duration of the current period is not specified, but to be consistent with SGMA concepts it needs to include several years around 2015, which was the implementation date of SGMA. Historical and current analysis periods for the Basin were selected from within the 1990 through 2018 modeling period. Ideally, each period is characterized by average precipitation and relatively constant land and water use. In the Basin, urbanization increase has been gradual throughout the 1990 to 2018 period. The historical period is represented by water years 1993 through 2007, and the current period by water years 2010 to 2013. Those periods had 101 percent and 102 percent of the 1899 to 2020 average annual rainfall, respectively.

The future period is intended to represent conditions expected to occur over the next 50 years. The model simulation period is only 29 years (1990 to 2018). To obtain a 50-year period, simulations of future conditions used the 1993 through 2017 sequence of rainfall and natural stream flow repeated twice. Average annual precipitation during 1993 to 2017 was 94 percent of the long-term average. For the baseline scenario, no adjustments were made to the hydrologic sequence. Adjustments made to simulate future climate change are described in Section 5.5.3.

5.4. MANAGEMENT AREAS

As defined in the GSP regulations, a Management Area (MA) is an area within a basin for which the GSP may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors. The Channel Aquifer area is more permeable than the alluvial fan aquifer areas, and it is where almost all groundwater pumping now occurs. However, there is no reason that monitoring, sustainability criteria, and management actions need to be different for the Channel Aquifer and alluvial fan aquifer areas. Accordingly, the Channel Aquifer area is not designated as a management area, and the Temescal Basin is managed as a whole.

5.5. METHODS OF ANALYSIS

Complete, itemized surface water, and groundwater balances were estimated by combining raw data (rainfall, stream flow, municipal pumping, and wastewater percolation from septic tanks and wastewater treatment plant discharge) with values simulated using models[2]. Collectively, the models simulate the entire hydrologic system, but each model or model module focuses on part of the system, as described below. In general, the models were used to estimate flows in the surface water and groundwater balances that are difficult to measure directly or that relate to time-dependent groundwater levels. These include surface and subsurface inflows from tributary areas, percolation from stream reaches within the Basin, groundwater discharge to streams, potential subsurface flow to and from neighboring basins, the locations and discharges of pumping wells, consumptive use of groundwater by riparian vegetation, and changes in groundwater storage. Descriptions of the inflows and outflows to the surface water and groundwater models are included below in Sections 5.6 and 5.7.

5.5.1. Rainfall-Runoff-Recharge Model

This Fortran-based model developed over a number of years by Todd Groundwater staff simulates hydrologic processes that occur over the entire land surface, including

[2] Water balance values are shown to nearest acre-foot to retain small items, but entries are probably accurate to only two significant digits.

precipitation, interception[3], infiltration, runoff, evapotranspiration, irrigation, effects of impervious surfaces, pipe leaks in urban areas, deep percolation below the root zone, and shallow groundwater flow to streams and deep recharge. The model simulates these processes on a daily time step for 286 recharge zones delineated to reflect differences in physical characteristics as well as basin and jurisdictional boundaries. Simulation of watershed areas outside the Basin are included to provide estimates of stream flow and subsurface flow entering the Basin. Daily simulation results were subtotaled to monthly values for input to the groundwater model. Additional details regarding the rainfall-runoff-recharge model can be found in **Appendix J** and the model code is available on request.

5.5.2. Groundwater Model

A numerical groundwater flow model of the Basin was completed in 2008 for the Groundwater Management Plan (Todd and AKM 2008). For this GSP, the model was revised, expanded to include the entire Basin, updated with new geological information, and updated through water year 2018.

The revised and updated model uses the MODFLOW 2005 code developed by the U.S. Geological Survey that is a public domain open-source software as required by GSP regulation §352.4(f)(3). The model produces linked simulation of surface water and groundwater, as described below. Additional documentation of the model update and calibration is provided in **Appendix J**.

5.5.2.1. Surface Water Module

Stream flow in MODFLOW is simulated using the Streamflow Routing Package (SFR) where a network of stream segments represents the small streams entering the Basin from Temescal Wash and tributary watersheds.

Surface water inflows to Temescal Wash were obtained from a similar groundwater flow model of the Bedford-Coldwater Subbasin. Small stream inflows were estimated using the rainfall-runoff-recharge model. Each stream segment is divided into reaches, one per model grid cell traversed by the segment. Flow is routed down each segment from reach to reach. Along each reach mass balance is conserved in the stream, including inflow from the upstream reach and tributaries, inflow from local runoff, head-dependent flow across the stream bed to or from groundwater, evapotranspiration losses, and outflow to the next downstream reach. Flow across the stream bed is a function of the wetted channel length and width, the bed permeability and the difference in elevation between the stream surface and groundwater at the reach cell. Wetted width and depth of the stream are functions of stream flow.

5.5.2.2. Groundwater Module

The MODFLOW groundwater model is constructed to cover the entire Basin. The model grid size is oriented north-south and has a uniform 100 feet (ft) horizontal grid spacing to

[3] Interception refers to precipitation that does not reach the soil, but instead falls on (and is intercepted by) plant leaves, branches, and plant litter, and is subject to evaporation loss.

provide sufficient resolution to resolve hydraulic gradients, well drawdown cones, and groundwater-surface water interactions in the Basin.

The model covers the entire Basin as delineated by DWR and also the southern part of the Chino Basin. Including part of the Chino Basin improves the ability of the model to simulate groundwater conditions beneath Prado Basin.

The numerical model has been constructed to reflect the hydrogeological conceptual model developed for the GSP, Chapter 3. The vertical extent of the Basin is based on the mapped depth to consolidated rock. The elevation of surface features and streambed elevations have been derived from geographic information system (GIS) files developed from the local topography and stream information.

Citrus orchards irrigated with groundwater were common in the Basin in the early 1990s, but except for one small grove those have all been replaced by urban development. Agricultural irrigation pumping of the orchards was estimated by the rainfall-runoff-recharge model, with pumping assigned to a hypothetical irrigation well at the center of each irrigated recharge zone. This pumping was phased out over time as urban development occurred. Urban irrigation is supplied by the municipal water system, which uses imported water and local wells. Municipal well extractions are known and are entered directly into the model. All major pumpers in the Basin report their annual production to Western Municipal Water District (WMWD), which was the source of data for several non-municipal pumping wells. Pumping at private domestic wells is not reported and there is currently no private domestic groundwater use in the Basin so none is included in the model.

5.5.3. Simulation of Future Conditions

GSP regulations §354.18(c)(3) require simulation of three future scenarios to determine their effects on water balances, yield and sustainability indicators. The growth and climate change scenarios were combined, resulting in the following two scenarios:

> **Baseline.** This represents a continuation of existing land and water use patterns, imported water availability, and climate.
>
> **Growth Plus Climate Change.** This scenario implements anticipated changes in land use and associated water use, such as urban expansion, and anticipated effects of future climate change on local hydrology (rainfall recharge and stream percolation) and on the availability of imported water supplies.

Both of the future simulations assume that the level of development and related water demand are constant throughout the simulation. That is, development in the growth plus climate change simulation is not phased in over time but rather corresponds to 2068 development throughout the simulation. This is the best way to demonstrate whether 2068 land use is sustainable because it allows for assessment of the effects of variations in climatic conditions (wet and dry cycles) on groundwater conditions, avoids subjective decisions about the concurrent timing of droughts and development, and provides time for the full effect of future conditions on groundwater to become apparent.

5.5.3.1. Baseline Scenario

The baseline simulation is a 50-year period, as required by SGMA regulations, with water budget components developed using the criteria and assumptions described below. Initial water levels are simulated water levels for September 2018 from the historical calibration simulation. That year represents relatively recent, non-drought conditions. These simulated water levels are internally consistent throughout the model flow domain and reasonably matched measured water levels at wells with available data (see **Appendix J** for discussion of model calibration).

Surface water and other inflows came from multiple sources. Monthly inflows in Temescal Wash were obtained from the baseline and growth plus climate change simulations produced by the Bedford-Coldwater Subbasin groundwater model (Todd, H&H, and Stantec 2021), which was used to develop the GSP for that subbasin. Small stream and bedrock inflows simulated for 1993 to 2017 of the calibration model period were repeated twice to obtain 50 years of data.

In the baseline scenario, land use remains the same as the current conditions. In the model, land use is represented by 2014 land use mapped by remote sensing methods and obtained from DWR (2017), adjusted for subsequent urbanization identified in Google Earth imagery (Google Earth 2021).

Municipal, commercial, and industrial (M&I) pumping was set equal to the estimated sustainable yield. M&I pumping was relatively high during 2002 to 2014 and exceeded the sustainable yield, as evidenced by the steady declines in groundwater storage during that period. Using the groundwater model, City of Corona (Corona) pumping (which represents 97 percent of the M&I total) was decreased until the future baseline scenario no longer produced long-term storage declines. The adjusted M&I pumping equaled 98 percent of the 2010 to 2018 average, or 15,615 acre-feet per year (AFY). Total municipal use was assumed to equal the 2010 to 2018 average. This reflects an assumption that the amounts of imported water are adjusted to make up the difference between total water demand and sustainable groundwater yield. In the groundwater model, total municipal water use was used only to estimate pipe leaks.

The Baseline scenario also assumes that wastewater percolation and recycling continue as they have in recent years. Discharges from Water Reclamation Facility 1 (WRF-1) and WRF-2 to percolation ponds, streams and recycled uses were estimated as the average amounts during 2010 to 2018.

5.5.3.2. Growth Plus Climate Change Scenario

The growth plus climate change scenario incorporated anticipated effects of climate change, urban development, and associated changes in water and wastewater management. In this scenario, rainfall and reference evapotranspiration (ET_0) were adjusted to 2070 conditions using monthly multipliers developed by DWR based on climate modeling studies. The multipliers were applied to historical monthly data for the 1993 to 2017 hydrologic period used in the model. DWR prepared a unique set of multipliers for each four square kilometer (km^2) cell of a grid covering the entire state. Nine climate grid cells overlie the Basin and its tributary watershed areas. For each recharge analysis polygon in the rainfall-runoff-recharge

model, multipliers from the nearest climate grid cell were used. The climate in 2070 is expected to be drier and warmer than it presently is.

Figure 5-2 compares average monthly precipitation and ET_0 before and after applying the climate change multipliers. Simulations of irrigated turf in the rainfall-runoff-recharge model indicated that the combined effect of the warmer and drier climate will increase annual irrigation demand by about 10 percent.

In the growth plus climate change scenario, bedrock inflow and surface inflow from tributary streams along the perimeter of the Basin were re-simulated using the rainfall-runoff-recharge model to reflect the effects of urban development in some of the tributary watersheds and of climate change. Urbanization also increased surface runoff within the Basin, which was routed to small streams and Temescal Wash.

For inflows from Temescal Wash, Cucamonga Creek and Chino Creek (which were not simulated using the rainfall-runoff-recharge model) and future baseline flows were adjusted to 2070 conditions using DWR streamflow multipliers. The DWR data set ends in 2011. Multipliers for 1987 to 1992 were used for 2012 to 2017 based on similarity of cumulative departure of precipitation for the two periods. Then 1992 to 2017 adjusted stream flows were used twice in succession to simulate 2019 to 2068. Surface discharges from the WRCRWA reclaimed water facility were from future projections developed during planning studies for that facility.

Land use in 2018 is shown in **Figure 5-3**. Land use maps for 1990, 2018 and 2068 were developed on the basis of Riverside County digital crop maps (1993 and 2000), Google Earth historical imagery (Google Earth 2021), a 2014 statewide crop map developed by DWR (DWR 2017), Corona General Plan 2020 to 2040 (Corona 2021), and Corona's 2020 Urban Water Management Plan (Michael Baker 2021). Corona was one of the fastest growing cities in the United States during the past several decades. From 1990 to 2018, the dominant land use change was conversion of citrus groves and natural grassland to residential use. **Table 5-2** lists the acreages of several categories of land use in the Basin and tributary watersheds in 1990, 2018 and 2068.

The rate of growth is expected to slow considerably during the next few decades. Within the current Corona city limits, population is expected to increase by 11 percent between 2020 and 2040, and commercial/industrial building space by 18 percent. The Urban Water Management Plan (UWMP) directs more growth to its sphere of influence areas outside the Corona city limits, with a projected 55 percent increase in population and 490 percent increase in commercial/industrial building space. Redevelopment within Corona will have minor effects on groundwater recharge, but development in the sphere of influence areas will have a major effect.

Land use is held constant at the 2068 level of development throughout the 50-year simulation period. This approach avoids errors that can arise from the assumed timing of future droughts and provides a long hydrologic analysis period for assessing the sustainability of 2068 land and water use conditions.

The 2020 draft UWMP (Michael Baker 2021) anticipates a steady decline in per-capita water use from 180 gallons per-capita per day (gpcd) in 2020 to 155 gpcd in 2045. This is plausible but possibly optimistic given that per-capita use has not been declining in recent years and rebounded slightly from drought-related decreases achieved during 2015 to 2016. It was conservatively assumed here that per-capita water use would not continue to decline during 2045 to 2068.

Combining the estimates of population and per-capita water use for 2068, total municipal water use in 2068 would be 34,490 AFY, or essentially the same as the 2010 to 2018 average (about 1 percent higher).

Pipe leaks were assumed to remain at the existing percentage of total water use in Corona and Norco. Municipal groundwater pumping was assumed to remain at the sustainable yield level, which was tentatively estimated to equal average production during 2010 to 2018.

Percolation of reclaimed water at WRF-2 was assumed to remain at the average for 2010 to 2018. This assumes that future decreases in per-capita water use will be achieved primarily through reductions in landscape irrigation. It also implies that future increases in wastewater generation due to population growth will be partially offset by increased indoor water conservation, and any remaining increase will become recycled water for irrigation.

Flow across the northern model boundary that cuts through the Chino Basin was set to zero, consistent with the mandated objective of *hydraulic control*. Hydraulic control is the elimination of groundwater discharge from the Chino Basin to the Prado Wetlands and Santa Ana River, achieved by pumping from a line of desalter wells located roughly parallel to and 2 to 4 miles north of the Santa Ana River. The objective of hydraulic control was included in the 2004 update of the Santa Ana River Basin Plan (SWRCB 2020a). Hydraulic control is considered necessary to maximize the safe yield and to prevent degraded groundwater from discharging from the Chino Basin to the Santa Ana River and impacting downstream beneficial uses (WEI 2005 and 2019).

Subsurface inflow from the Arlington Basin through Arlington Gap was assumed to be zero, consistent with long-term declining trends and modeling of future conditions in the Arlington Basin (Shaw 2020).

Table 5-2. Temescal Basini Land Use in 1990, 2018, and 2068 (acres)

Land Use	Channel Aquifer			Alluvial Fan Aquifder			Prado/Chino Area			Tributary Watersheds		
	1990	2018	2068	1990	2018	2068	1990	2018	2068	1990	2018	2068
Citrus	0	0	0	2,997	0	0	0	0	0	29	0	0
Truck crops	0	0	0	0	0	0	93	93	93	0	0	0
Pasture	0	0	0	0	0	0	379	379	379	0	0	0
Non-irrigated grain	0	0	0	0	0	0	2,499	1,176	1,176	0	0	0
Grassland	47	86	86	193	190	190	406	406	406	72	72	72
Shrubs/Trees	782	782	782	0	0	0	3,719	3,719	3,719	0	0	0
Dense riparian	0	0	0	0	0	0	0	0	0	0	0	0
Sparse riparian	0	0	0	499	1,036	1,734	0	0	0	234	1,097	2,414
Open water	799	799	799	6,425	10,956	10,867	1,389	2,833	2,833	704	2,704	2,704
Low-density residential	37	103	103	100	231	231	25	25	25	121	247	247
Residential	1,138	2,431	1,978	434	2,987	2,718	0	174	174	204	538	538
Turf	98	98	573	5	52	717	0	0	0	0	0	1,105
Commercial	1	1	1	219	121	0	0	0	0	142	646	368
Industrial	11	11	11	884	332	166	0	0	0	0	91	0
Quarry	0	0	0	0	0	0	0	0	0	0	0	0
Vacant	0	0	0	0	0	0	0	0	0	0	0	0

5.6. SURFACE WATER BALANCE

This section describes and quantifies the water balance of creeks and rivers that cross the Basin. All significant inflows to and outflows from these surface water bodies are included in the water balance. The surface water balance shares two flows in common with the groundwater balance: 1) percolation from surface water to groundwater and 2) seepage of groundwater into surface water. Each of these is an outflow from one system and an inflow to the other. Key features of the surface water balances for each management area and analysis period are described below, followed by additional information about the methods used to quantify items in the water balances.

Historical annual surface water balances for the Temescal Basin during 1990 to 2018 are shown in **Figure 5-4** (upper graph). Average annual surface water budgets for the model, historical, current, and future budget analysis periods are listed in **Table 5-3** and detailed surface water budget tables are included in **Appendix K**. The largest inflows to the Temescal Basin are from Temescal Wash and tributary watersheds along the western and eastern edges of the Basin, and those occur predominantly in wet years. The only other surface flow of significance is the small but relatively steady discharge of reclaimed water from WRF-1 to Butterfield Drain, which enters Temescal Wash just upstream of the Prado Wetlands. Outflow is almost entirely surface outflow from Temescal Wash to the Prado Wetlands, with some losses to percolation along unlined reaches of stream channels.

Surface flows in the Prado Wetlands and southern Chino Basin part of the groundwater model flow domain are generally steadier than surface flows in the Temescal Basin part of the model (**Figure 5-4**, middle graph). This is partly because the data shown in the graph are monthly flows used in the groundwater model, which may exclude some ephemeral high flow events. But in addition, flow in the Santa Ana River consists to a significant degree of discharges from wastewater treatment plants, which are relatively steady. Outflows from Prado Dam are also relatively steady because streamflow fluctuations upstream are absorbed to some extent by storage fluctuations in the wetlands.

A substantial amount of water has been imported into the Basin since before 1990. It is delivered directly to users and does not flow into streams or lakes. Use of imported water by Corona is shown in **Figure 5-4** (bottom graph). Imported water consists of State Water Project (SWP) water purchased from the Metropolitan Water District of Southern California (Met) and delivered to Corona.

Table 5-3 Average Annual Surface Water Budgets

Inflow or Outflow	Historical 1993 to 2007	Current 2010 to 2013	Baseline[1] 2019 to 2068	Growth Plus Climate Change[1] 2019 to 2068
Inflows				
Temescal Wash	18,560	10,761	14,920	12,857
Tributary inflow	25,617	23,016	21,399	4,643
Wastewater discharges	3,644	2,761	2,895	2,895
Groundwater flow into streams	5,980	4,917	990	1,380
Total Inflows	53,801	41,455	40,206	21,776
Outflows				
Stream percolation	-10,046	-10,544	-1,661	-1,714
Surface outflows	-44,001	-38,894	-38,544	-20,062
Total Outflows	-54,048	-49,437	-40,206	-21,776

[1] The 50-year future baseline simulation uses historical hydrology for 1993 to 2017 two times in succession.

5.6.1. Inflows to Surface Water

5.6.1.1. Precipitation and Evaporation

Precipitation and evapotranspiration on the land surface are accounted for in the rainfall-runoff-recharge model. Those processes are not included in the surface water balances, which address only water in stream channels, lakes, and imported water. Precipitation and evaporation on the surface of creeks and rivers are invariably miniscule percentages of total stream flow and are not included in the water budget.

5.6.1.2. Tributary Inflows

Tributary inflows to the Basin are from Temescal Wash and tributary watersheds along the east and west sides of the Basin. Temescal Wash inflows were obtained from the Bedford-Coldwater Subbasin groundwater model. Surface inflows from seven Santa Ana Mountain watersheds and four watersheds along the east side of the Basin were calculated on a daily basis by the rainfall-runoff-recharge model. Daily flows could not simply be averaged over each month to produce inflows for the groundwater model because the model would then overestimate the amount of stream recharge. This error stems from the ephemeral occurrence of stream flow and the nonlinear relationship between stream flow and percolation. The error can best be illustrated by a hypothetical example in which daily stream flows during a month consist of one day of flow at 60 cubic feet per second (cfs) and zero flow the rest of the days. If the percolation capacity of the stream reach over the groundwater basin is 10 cfs, total percolation for the month would be 10 cfs for one day, or 19.83 acre-feet (AF). The 50 cfs that exceeded the percolation capacity would flow out to the Santa Ana River. If the daily flows were simply averaged over a 30-day month, the monthly flow would be 2 cfs. The groundwater model would calculate that all of that water would percolate because 2 cfs is less than the percolation capacity of the channel. This would result in 2 cfs of percolation over the course of 30 days, or 119 AF, during the month.

To minimize this error, daily flows entering the Basin from each tributary were clipped at the estimated percolation capacity of the unlined reach of channel overlying the Basin. That is, daily flows in excess of the estimated percolation capacity were assumed to flow out to the Santa Ana River. Averaging the clipped daily flows produced monthly flows realistically capable of percolating. **Figure 5-5** compares average annual stream flow with and without clipping. The largest decreases were where large watersheds discharged into channels that are cement-lined along most of their length overlying the Basin, leaving only a short reach where percolation can occur.

5.6.1.3. Valley Floor Runoff

The rainfall-runoff-recharge model simulates runoff from valley floor areas, which include impervious surfaces in urban areas. Runoff from valley floor areas was added to flows in tributary streams or Temescal Wash at several locations.

5.6.1.4. Wastewater Discharges

The only discharge of reclaimed water to surface waterways in the Temescal Basin is the discharge from Corona WRF-1 plant to Butterfield Drain, which enters Temescal Wash at the

southern edge of the Prado Wetlands. In 2012, the State Water Resources Control Board allowed Corona to decrease the discharge from 4.57 cfs to 2.25 cfs (1,625 AFY).

5.6.1.5. Groundwater Discharge to Streams

Groundwater can discharge into streams when the water table next to the stream is higher than the stream bed or the water level in the stream. The depth to groundwater is tens of feet in the southern part of the Temescal Basin, but the depth decreases to the north (see **Figure 4-22**). At the Butterfield well near the southern edge of the Prado Wetlands, depth to water was 18 to 35 feet during 2012 to 2018 (the period of record for that well). The only natural outflow path from the Basin is discharge to the Santa Ana River near Prado Dam. Somewhere between the Butterfield Well and Prado Dam the depth to water presumably decreases to zero. No shallow wells are available in that region to confirm and monitor depth to water.

5.6.2. Outflows of Surface Water

5.6.2.1. Net Evaporation

Evaporation from streams is almost always a negligible fraction of total flow and is not explicitly itemized in the water budgets or simulated in the model.

5.6.2.2. Surface Water Percolation to Groundwater

The lower reaches of almost all streams entering the Temescal Basin are concrete-lined. The only opportunity for percolation is along the unlined reaches near the Basin margin (see **Figure 4-17**). The percolation capacities of the unlined reaches of tributary streams were estimated to be approximately 5 cfs per mile (cfs/mi). This would be the percolation rate along a creek channel with a wetted width of 16 feet and a bed permeability of 5 feet per day. Temescal Wash was estimated to have a percolation capacity of 20 cfs/mi along the 2-mile unlined reach where it enters the Basin, based on greater channel width and permeability. These capacities were applied to simulated daily flows to obtain a time series of flows capable of percolating. Those flows were averaged to monthly values and used in the groundwater model, which included adjustments for shallow depth to groundwater (relevant only near Prado). Based on these assumptions and calculations, percolation from streams contributes on the order of 10,000 AFY of recharge to the Basin, which is about 18 to 20 percent of total recharge on an average annual basis.

5.6.2.3. Surface Outflow from the Basin

Surface outflow from the Temescal Basin equals stream inflows minus percolation losses plus groundwater discharge to streams. Over periods of months or years, storage change of surface water is negligible in the absence of lakes or reservoirs. Surface outflow is by far the largest outflow, especially in wet years. The values in **Table 5-3** understate the dominance of this outflow because the table excludes peak flows that were not passed to the groundwater model.

5.7. GROUNDWATER BALANCE

Annual groundwater inflows and outflows for the Basin for the 1990 to 2018 model simulation period are shown as stacked bars in **Figure 5-6**. Inflows are stacked in the positive (upward) direction and outflows are stacked in the negative (downward) direction. A similar stacked-bar chart for the baseline simulation is shown in **Figure 5-7** and for the growth plus climate change simulation in **Figure 5-8**. Average annual groundwater budgets for the Channel Aquifer area and the alluvial fan aquifer area during each of the water budget analysis periods are listed in **Table 5-4**. Detailed groundwater budget tables are included in **Appendix K**. Highlights of the water budgets are described below, followed by additional information on methods used to quantify each budget item.

Percolation from streams and percolation of reclaimed water have been the largest sources of recharge to the Basin, followed by rainfall recharge in non-irrigated areas. Percolation from streams varies substantially from year to year but averaged about 34 to 39 percent of total inflows in the historical and current scenarios. In the baseline and growth plus climate change scenario stream percolation represented a slightly smaller portion of inflows. Percolation of reclaimed water was of a similar magnitude in the historical and future scenarios but became a larger percentage of total inflow because of decreases in other inflows. Inflows from irrigation deep percolation, bedrock inflow and pipe leaks were of similar magnitudes in the historical and current periods (7 to 9 percent of total inflows). Because of urbanization in recent years, irrigation deep percolation and pipe leaks became larger percentages of total inflow in the future scenarios. Inflow from the Chino Basin is the smallest inflow, amounting to only 2 to 6 percent of total inflows in all scenarios.

Pumping by municipal wells increased during the historical simulation, increasing from 43 percent of total outflows in the historical period to 59 percent in the current period. Although municipal pumping was smaller in the future simulations, it represented a larger percentage (71 percent) of total outflows because of decreases in other outflows. The next largest outflows were of roughly similar magnitudes: groundwater discharge to streams, riparian evapotranspiration (ET) and subsurface outflow to the Chino Basin. These each accounted for 10 to 19 percent of total outflows during the historical and current periods and slightly smaller percentages in the future simulations. Pumping at agricultural wells decreased rapidly in the 1990s, dwindling to negligible amounts in the current period.

The Basin water budgets were negative for the historical and current analysis periods, due to a variety of reasons and reflecting the different time periods. During 2000 to 2011, relatively high amounts of municipal groundwater pumping contributed to a gradual decrease in storage. Since 2011, the predominantly dry climatic conditions have resulted in reduced inflows and thus a decrease in storage. As documented in Section 4.1, water levels in wells located in the Channel Aquifer decreased slightly over the historical period. The observed water level decline was not significant and did not impact beneficial users of the Basin. However, relatively high estimated storativity in the Channel Aquifer and the slight water level decline resulted in a net negative change in storage over the time period.

Storage declines during the early years of the simulation may have resulted from incorrectly estimated initial water levels. Initial conditions in the model are user defined and act as

boundary conditions, if initial groundwater levels are set too high at the start of the simulation, the model will reduce water levels to reach equilibrium. The result is a calculated change in storage that may be an artifact of the prescribed starting water levels. Geographically distributed water level data is not available pre-1990 and the initial conditions are largely set by interpolating sparsely observed water levels. Additional improvements and sensitivity analysis could provide more information on the effect of the initial conditions and should be considered for the next GSP update.

The future baseline scenario is intended to represent a continuation of existing conditions. For most of the budget items that are inputs to the model (for example, irrigation deep percolation, pipe leaks, reclaimed water percolation and pumping), average values during 2010 to 2018 were used. An exception was municipal pumping by Corona, which was relatively high during 2002 to 2014. Using the 2010 to 2018 average produced storage depletion in the future baseline simulation. While the numerical model simulates declines in storage over the historical period, groundwater level declines have been relatively small and undesirable results relative to groundwater levels or storage have not occurred in the Basin.

Corona's objective is to pump within the sustainable yield of the Basin and to supply the remaining municipal water demand with imported and recycled water. This policy is reflected in the generally decreasing amounts of municipal pumping from 2008 to 2017. Through iteration, using the groundwater model, municipal pumping of 15,600 AFY was found to produce essentially no long-term storage change in the future baseline simulation. This equals 98 percent of average Corona pumping during 2010 to 2018 but is more than the amounts of Corona pumping in 2016 and 2017.

However, adaptive management and continued assessment of pumping volumes will be critical to maintaining sustainability as inflow to the Basin can vary widely based on hydrology and the model simulation is only a forecast of future conditions.

Growth and climate change had relatively small effects that tended to offset each other. The warmer, drier climatic conditions tended to decrease stream percolation and rainfall recharge. Urban growth—much of which is projected to be in tributary watershed areas—tended to increase recharge because of irrigation deep percolation, pipe leaks and percolation of runoff from disconnected impervious areas. Notably, total water use and percolation of reclaimed water were assumed not to change appreciably, consistent with assumptions in the Corona's UWMP that population growth will be offset by decreases in per-capita water use. Consequently, individual inflows and outflows in the growth plus climate change scenario were identical to or very close to the values in the future baseline scenario.

Table 5-4. Average Annual Groundwater Budgets

Water Balance Items	Temescal Basin				
	SGMA Historical 1993 to 2007	SGMA Current 2010 to 2013	25-Year Historical 1993 to 2017	Baseline[1] 2019 to 2068	Growth Plus Climate Change[2] 2019 to 2068
Groundwater Inflow					
Percolation from streams	8,112	9,942	7,976	7,918	8,817
Bedrock inflow	1,024	952	980	1,084	1,314
Dispersed recharge: non-irrigated land	4,921	4,380	4,331	2,742	2,668
Dispersed recharge: irrigated land	2,042	1,680	1,892	3,172	3,253
Pipe leaks	2,585	2,520	2,560	2,151	2,174
Reclaimed water percolation	8,915	6,200	7,885	6,122	6,122
Inflow from Adjoining Basins	2,003	1,400	1,895	1,026	126
Total Inflow	**29,601**	**27,075**	**27,520**	**24,213**	**24,473**
Groundwater Outflow					
Wells - M&I and domestic	-13,631	-17,239	-14,668	-15,615	-15,615
Wells - agricultural	-3,622	-1,386	-2,722	-22	-23
Groundwater discharge to streams	-4,545	-1,295	-3,179	-1,739	-1,504
Riparian evapotranspiration	-4,980	-3,922	-4,482	-4,538	-4,997
Outflow to Adjoining Basins	-2,966	-2,085	-2,664	-2,364	-2,301
Total Outflow	**-29,744**	**-25,927**	**-27,714**	**-24,278**	**-24,439**
Net Change in Storage					
Inflows minus outflows	-143	1,148	-194	-65	34

Notes:

[1]: The 50-year future baseline simulation uses historical rainfall and evapotranspiration for 1993 to 2017 two times in succession.

[2]: Future baseline rainfall and evapotranspiration are adjusted for climate change in this scenario.

5.7.1. Inflows to Groundwater

Inflows to the Temescal Basin groundwater flow system include dispersed recharge from rainfall and irrigation, percolation from streams, percolation of reclaimed water and subsurface inflow. The methods and data used to calculate each of these flows is described below.

5.7.1.1. Dispersed Recharge from Rainfall and Irrigation

Dispersed recharge from rainfall and applied irrigation water is estimated by the rainfall-runoff-recharge model. The model simulates soil moisture storage in the root zone, with inflows from rainfall infiltration and irrigation, and outflows to evapotranspiration and deep percolation. Simulation is on a daily basis. In recharge zones with irrigated crops—which includes urban landscaping and agricultural irrigation (citrus)—irrigation is assumed to be applied when soil moisture falls below a certain threshold. When soil moisture exceeds the root zone storage capacity, the excess becomes deep percolation. Rainfall and irrigation water comingle in the root zone and in deep percolation. For the purposes of displaying an itemized water balance, the amount of deep percolation derived from irrigation is estimated as a percentage of the simulated irrigation quantity, and the remainder of the dispersed recharge is attributed to rainfall. Deep percolation of applied irrigation water (irrigation return flow) is generally similar from year to year, whereas rainfall percolation varies significantly on an annual basis. Because urban landscape irrigation increased while agricultural irrigation decreased during the simulation period, total recharge on irrigated lands decreased only slightly. Water pipe leaks were estimated as the percentage of unaccounted for water listed in the 2015 Corona UWMP, which was seven percent of delivered water (KWC Engineers 2016), distributed uniformly over areas of urban land use. Sewer pipes convey only water used indoors, and their leak rate was assumed to be half of the leak rate for water pipes. For input to the groundwater model, the one-dimensional dispersed recharge rates are mapped onto model grid cells overlying each recharge polygon on an area-weighted average basis.

Figure 5-9 shows a map of average annual dispersed recharge during 1993 to 2007, which is a relatively long averaging period that includes a wide range of year types. Most dispersed recharge occurs during relatively wet years. Average annual recharge rates ranged from less than 0.3 to slightly over 12 inches per year (in/yr). Much of the southern half of the Temescal Basin converted from citrus orchards to residential development during that period. Recharge from agricultural irrigation was replaced by irrigation from landscape irrigation, pipe leaks and percolation of runoff from disconnected impervious surfaces. As a result, average annual dispersed recharge in that part of the Basin was similar to recharge in the northern part, which was urbanized throughout the simulation period. Dispersed recharge in tributary watersheds appears to be low because most of the deep percolation beneath the root zone was assumed to become stream base flow rather than deep recharge.

5.7.1.2. Percolation from Streams

Inflows to the stream network in the surface water module of the groundwater model include a combination of simulated runoff from tributary watersheds and valley floor areas

obtained from the rainfall-runoff-recharge model and simulated inflows from adjacent groundwater models of the Bedford-Coldwater and Chino Basins.

The surface water module of the groundwater model simulates percolation reach by reach along each stream that crosses the Basin. The percolation rate is a function of stream bed permeability, wetted area, and the difference in elevation between the stream surface and the underlying water table. Along reaches with natural channel materials, a permeability of 5 feet per day (ft/day) was assumed. Most of the streams that cross the Temescal Basin are lined with concrete along much of their length. Those reaches were assigned a permeability of zero. The natural channel reaches of the tributary streams are probably tens of feet above the water table, which means they are not hydraulically connected to groundwater. Percolation is a function of wetted area and permeability only.

Converting from daily to monthly analysis can introduce large errors in estimated percolation. If daily flows are averaged over a month, estimated stream flow appears to be much more moderate and perennial than the actual stream flow. The groundwater model would overestimate percolation in that case. To avoid this error, monthly flows were obtained from daily flows by first clipping the daily flows to values less than or equal to the estimated percolation capacity of the unlined reach of channel. Those flows were then be averaged to obtain monthly flow for input to the groundwater model.

The Santa Ana River, Cucamonga Creek and Chino Creek are not lined. Monthly inflows to those waterways were obtained from an existing groundwater model of the Chino Basin (WEI 2019).

5.7.1.3. Reclaimed Water Percolation

Reclaimed wastewater is currently percolated at the Lincoln Cota Percolation Ponds, which are adjacent to the left bank of Temescal Wash between Lincoln Avenue and Cota Street. They are just outside the Channel Aquifer area. Prior to 1998, reclaimed water was also percolated in ponds at WRF-1 next to the Prado Wetlands. Since then, water from that facility has been sent to the Lincoln Cota ponds. Measured percolation volumes are added directly to the top layer of the groundwater model.

5.7.1.4. Subsurface Groundwater Inflow

Subsurface inflows from tributary watersheds and neighboring basins are estimated by various methods. Subsurface flow from tributary watersheds is calculated by the rainfall-runoff-recharge model by partitioning rainfall deep percolation into stream base flow and subsurface inflow. The subsurface flow is added as specified monthly volumes of water to model cells adjacent to the tributary watershed. Although the Bedford-Coldwater Basin and Temescal Basin share a boundary, models of both basins indicated little flow across it because groundwater tends to flow parallel to the boundary toward Temescal Wash. Based on previous studies, a small amount of subsurface inflow from the Arlington Basin through the Arlington Gap was included in historical simulations. That flow is expected to decrease to zero in the future. Flow between the Temescal and Chino Basins is simulated by the groundwater model as a function of water-level gradients and permeability along the boundary between the basins.

5.7.2. Outflows from Groundwater

Major outflows from the water budget analysis areas are groundwater pumping (municipal, industrial, and agricultural), subsurface outflow, groundwater discharge into streams, and evapotranspiration by riparian vegetation.

5.7.2.1. Pumping by Wells

Pumping from M&I wells has been measured and recorded for many years by Corona and WMWD. Those data are used in the groundwater model. Agricultural pumping to irrigate citrus orchards in the 1990s was estimated using the rainfall-runoff-recharge model, which produces estimates of irrigation demand based on reference evapotranspiration, crop type and growth state, and availability of soil moisture from rainfall. Ten percent of applied irrigation water was assumed to percolate past the root zone and return to the groundwater supply. As described in Section 5.7, Corona pumping for the future baseline and growth plus climate change scenarios was set at 98 percent of the 2010 to 2018 average historical pumping.

5.7.2.2. Subsurface Outflow

Subsurface outflows to the Chino Basin were calculated with the groundwater model by the same methods used to simulate subsurface inflows. There are no outflows from the Temescal Basin to the Arlington or Bedford-Coldwater Basins because the water level gradients are always toward the Temescal Basin.

5.7.2.3. Groundwater Discharge to Streams

Where streams are hydraulically connected to the water table, discharges of groundwater into the streams are simulated by the groundwater model based on streambed wetted area, permeability, and on the amount by which the simulated groundwater elevation in a model stream cell is higher than the simulated surface water elevation. This condition is present primarily along the lower reaches of the Santa Ana River and other channels within the Prado Wetlands.

5.7.2.4. Riparian Evapotranspiration

Evapotranspiration of groundwater by phreatophytic riparian vegetation is influenced by available soil moisture and by depth to the water table. Like other types of vegetation, phreatophytes use soil moisture supplied by rainfall when it is available. Any remaining evapotranspiration demand is met by drawing water from the water table. Phreatophyte use of groundwater is assumed to decrease from the maximum rate when the water table is at the land surface to zero when the water table is 20 feet or more below the ground surface. These calculations are applied at model cells within the Prado Wetlands. A patch of dense riparian vegetation is also present where Temescal Wash enters the Basin from an upstream bedrock reach. However, that vegetation appears to be supported by percolation from the Wash, not groundwater, because the water table appears to be more than 30 feet below the ground surface in that area. The water demand of riparian vegetation was assumed to equal reference evapotranspiration.

5.8. CHANGE IN GROUNDWATER STORAGE

Figure 5-10 shows the cumulative change in Basin storage from the model during 1990 through 2068. The baseline and growth plus climate change scenario results for 2019 to 2068 are displayed as continuations of the historical storage changes from 1990 to 2018.

As shown, groundwater storage decreased fairly steadily during 1990 to 2018. Average annual storage changes for the current and two historical periods ranged from decreases of 194 AFY to an increase of 1,148 AFY, as shown in **Table 5-4**. Total outflows were between 0.7 percent greater and 4.2 percent lower than total inflows. Factors that could have contributed to this simulated decline include incorrectly estimated initial water levels, relatively high amounts of municipal groundwater pumping during the early 2000s, and predominantly dry climatic conditions since 2011.

Average annual storage changes during both future scenarios were very slightly positive, with total inflows about two percent greater than total outflows. This was the intentional result of adjusting Corona pumping to achieve close to zero net storage change during 2019 to 2068. The abruptness of the transition from historical to future conditions is primarily the result of decreased pumping, but also to the effects of drought conditions at the end of the historical period. The similarity of the future baseline and growth plus climate change scenarios is due to the small differences in all water budget items between those two scenarios. Also, the effects of urban growth tended to offset the effects of the warmer, drier climate.

5.9. ESTIMATE OF SUSTAINABLE YIELD

The sustainable yield is defined as the volume of pumping that the Basin can sustain without causing undesirable effects. It is not a fixed or inherent natural characteristic of a groundwater basin. Rather, it is influenced by land use activities, importation of water, wastewater and stormwater management methods, potential recharge with recycled water, and the locations of wells with respect to interconnected streams. The estimates of sustainable yield presented in this section reflect the current status of those variables under the historical and future scenarios.

A long analysis period is needed to evaluate yield because of the episodic nature of natural recharge. Whereas pumping, irrigation return flow, and pipe leaks are fairly constant from year to year, recharge from precipitation and streams varies widely. Because of evolving land use during 1990 to 2018, no subset of years is ideal for estimating sustainable yield. For the purposes of this GSP historical sustainable yield was calculated based on 1993 to 2017, which is representative of long-term average conditions in terms of precipitation and stream flow. Sustainable yield was estimated for the historical simulation (using 1993 to 2017) and the two future simulations (both using all 50 years of the simulation), as shown in **Table 5-5**.

Table 5-5. Estimated Sustainable Yield

25-Year Historical 1993 to 2017[1] (AFY)	Baseline 2019 to 2068[2] (AFY)	Growth Plus Climate Change 2019 to 2068[2] (AFY)
17,195	15,572	15,672

[1] For the historical sustainable yield estimate, average annual water budgets during 1993 to 2017 were used.
[2] The 50-year future simulation uses historical hydrology for 1993 to 2017 two times in succession.

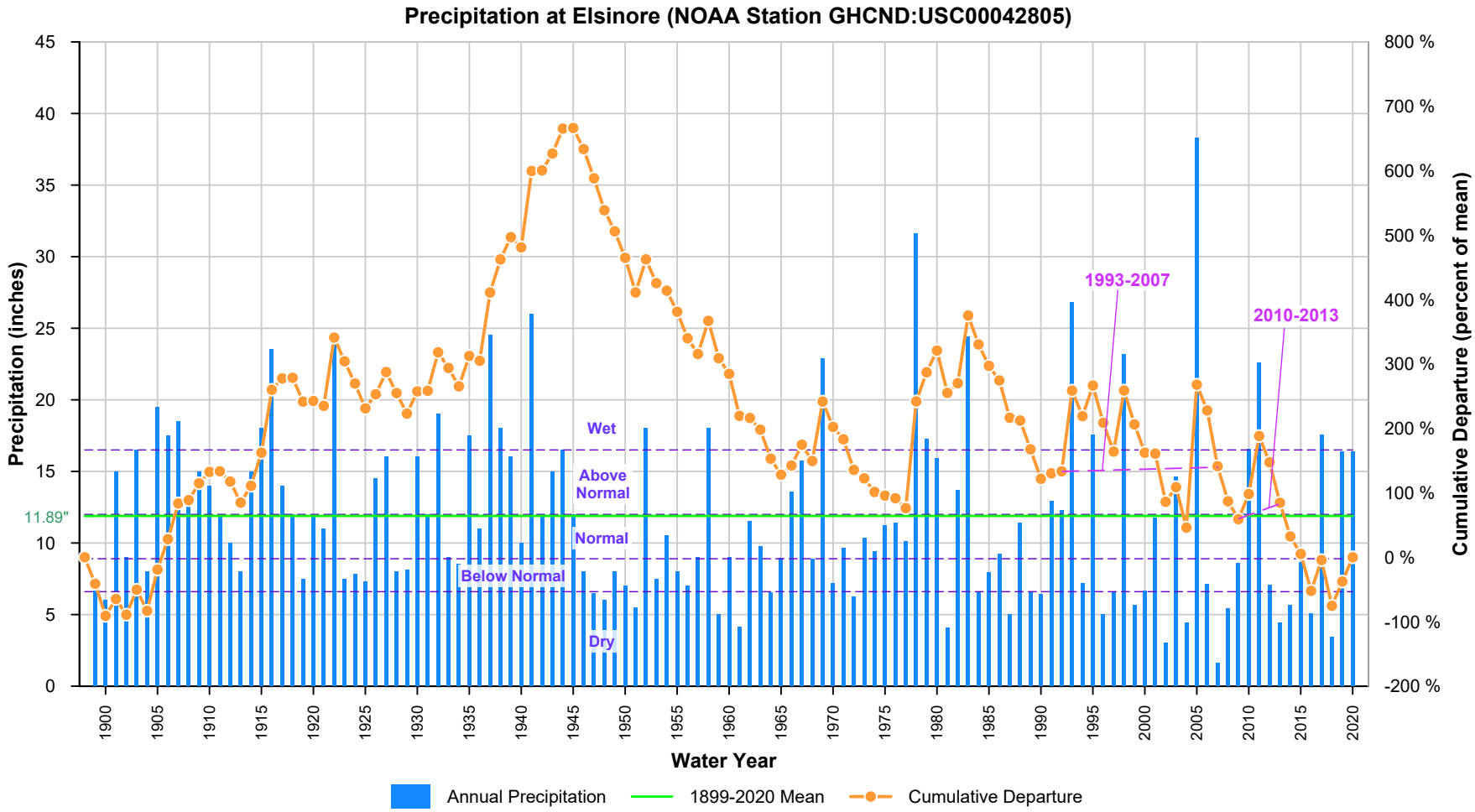
These sustainable yield estimates equal total pumping plus storage change. This simple method of estimating yield ignores the interaction of pumping with other head-dependent boundaries, including interconnected surface water, riparian vegetation ET and subsurface inflows and outflows. All four of those types of boundaries are present in the Temescal Basin, which means that increasing the amount of pumping can theoretically increase the yield of the Basin, by increasing head-dependent inflows and decreasing head-dependent outflows. Conversely, a decrease in pumping will not result in an equal decrease in the rate of storage depletion because the other head dependent boundaries absorb some of the change in pumping. The amount of pumping in the future baseline simulation accounts for these complex interactions. It was obtained by trial and error as the amount of Corona pumping that resulted in close to zero long-term storage change. That means it also results in zero long-term change in other head-dependent boundary flows such as groundwater discharge to the Prado Wetlands. Large changes in those flows could cause undesirable results for groundwater dependent ecosystems.

The yield estimates in the table are for total groundwater pumping in the Basin, not just Corona pumping. Although Corona pumping is currently about 93 percent of total pumping, several industrial users also pump groundwater and others might do so in the future.

The yield estimates based on the future scenarios are probably a better basis for planning than the estimates based on the historical and current periods because the latter periods were influenced by factors that do not apply to the future period and because the future scenarios have a long hydrologic averaging period. Sustainable yields calculated from the future scenarios are based on projections far into the future. Slight imbalances in estimated water budgets can result in large cumulative changes in storage, and hence in the calculated yields. By the same token, the long planning horizon provides ample time to adjust water management (recharge and pumping) to maintain basin operation within the sustainable yield if long-term rising or falling trends in cumulative storage in fact occur. In the context of this GSP, sustainable yield estimated from the water budget is contingent on the absence of undesirable results related to water levels, storage, subsidence, water quality, or depletion of interconnected surface water. Quantitative sustainability criteria are presented in Chapter 6 that define thresholds at which groundwater conditions become undesirable for each of those sustainability indicators. For example, if pumping at the above estimates of sustainable yield caused subsidence or significant impacts on riparian or aquatic habitats, the yield may need to be reduced to avoid those impacts. It should be noted that the future

sustainable yield is calculated in the model using projected hydrological conditions. Conditions vary widely in the Basin between wet years and dry years and the actual precipitation (along with ET and other inflows) would influence the available yield of the Basin.

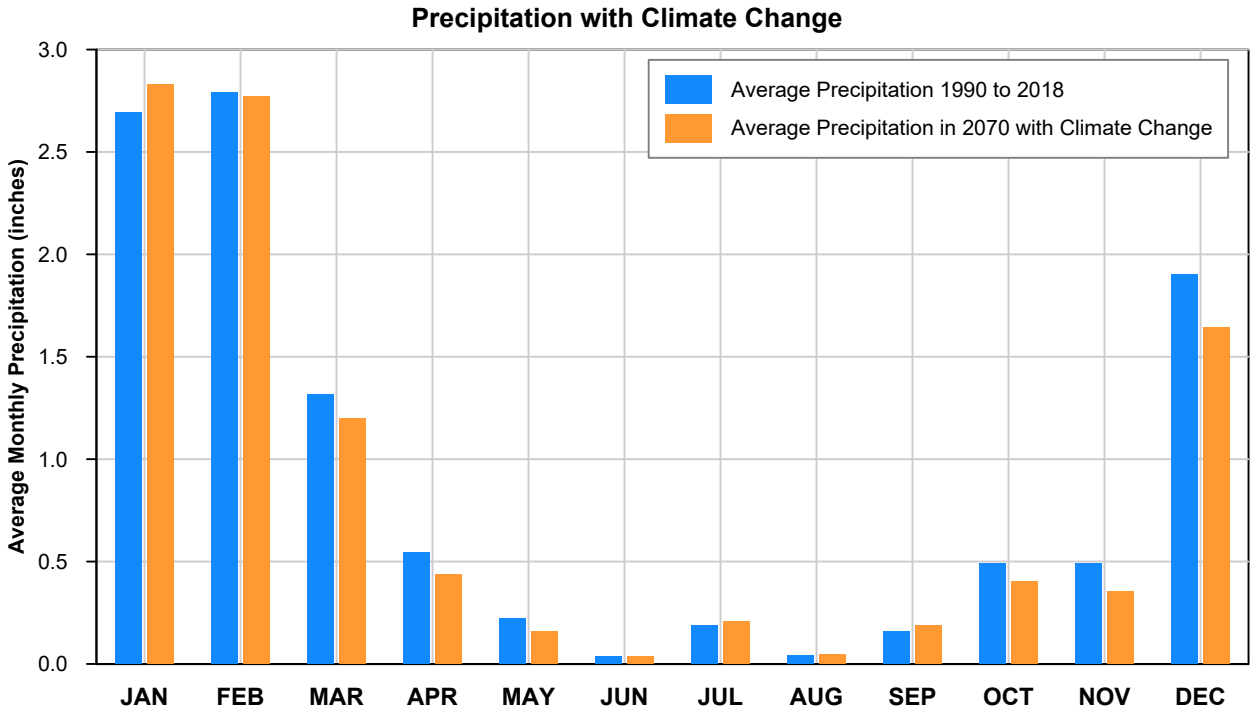
Accordingly, this sustainable yield value is a broad indicator. It indicates no overdraft based on the water budget, but it must be interpreted through evaluation of undesirable results.

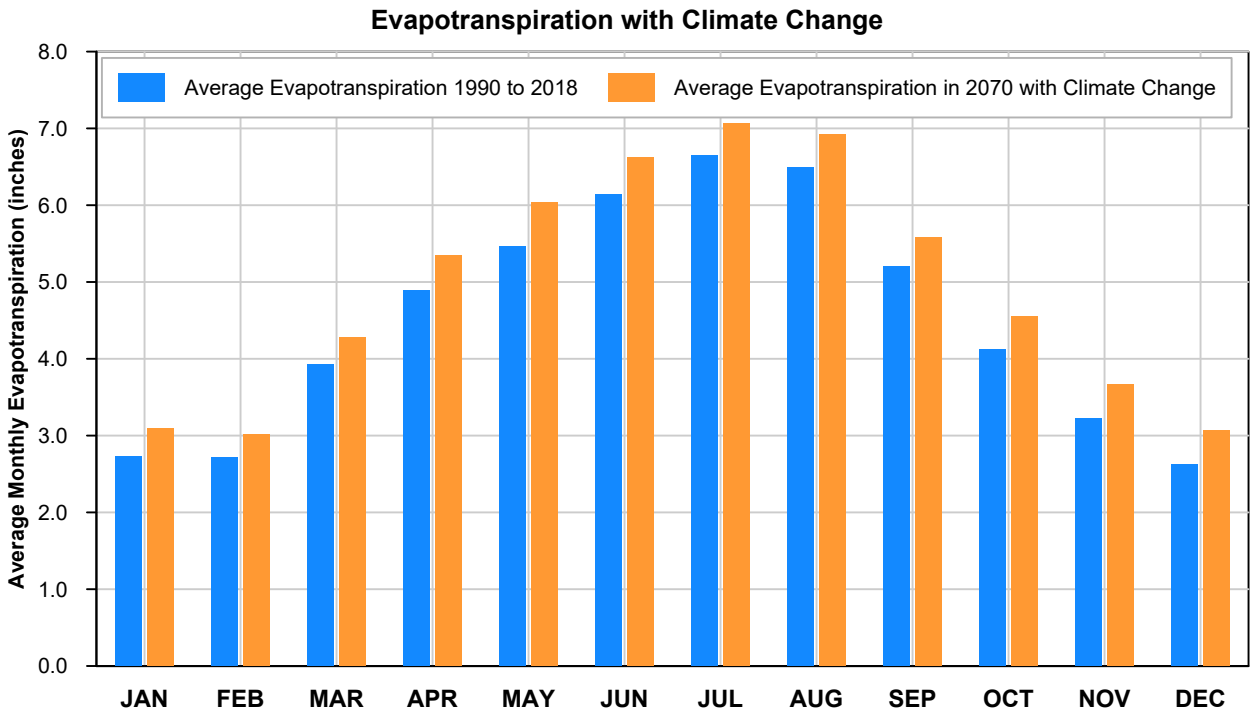


TODD GROUNDWATER

Figure 5-1
Cumulative Departure of Annual Precipitation at Lake Elsinore

Path: T:\Projects\Corona GSP 4641\GRAPHICS\Figure 5-1 Cumulative Departure of Precipitation.gpj





TODD GROUNDWATER

Figure 5-2
Effect of Climate Change on Precipitation and Evapotranspiration

Path: T:\Projects\Bedford Coldwater GSP 80802\GRAPHICS\Figure 5-3 Effect of Climate Change on Precipitation and Evapotranspiration.gpj

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 5 - Water Budget\Figure 5-3 2018 land use_r1.mxd

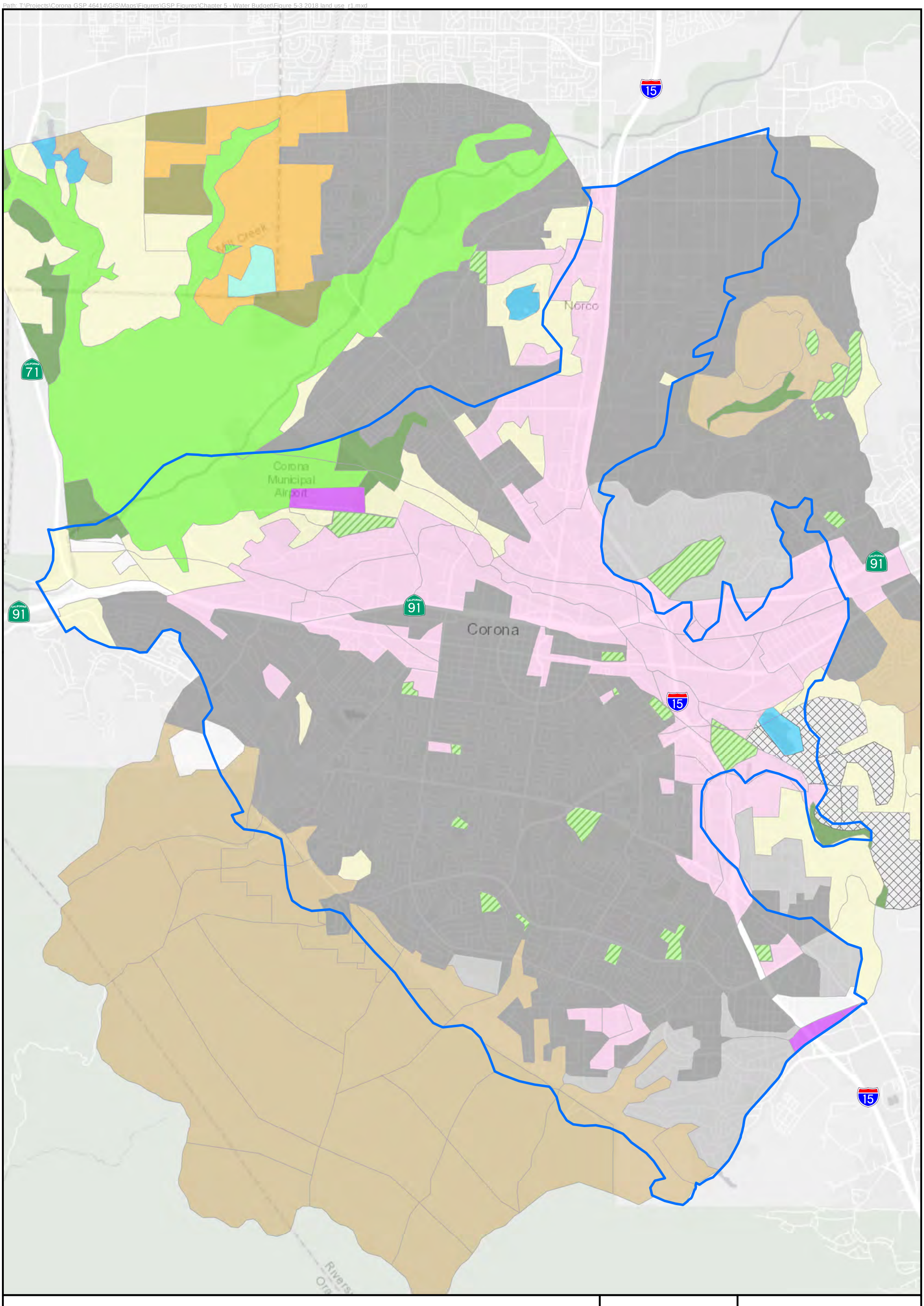
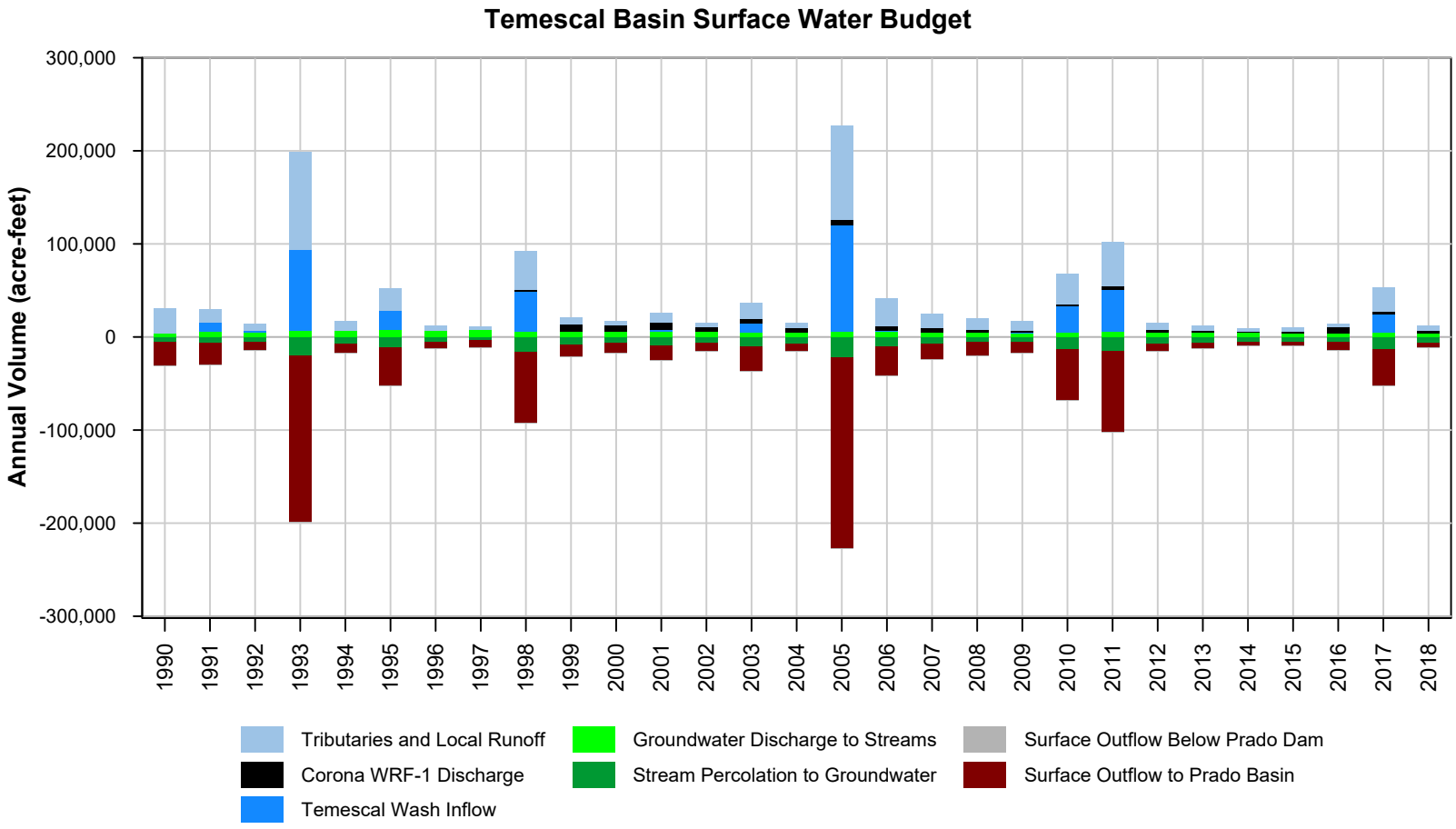
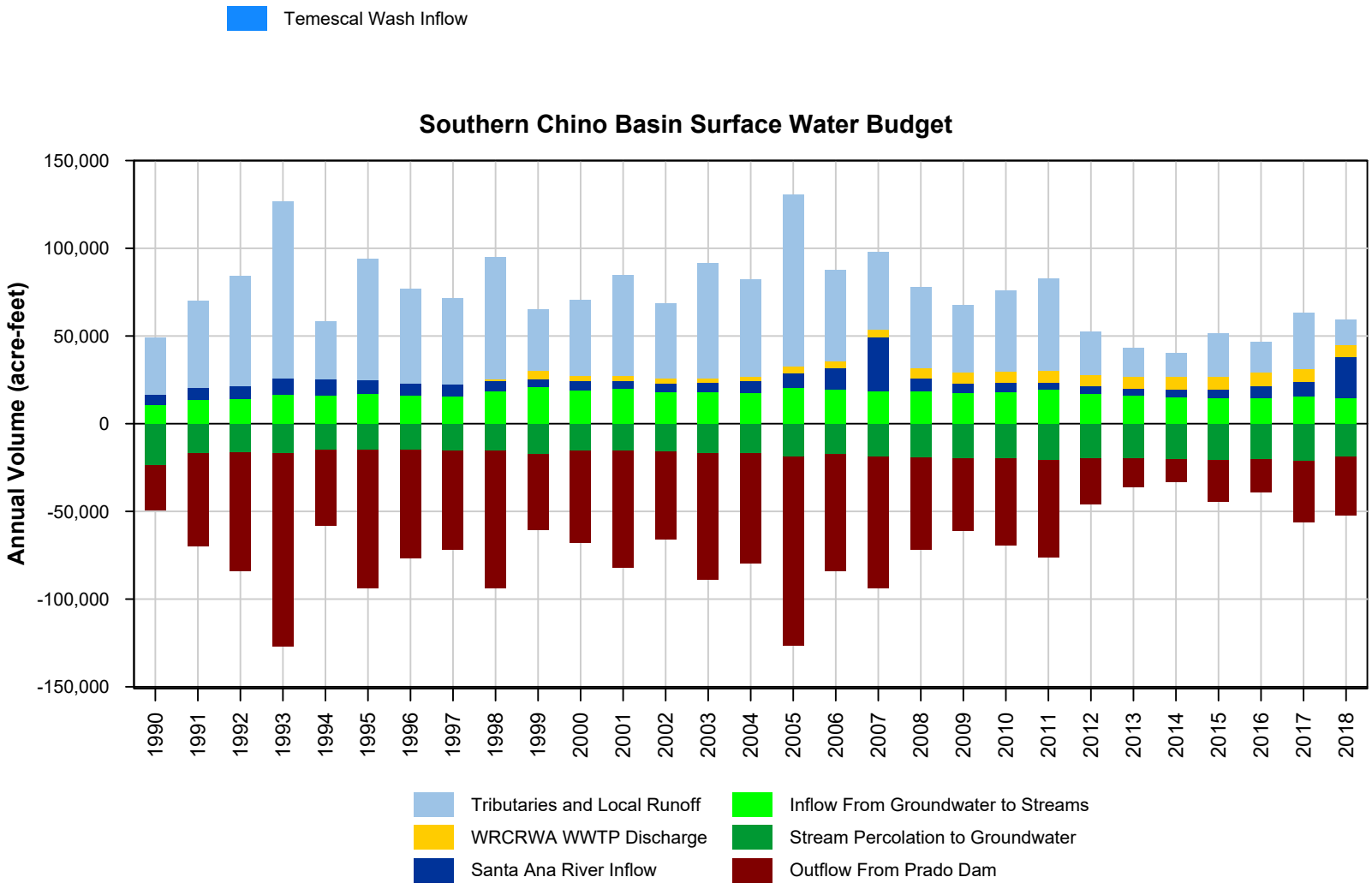
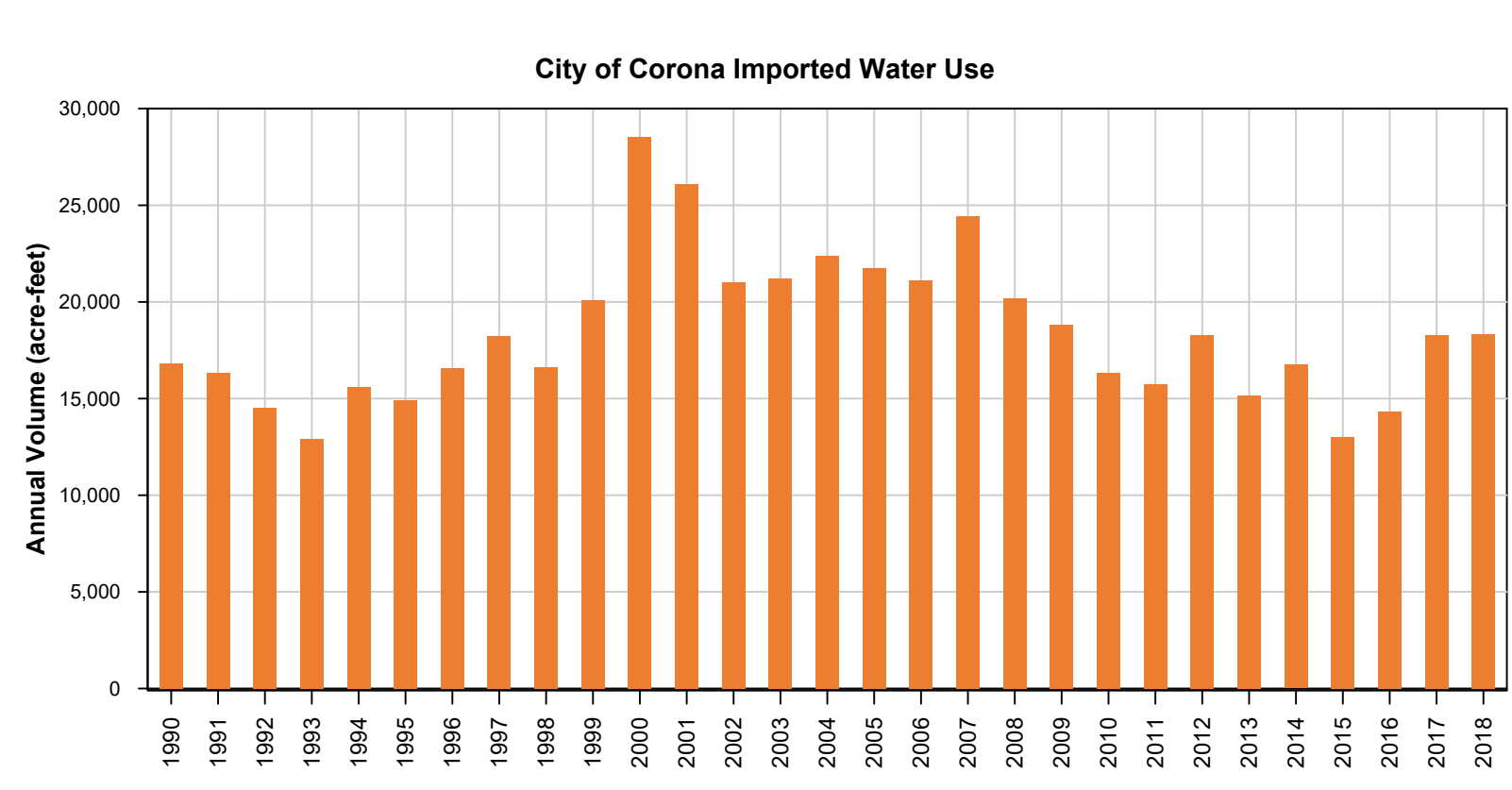


Figure 5-3
Land Use in 2018

TODD GROUNDWATER



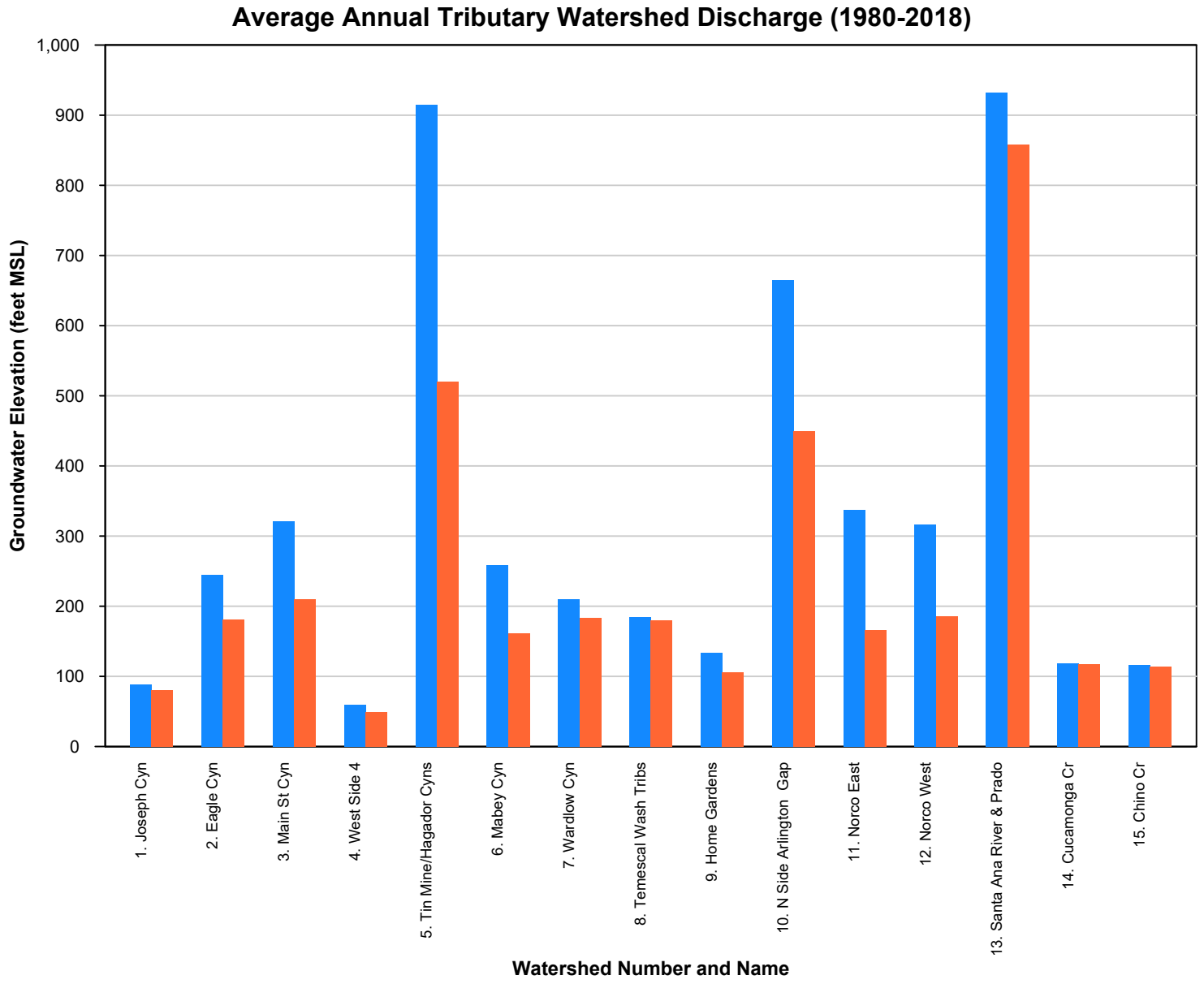




TODD GROUNDWATER

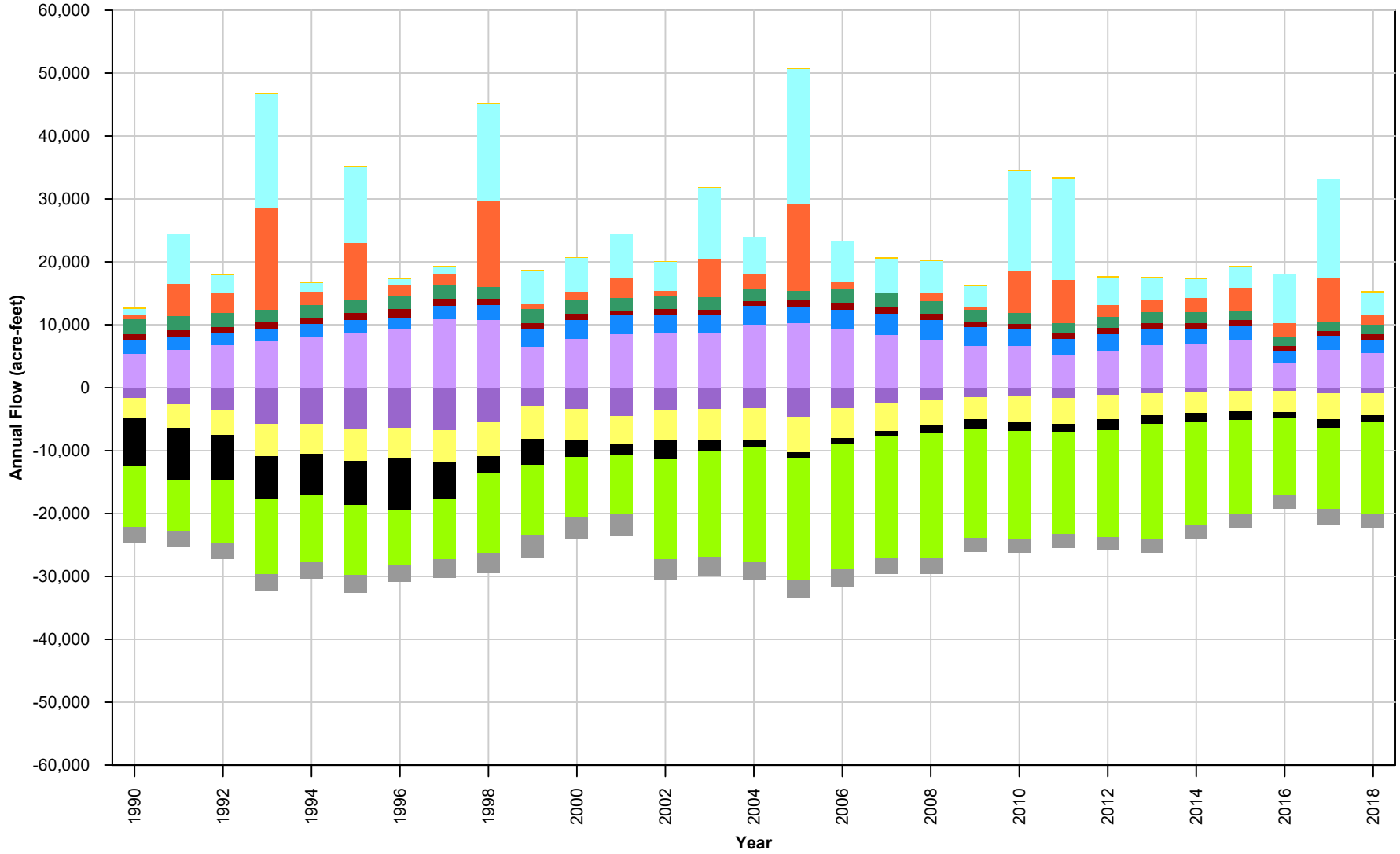
Figure 5-4
Surface Water Budgets
1990 through 2018

Path: T:\Projects\Corona GSP 464141\GRAPHICS\Figure 5-4 Annual Surface Water Budgets 1990-2018.gpj



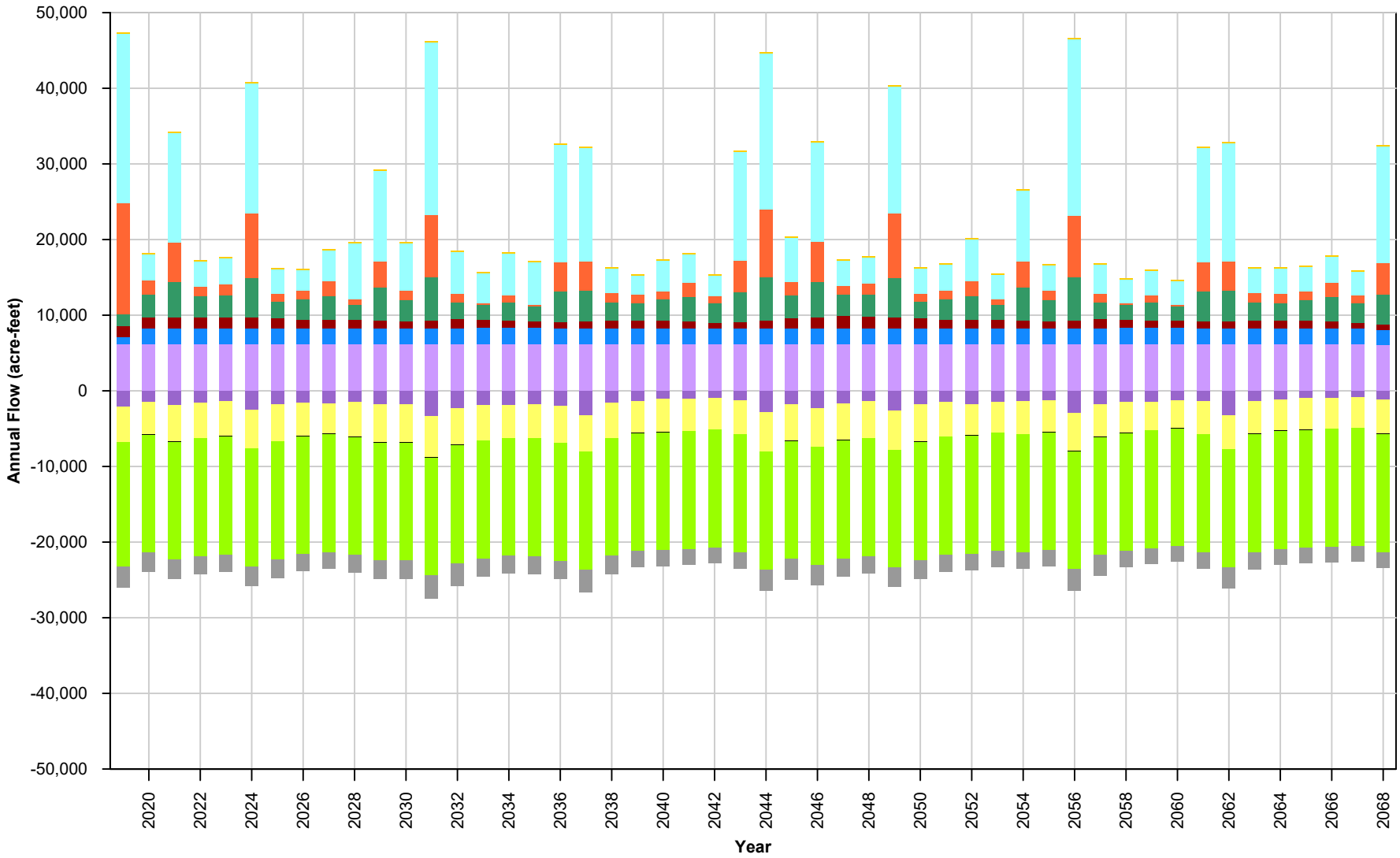
TODD GROUNDWATER

Figure 5-5
Effect of Clipping on Simulated Tributary Stream Flow



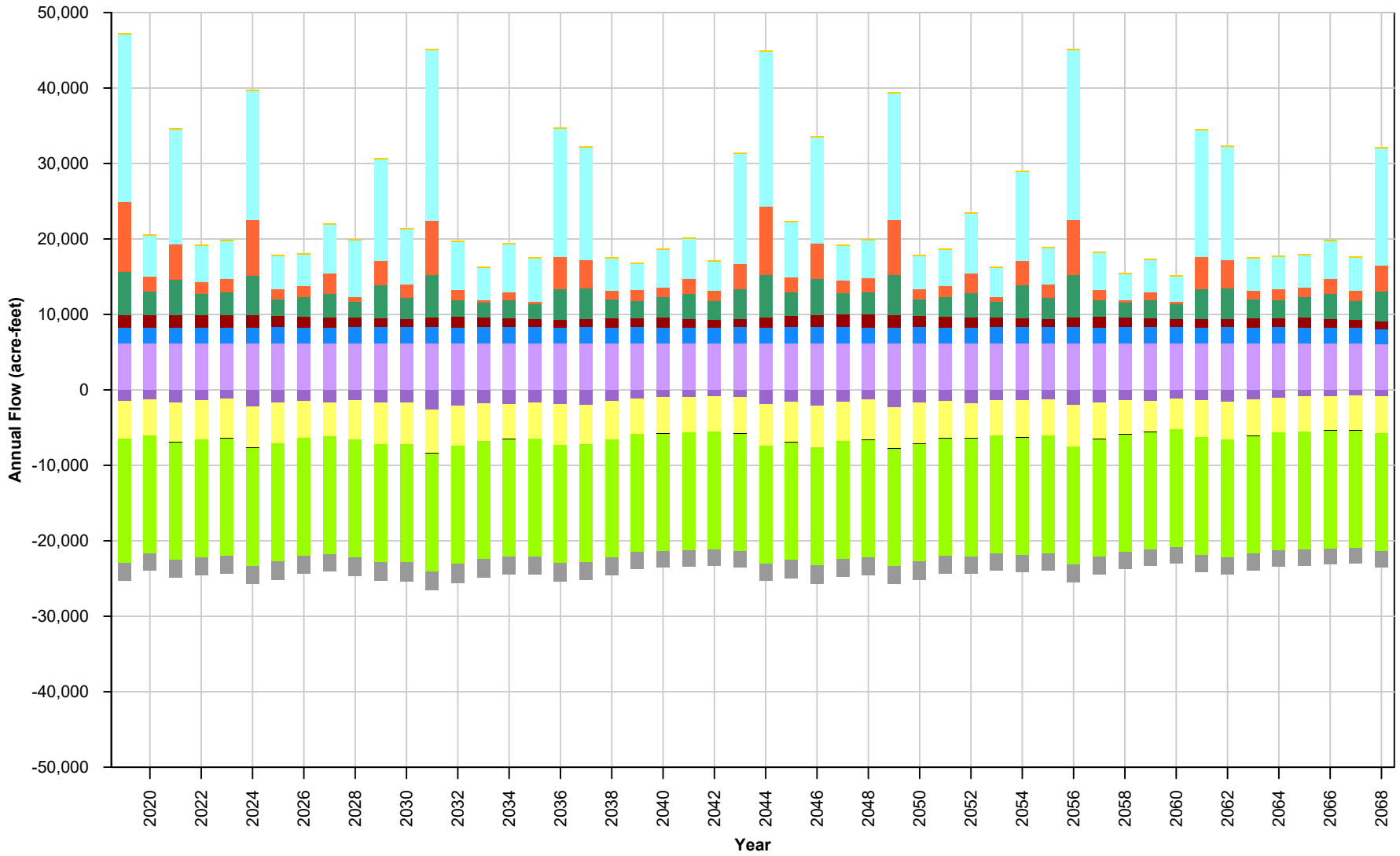
TODD GROUNDWATER

Figure 5-6
Temescal Basin
Annual Groundwater Budgets, 1990 to 2018



TODD GROUNDWATER

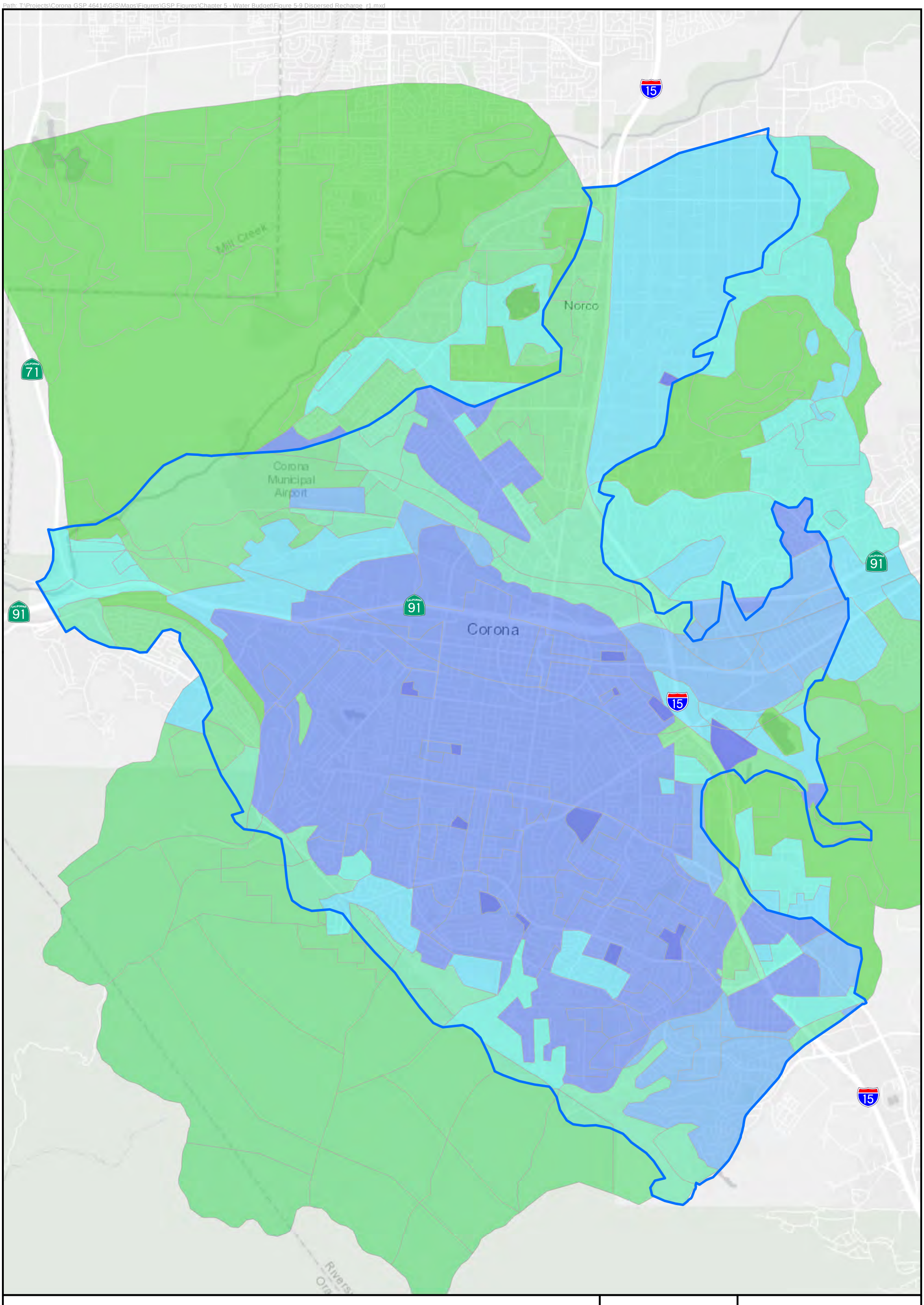
Figure 5-7
Annual Groundwater Budgets
Future Baseline



TODD GROUNDWATER

Figure 5-8
Annual Groundwater Budgets, Growth Plus Climate Change

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 5 - Water Budget\Figure 5-9 Dispersed Recharge_r1.mxd



Average Annual Dispersed Recharge 1993-2007 (in/yr)

0 - 0.3	3 - 4
0.3 - 1	4 - 5
1 - 2	5 - 8
2 - 3	8 - 13

Temescal Basin

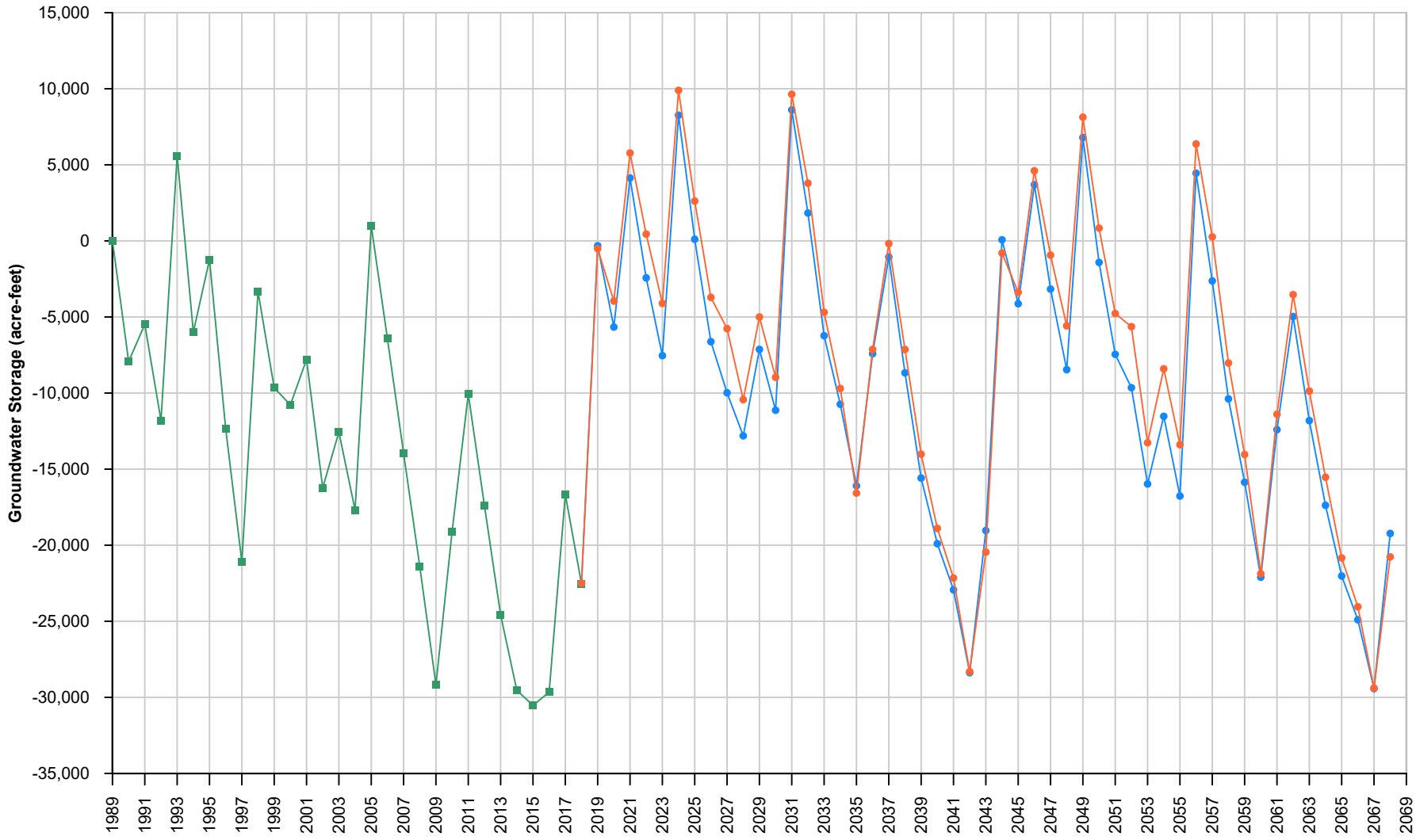
N

0 0.5 1

Miles

Figure 5-9
Dispersed Recharge

TODD GROUNDWATER



TODD GROUNDWATER

Figure 5-10
Cumulative Storage Changes 1990 to 2068

6. SUSTAINABLE MANAGEMENT CRITERIA

The Sustainable Groundwater Management Act (SGMA) defines sustainable management as the use and management of groundwater in a manner that can be maintained without causing *undesirable results*, which are defined as significant and unreasonable effects caused by groundwater conditions occurring throughout a groundwater basin:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply
- Significant and unreasonable reduction of groundwater storage
- Significant and unreasonable seawater intrusion
- Significant and unreasonable land subsidence that substantially interferes with surface land uses
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water

For these sustainability indicators[4], a Groundwater Sustainability Plan (GSP) must develop quantitative sustainability criteria that allows the Groundwater Sustainability Agency (GSA) to define, measure, and track sustainable management. These criteria include the following:

- Undesirable Result – significant and unreasonable conditions for any of the six sustainability indicators
- Minimum Threshold (MT[5]) – numeric value used to define undesirable results for each sustainability indicator
- Measurable Objective (MO) – specific, quantifiable goal to track the performance of sustainable management
- Interim Milestone – target value representing measurable groundwater conditions, in increments of five years, set by the GSA as part of the GSP.

Together, these sustainability criteria provide a framework to define sustainable management, delineate between favorable and unfavorable groundwater conditions, and support quantitative tracking that identifies problems promptly, allows assessment of management actions, and demonstrates progress in achieving the goal of sustainability.

[4] If one or more undesirable results can be demonstrated as not present and not likely to occur, a GSA is not required to establish the respective sustainability criteria per GSP Regulations §354.26(d); in the inland Temescal Basin seawater intrusion is not present and not likely to occur.

[5] The abbreviations for Minimum Threshold (MT) and Measurable Objective (MO) are provided because these terms are used often; however, the full unabbreviated term is used when helpful for clarity or when included in a quotation.

6.1. SUSTAINABILITY GOAL

The sustainability goal can be described as the mission statement of the GSA for managing the Basin; it embodies the purpose of sustainably managing groundwater resources and reflects the local community's values—economic, social, and environmental. The sustainability goal for the Temescal Subbasin (Basin), stated below, was developed through discussion at several public meetings with the GSA and the Technical Advisory Committee (TAC).

6.1.1. Description of Sustainability Goal

To sustain groundwater resources for the current and future beneficial uses of the Basin in a manner that is adaptive and responsive to the following objectives:

- Provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses
- Provide reliable storage for water supply resilience during droughts and shortages
- Protect groundwater quality
- Support beneficial uses of interconnected surface waters, and
- Support integrated and cooperative water resource management.

This goal is consistent with SGMA and is based on information from the Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget sections of this GSP that:

- Identify beneficial uses of Temescal Basin groundwater and document the roles of local water and land use agencies
- Describe the local hydrogeologic setting, groundwater quality conditions, groundwater levels and storage, and inflows and outflows of the Basin
- Document the ongoing water resource monitoring and conjunctive management of groundwater, local surface water, recycled water and especially imported water sources that help protect groundwater quality and maintain water supply.

6.1.2. Approach to Sustainability Indicators

The approach to assessing the sustainability indicators and setting the sustainability criteria has been based on 1) review of available information from the Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget sections of this GSP and 2) discussions with Temescal Basin stakeholders and local agency representatives, for example at TAC meetings and workshops.

This approach has developed since mid-2020 and generally began with definition of what an undesirable result is; this initially has been exploratory and qualitative and based on plain-language understanding of what *undesirable* means. Potential minimum thresholds have been explored in terms of when, where, how long, why, under what circumstances, and what beneficial use is adversely affected. This step identified seawater intrusion as not present and not likely to occur.

Beyond a qualitative identification of undesirable, the approach to defining sustainability indicators varies among the undesirable results. Several of the undesirable results are directly or indirectly related to groundwater levels, including conditions related to groundwater storage, subsidence, and interconnected surface water. The definition began in terms of groundwater levels in individual wells but has recognized that storage depletion, subsidence, and impacts on connected surface water occur as water levels decline. As a result, the sustainability criteria for those indicators are interrelated across space and time, coordinated and as consistent as is reasonable and as available data allow.

The consideration of the causes and circumstances of undesirable results is important in the Basin particularly for groundwater quality because general quality is poor throughout much of the Basin and has been poor for decades. Sustainable management relating to groundwater quality is all about use and management of groundwater without *causing* undesirable results but does not necessarily include reversing natural undesirable conditions. Moreover (per SGMA §10727.2(b)(4)), a GSP may but is not required to address undesirable results that occurred before and have not been corrected by the SGMA benchmark date of January 1, 2015.

While native groundwater quality is poor, salt and nitrate loading are recognized as potential sources of groundwater quality deterioration throughout much the Basin. Such loading has been occurring for more than 100 years, however changes in groundwater quality at depth (where groundwater typically is pumped) will lag behind the salt and nutrient loading at the ground surface by decades. This means that groundwater quality monitoring data can be misleading, sustainability criteria potentially could be reactive to decades-old land use conditions and insensitive to the future, and the effects of management activities will not be seen for decades. Given all that, implementation of management actions is recognized as needed and such actions will be helpful in the long term.

Another important aspect to defining sustainability criteria has been considering what we know and more importantly what we don't know about undesirable results that may be detected or may potentially occur in the Basin. From a big picture perspective, the Basin is well managed—historical groundwater levels have been largely stable, subsidence has not been perceived, groundwater storage has been managed such that recent drought impacts have been minimized, local groundwater quality degradation is being addressed through treatment and blending, and inter-connected surface water and groundwater dependent ecosystems (GDEs) are being maintained. While water resource monitoring has been useful and adaptive, significant data gaps and uncertainties exist. Because groundwater conditions are regarded generally as good and because considerable uncertainties exist, the process of setting sustainability criteria has been directed toward open discussion of uncertainties, in-depth identification of data gaps and the means to fill them, and a strong intention for flexibility and adaptive management.

The intent is to quantify and qualify sustainability criteria such that they guide good management without setting off false alarms or triggering costly, ineffective, or harmful management actions.

6.1.3. Summary of Sustainable Management Criteria

This section documents the six sustainability criteria as relevant to the Basin and as guided by the Sustainability Goal. The GSAs have managed the Basin without experiencing undesirable results, but continuation and improvement is needed of existing management actions—most notably continuing to use imported water and its conjunctive use with groundwater. It also will include improvement and expansion of management actions and monitoring; these are addressed for each sustainability criterion's Measurable Objective in a subsection, Discussion of Monitoring and Management Measures to be Implemented.

While significant and unreasonable undesirable results have not been experienced in the Basin, the following sustainability criteria are defined in this section because potential exists for undesirable results.

- The Minimum Threshold relative to **chronic lowering of groundwater levels** is defined at designated Key Wells by historical groundwater low levels. Undesirable results are indicated when two consecutive exceedances occur in each of two consecutive years, in 60 percent or more of the Key Wells. The Measurable Objective is to maintain groundwater levels above the MTs and to maintain groundwater levels within the historical operating range.
- The Minimum Threshold for **reduction of storage** is fulfilled by the minimum threshold for groundwater levels as proxy. The Measurable Objective for storage is fulfilled by the MT for groundwater levels, which maintains groundwater levels within the historical operating range.
- The Minimum Threshold for **land subsidence** is defined as a rate of decline equal to or greater than 0.2 feet (ft) in any five-year period. This has been considered in terms of a potential cumulative decline equal to or greater than one foot of decline since 2015; 2015 represents current conditions and the SGMA start date. The extent of cumulative subsidence across the Basin will be monitored and evaluated using Interferometric Synthetic Aperture Radar (InSAR) data. Subsidence is closely linked to groundwater levels and it is unlikely that significant inelastic subsidence would occur if groundwater levels remain above their minimum thresholds.
- The Minimum Thresholds for **degradation of water quality** address nitrate and total dissolved solids (TDS). The MT for nitrate is defined initially as no statistically significant increase in the percentage of wells with 5-year average concentrations exceeding the nitrate maximum contaminant limit (MCL) of 45 milligrams per liter (mg/L) based on current conditions (2015 through 2019). The MT for TDS is defined initially as no statistically significant increase in the percentage of wells with 5-year average concentrations exceeding the TDS Secondary MCL of 1,000 mg/L based on current conditions. The Measurable Objectives for both are defined as maintaining or reducing the percentage of wells with average concentrations exceeding the MTs.
- The Minimum Threshold for **depletion of interconnected surface water** is defined as a depth to water of 15 feet in shallow monitoring wells in the southern Prado

area, where declines to lower water levels are correlated with Temescal Basin pumping and/or water levels.

6.2. CHRONIC LOWERING OF GROUNDWATER LEVELS

Chronic lowering of groundwater levels can indicate significant and unreasonable depletion of supply, causing undesirable results to domestic, industrial, or municipal groundwater users if continued over the planning and implementation horizon. As a clarification, drought-related groundwater level declines are not considered chronic if groundwater recharge and discharge are managed such that groundwater levels recover fully during non-drought periods.

Declining groundwater levels directly relate to other potential undesirable effects (for example regarding groundwater storage, land subsidence and interconnected surface water); these are described in subsequent sections. Effects on well users are described here.

Groundwater elevation trends in Basin are documented in Groundwater Conditions Section 4.1; hydrographs of representative wells are presented for the Basin. The Basin is not characterized by overdraft with widespread chronic groundwater level declines. Groundwater levels in broad areas of the Basin have been maintained at relatively high levels because of the availability of imported water supplies. In addition, while groundwater level declines still occur with dry and critically-dry years, recent drought-related declines have not been as rapid or deep as in previous droughts. Many areas of the Basin experienced record lows during the most recent drought. However, the Basin was not marked by reports of significant water level decline impacts to production wells.

6.2.1. Description of Undesirable Results

As groundwater levels decline in a well, a sequence of increasingly severe undesirable results will occur. These include an increase in pumping costs and a decrease in pump output (in gallons per minute). With further declines, the pump may break suction, which means that the water level in the well has dropped to the level of the pump intake. This can be remedied by lowering the pump inside the well, which can cost thousands of dollars. Chronically declining water levels will eventually drop below the top of the well screen. This exposes the screen to air, which can produce two adverse effects. In the first, water entering the well at the top of the screen will cascade down the inside of the well, entraining air; this air entrainment can result in cavitation damage to pumping equipment. The other potential adverse effect is accelerated corrosion of the well screen. Corrosion eventually creates a risk of well screen collapse, which would likely render the well unusable. If water levels decline by more than about half of the total thickness of the aquifer (or total length of well screen), water might not be able to flow into the well at the desired rate regardless of the capacity or depth setting of the pump. This might occur where the thickness of basin fill materials is relatively thin. While describing a progression of potential adverse effects, at some point the well no longer fulfills its water supply purpose and is deemed to have “gone dry.” For the purposes of this discussion, a well going dry means that the entire screen length (to the bottom of the deepest screen) is unsaturated.

For purposes of setting a Minimum Threshold, undesirable results are defined as a well going dry. This appears to be a low standard and not protective of private wells; but this is an initial definition to start the analysis. The rationale is summarized as follows with more explanation in the following sections:

- There are very few active private wells in the Basin (see Section 2.3.2.1). The owners and operators of those wells are known and they have not reported any adverse effects to those wells in the past.
- None of the existing private well owners report that their wells went dry or were otherwise affected during the recent drought. Because of this, some flexibility exists for purposes of analysis.
- Responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner; there is a reasonable expectation that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts.
- As discussed below, MTs are set at historical groundwater level lows.
- No private wells have been reported to have water shortages for the Basin in the DWR led *Household Water Supply Shortage Reporting System* (DWR 2021), Including during recent dry periods corresponding to historical groundwater level lows in some monitored wells.

6.2.2. Potential Causes of Undesirable Results

For the Basin, the primary potential cause of groundwater level undesirable results would be reduction of surface water supplies and associated increase in groundwater use and reduction in groundwater recharge from return flows. Reduction of imported water could have direct adverse impacts on municipal and industrial water users throughout the Basin.

Given that the Basin is not characterized by basin-wide chronic groundwater level declines, then the undesirable results of a well losing yield, having damage, or "going dry" represent a more complex interplay of causes and shared responsibility.

Some of the potential causes are within GSA responsibility; most notably, a GSA is responsible for groundwater basin management without causing undesirable results such as chronic groundwater level declines. SGMA also requires that a GSA address significant and unreasonable effects caused by groundwater conditions *throughout the basin.* This indicates that a GSA is not solely responsible for local or well-specific problems and furthermore that responsibility is shared with a well owner. A reasonable expectation exists that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts, and with some anticipation that neighbors also might construct wells (consistent with land use and well permitting policies). As indicated above, there are very few active private wells in the Basin and those wells have not shown impacts in the past.

6.2.3. Definition of Undesirable Results

As context, the Basin Sustainability Goal has the objective to provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses.

In that light, the definition of undesirable results would be the chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. This is defined by groundwater conditions occurring throughout the Basin. This definition also recognizes that chronic lowering of groundwater levels could affect groundwater flow to or from the hydraulically connected Bedford-Coldwater, Chino, and Coastal Plain of Orange County basins, and thereby potentially affect the maintenance of sustainability in those basins.

As documented in Groundwater Conditions Section 4.1, analysis of hydrographs reveals that the Basin is not characterized by basin-wide chronic groundwater level declines. While affected at times by drought, groundwater levels in broad areas of the Basin have been maintained at relatively high levels because of the availability of imported water. Moreover, the Basin has not been marked by reports of significant water level decline impacts to shallow supply wells. In the absence of reported well problems, it can be concluded that undesirable results for the chronic lowering of water levels are not occurring in Basin and that the Basin is managed sustainably relative to groundwater levels.

While water levels have declined slightly in recent years due to dry climatic conditions, modeling of future expected conditions show these declines are not expected to continue in the future (see Chapter 5). This finding is consistent with the water budget analyses that indicate (within the range of uncertainty) balanced inflows and outflows in the future.

6.2.4. Potential Effects on Beneficial Uses and Users

Groundwater is a significant source of supply in the Basin and supplies wells municipal, industrial, and other beneficial uses. Groundwater has been and is being used for the range of beneficial uses, even during drought, and with reasonable operation and maintenance by well owners. Historically, changes in water levels in production wells have not correlated with changes in vegetation health or density in the Prado Wetlands (see Sections 4.10.4). The mutual consistency of the water-level MT and interconnected surface water MT is discussed in Section 6.7.4.

6.2.5. Sustainable Management Criteria for Groundwater Levels

The general approach to defining sustainability criteria (minimum thresholds and measurable objectives) for groundwater levels has involved selection of representative monitoring wells (Key Wells), review of groundwater level data, and review of supply well location/construction information to gage potential undesirable effects on wells. Specifically, this has included evaluating historical low levels in Key Wells. This approach is founded on the idea that undesirable results were not reported when groundwater elevations were at their minimum values and therefore returning to those minima should not cause undesirable results in the future.

6.2.5.1. Selection of Key Wells

The approach includes selection of existing monitored wells within the Basin that are or represent active supply wells. Sustainability criteria would be defined for each of these Key Wells and each would be monitored for groundwater levels with respect to MTs and MOs. The Key Wells (**Figure 6-1**) have been identified by reviewing groundwater level hydrographs from all currently monitored wells and selecting wells that have a long, reliable, and recent record of groundwater level monitoring, that represent local or regional trends, and that together provide a broad geographic distribution for the Principal Aquifer, the Secondary Aquifer, and the Basin as a whole. The distribution of these wells also has been reviewed with respect to maps showing density of wells across the Basin (e.g., **Figures 2-5** through **2-8**). These wells are mostly production wells, which is not optimal for monitoring; on the other hand, they are generally representative of production wells.

Groundwater level data and hydrographs of each Key Well have been reviewed to identify the all-time lowest groundwater elevation at each Key Well. As discussed in Groundwater Conditions Section 4.1.3, historical minima in many wells were recorded with the most recent drought, which implies that most currently active wells in the Basin would have experienced those historical minima.

The identified historical low at each Key Wells (i.e., historical maximum depth to water) represents the first approximation of a minimum threshold, with the realization that the final selection of the MT for a Key Well could be adjusted upward to be more protective of nearby supply wells.

6.2.5.2. Evaluation of Existing Wells

Existing wells in the Basin were assessed in the development of water level sustainability criteria. The California Department of Water Resources (DWR) has developed a database of information relating to well locations, use, construction, yield, and other information. By way of background, information on local supply wells has been recorded on Water Well Drillers Reports and is available mostly as paper or scanned copies. DWR has identified 383 individual paper records for wells in the Basin. However, detailed information from most of these records has not been digitized.

Accurate data on the location and elevation of most wells is not available. Most of the wells identified by DWR within the Basin have only been located to the center of a Public Land Survey System (PLSS) section. As a result, precise locations relating to Basin aquifer units and Key Wells are unknown.

In addition, construction information on most wells has not been entered into databases where it can be analyzed readily, and the status of wells is not known. Currently, DWR only has digitized construction information for 53 domestic, agricultural, or other production wells within the Basin. The current status of these wells is unknown, and most are fairly old. Of the 53 domestic, agricultural, or other production wells in the Basin with construction records in the DWR database, only seven were constructed after January 1, 2000 and 41 of the 53 were constructed before 1990. As described in Water Budget Section 5, land use and groundwater production has changed significantly since the late 1980s. Additionally, the GSA agencies are the municipal water purveyors in the Basin and in this capacity they have

assessed the presence of private domestic wells in the Basin; no existing active private domestic wells were identified through this assessment.

Given the age of the existing wells, they should have been present during the recent historical groundwater level minima in the Basin. In fact, DWR records indicate that only three wells have been constructed in the Basin since the end of the recent drought. One of these wells (Corona Well 32) is a municipal supply well and the other two are listed as landscape irrigation wells. Given the age of most of the wells in the Basin, the historical minima in Key Wells are deemed to be protective with regard to groundwater level declines. As discussed in Sections 6.2.1 and 6.2.2, groundwater level declines involve a continuum of potential impacts that range from those effects not noticed by the well owner to those that are noticed and reasonably handled by the well owner.

6.2.6. Minimum Thresholds

According to GSP Regulations Section 354.28(c)(1) the minimum threshold for chronic lowering of groundwater levels must be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. MTs for chronic lowering of groundwater levels are to be supported by information on the rate of groundwater elevation decline based on historical trends, water year type, and projected water use in a basin. However, as documented in the Groundwater Conditions Section 4.1.3, groundwater levels are not chronically declining in the Basin. While groundwater levels decline in dry and critically-dry years, they have recovered in normal, above normal, and wet years. Groundwater levels in many Key Wells were at historical lows during the recent drought (thereby defining the respective MT) but all have since recovered.

Under current conditions, groundwater levels in Key Wells are above the MTs and no undesirable results are known to occur. Nonetheless, MTs have been developed because the potential exists for chronic lowering of groundwater levels.

Using recent and reliable information on the construction of existing supply wells, the MT levels shown in **Table 6-1** are protective of most supply wells, based on available information. The MTs are based on historical low groundwater levels or levels that are higher. Because of this, the MTs are not only protective of local wells but also would help minimize potential impacts on groundwater flow to or from other area, such as the neighboring basins.

Based on historical lows, the MTs account for historical groundwater level variations, and consideration has been given to supporting basin management flexibility, for example to avoid setting off false alarms or triggering costly, ineffective, or harmful management actions. However, MTs have not been adjusted downward at this time, although periods of record for some groundwater level hydrographs are short and may not include actual historical lows that could recur.

Table 6-1. Minimum Thresholds for Groundwater Levels

Local Well Name	Earliest Monitoring Date	Average Depth to Groundwater (ft bgs)	Pump Intake Depth (ft bgs)	Date of Static Maximum Depth to Groundwater	Maximum Static Depth to Groundwater (ft bgs)
Corona 7A	6/1/2002	156.84	230	1/1/2003	178
Corona 8	12/13/2012	112.6	No Pump	5/4/2014	129.5
Corona 8A	1/1/1998	119.69	192	10/1/2001	131
Corona 9A	7/1/2002	80.72	220	7/1/2002	159
Corona 11	7/18/1959	134.14	180	9/13/2017	158
Corona 11A	12/6/2017	143.48	221.2	5/31/2014	155.2
Corona 12A	3/1/1993	158.59	280.3	11/2/2005	164
Corona 13	2/1/1977	141.19	182	6/1/1989	174
Corona 14	2/1/1924	184.92	250	5/1/2009	239
Corona 15	8/13/1952	116.63	171.6	12/1/2004	134
Corona 16	12/13/2012	140.3	No Pump	7/2/2018	159.5
Corona 17A	6/1/2002	110.63	182	5/13/2006	125
Corona 19	4/1/1992	102.73	200	9/1/2003	124.5
Corona 22	4/1/2001	150.19	387	5/1/2004	153.3
Corona 25	4/1/2001	61.71	180	7/1/2003	161.5
Corona 26	5/1/2001	136.86	333	10/1/2004	122
Corona 27	3/1/2003	154.19	436.7	3/3/2020	211
Corona 28	3/1/2003	90.59	174	9/6/2016	95.2
Corona 29	3/18/2009	88.63	230	8/1/2018	88.2
Corona 30	8/28/2009	56.9	No Pump	4/24/2014	70.6
Corona 31	3/18/2009	95.13	217	8/7/2009	132.2
Corona 33	3/13/2019	58.8	255	2/4/2020	68.1
Corona 10th/Lincoln	11/17/2011	197.5	No Pump	9/21/2013	204

6.2.6.1. Minimum Thresholds and Criteria for Undesirable Results

Undesirable results are based on exceedances of MT levels and must be defined not only in terms of how they occur (see Section 6.2.2 Potential Causes of Undesirable Results), but also when and where. By definition, undesirable results are not just drought-related but chronic and are not just local but basin-wide.

The distinction between drought and chronic declines may not be clear when declines are occurring, particularly during drought when it is not known whether subsequent years will bring recovery. Moreover, effects of declining levels on individual well owners may be real problems, whether or not they represent basin-wide sustainability issues.

The groundwater level monitoring program in the Basin is currently primarily monthly, with some wells monitored quarterly. These data will be incorporated into annual GSP reporting as required by SGMA and discussed in Section 7 of this GSP. Accordingly, groundwater level monitoring and annual reporting provides an early warning system that allows response by the GSA and local groundwater users. From this perspective, two consecutive exceedances in each of two consecutive years is regarded as indicating when an undesirable result is occurring. The exceedances would be measured at a Key Well as part of the regular quarterly monitoring program. It should be noted that GSA responses do not have to wait for two years and may involve a staged response as in urban water shortage contingency plans.

To summarize for the Basin:

> The **Minimum Threshold** for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well by historical groundwater low levels. Undesirable results are indicated when two consecutive exceedances occur in each of two consecutive years, in sixty percent or more of the Key Wells.

6.2.6.2. Relationship of Minimum Threshold to Other Sustainability Indicators

The establishment of MTs also needs to consider potential effects on other sustainability indicators. These indicators are discussed later in this section; the following are brief discussions.

- **Groundwater Storage**. The MTs for groundwater levels are protective of groundwater storage. These MTs are defined in terms of historical groundwater low levels and groundwater storage is recovering following the recent historical lows; it is not being depleted. The major concern expressed in the Sustainability Goal is to have reliable storage for drought or shortage; the MTs for groundwater levels will maintain groundwater levels and thus storage, too.
- **Seawater Intrusion.** There is no possibility of seawater intrusion in the Basin. Accordingly, there is no seawater intrusion minimum threshold and no relationship with other minimum thresholds.
- **Subsidence.** Subsidence is closely linked to groundwater levels. It is unlikely that significant inelastic subsidence would occur if groundwater levels remain above

historical levels, which have been used to define groundwater level MTs. Accordingly, the minimum threshold for groundwater levels is consistent with and supportive of the objective to prevent subsidence undesirable results.

- **Water Quality.** General relationships are recognized, for example that contaminants may be mobilized by changing groundwater levels or flow patterns. Maintenance of groundwater levels above historical low levels and within historical ranges would minimize any effects on maintenance of water quality at or above minimum thresholds. The groundwater quality issues in the Basin are associated primarily with salt and nutrient loading and not likely to be affected by groundwater levels or flow within historical ranges.
- **Interconnected Surface Water.** The minimum thresholds for interconnected surface water are shallow groundwater levels in the southern portion of the Prado Wetlands. The storage reduction minimum threshold does not propose decreased groundwater elevations below historical levels, so groundwater levels are expected to remain within the historical range. This means that water table depths in the Prado Wetlands will remain within the historical range, which was adequate to maintain the vegetation in good health.

6.2.6.3. Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Basin shares portions of its boundary with four other basins, the Bedford-Coldwater Basin to the south, the Riverside-Arlington Basin along the Arlington Gap to the east, the Chino Basin on the north, and Coastal Plain of Orange County Basin along the canyon between the Chino Hills and Santa Ana Mountains. Groundwater flows are generally north and west, from the Bedford-Coldwater Basin and from the Chino and Riverside-Arlington basins into the Basin. Bedrock is very shallow in the canyon connecting the Basin to the Coastal Plain of Orange County Basin, forcing groundwater into the Santa Ana River and Wardlow Wash, so little subsurface outflow occurs along this boundary. The groundwater level MTs would support maintenance of groundwater levels above their respective MTs throughout the Basin. This in turn will support maintenance of groundwater levels in all four neighboring basins.

6.2.6.4. Effect of Minimum Threshold on Beneficial Uses and Users

Groundwater is the major source of supply in the GSP Area and supplies wells for municipal, industrial, and other beneficial uses and users. The MTs are based on historical lows, which recognizes that groundwater has been and is being used reasonably for the range of beneficial uses even during drought, and with reasonable operation and maintenance by well owners. The MTs quantify undesirable results as involving two consecutive exceedances in each of two consecutive years, which provides early warning of declining groundwater levels.

6.2.6.5. Relationship of Minimum Threshold to Regulatory Standards

No federal, state or local standards exist for groundwater levels.

6.2.6.6. How Management Areas Can Operate without Causing Undesirable Results

Management areas have not been defined for the Basin so the establishment of MTs has been consistently conceived and applied to the entire Basin.

6.2.6.7. How the Minimum Threshold will be Monitored

Monitoring for the groundwater levels MT will be conducted as part of the ongoing groundwater level monitoring programs performed by the GSA agencies, data and analytical results will be presented in annual reports.

6.2.7. Measurable Objectives

MOs are defined herein as an operating range of groundwater levels, allowing reasonable fluctuations with changing hydrologic and surface water supply conditions and with conjunctive management of surface water and groundwater. The groundwater level MTs represent the bottom of the operating range and are protective of well owners and groundwater users. The top of the operating range is generally where the water table approaches the soil zone and ground surface, except where groundwater and surface water are interconnected or groundwater dependent ecosystems exist. Section 6.7 addresses these areas and potential undesirable results with Depletions of Interconnected Surface Water. With these important exceptions, the top of the operating range is below the soil zone, thereby minimizing potential agricultural drainage problems.

> The **Measurable Objective** is to maintain groundwater levels above the groundwater level MTs (as quantified above or the interconnected surface water MTs, whichever is higher at the relevant measurement event), and to maintain groundwater levels within the operating range as defined in this section.

Groundwater conditions with respect to chronic groundwater level declines are already sustainable. Therefore, no interim milestones are needed to achieve sustainability by 2042.

6.2.7.1. Discussion of Monitoring and Management Measures to be Implemented

Management actions to maintain groundwater levels have been ongoing and effective for decades. These actions (consistent with the Sustainability Goal objective to support integrated and cooperative water resource management) have included developing local surface water for percolation, acquiring imported water for direct use, providing recycled water for irrigation, and other conjunctive use operations. The GSA agencies also have education and outreach programs to promote water use efficiency and to reduce water demand.

Monitoring measures for water levels are discussed in Section 7.

6.3. REDUCTION OF GROUNDWATER STORAGE

Groundwater storage is the volume of water in the Basin; it provides a reserve for droughts or surface water supply shortages. The MT for reduction of groundwater storage is the volume of groundwater that can be withdrawn from a Basin without leading to undesirable results. Undesirable results would involve insufficient stored groundwater to sustain

beneficial uses through drought or shortage. The storage criteria are closely linked to groundwater levels. The sustainability indicator for groundwater storage addresses the ability of the groundwater Basin to support existing and planned beneficial uses of groundwater, even during drought and surface water supply shortage.

The water budget has been calculated using the numerical model, as described in Water Budget Chapter 5. In brief, this has included analyses of the cumulative change in storage for the historical and current period, 1993 through 2017, and for simulated future conditions. The future water budget analyses have shown the dynamic effects of drought and changes in groundwater use and indicate that groundwater storage in the Basin can be sustainably managed relative to storage. The water budget inflow and outflows have been balanced over the long term under expected future conditions. Furthermore, as indicated in Section 6.2, none of the water supply wells have been reported as going dry in the Basin during the historical period of record. No private wells have been reported to have water shortages for the Basin in the DWR led *Household Water Supply Shortage Reporting System* (DWR 2021).

6.3.1. Description of Undesirable Results

Given that the Basin has not experienced any impacts to wells related to groundwater storage, the undesirable result associated would be an insufficient supply to support beneficial uses during droughts. Storage is related to groundwater levels. Thus, undesirable results associated with storage would likely be accompanied by one or more undesirable results associated with groundwater levels, including reduced well yields, subsidence, and depletion of interconnected surface water.

6.3.2. Potential Causes of Undesirable Results

For groundwater storage in the Basin, the basic cause of undesirable results would be an imbalance of the water budget, such that outflows exceed inflows resulting in reduction of groundwater storage that adversely affects beneficial uses in the Basin. This imbalance could be caused in turn by reduced surface water supplies and associated groundwater recharge. Such reduction could potentially include the following conditions: 1) increased pumping due to disruption of imported water, 2) reduced percolation from Temescal Wash, 3) reduced natural recharge due to increased impervious area (development), or 4) increased pumping due to reduced recycled/non potable discharge and use. Undesirable results also could occur because of changes in land use causing increased demand for groundwater; this would be most problematic if these land uses do not have access to water supplies other than groundwater.

6.3.3. Definition of Undesirable Results

Undesirable results are defined with the understanding that the objective of groundwater management is to provide reliable storage for water supply resilience during droughts and shortages. Accordingly, the definition of potential undesirable results for storage reduction includes consideration of how much storage has been used historically (i.e., operating storage) and how much stored groundwater reserve is needed to withstand droughts.

In thinking about conceptual operating storage or groundwater reserves, it is important to bear in mind that these are not the total amount of groundwater that could potentially be extracted from the Basin. Most wells are in the range of 50 to 700 feet deep.

The depth of the Basin ranges from near zero feet in some areas to more than 1,200 feet in others (see **Figure 3-11**). Groundwater wells used for water supply are generally located in the Channel Aquifer portions of the Basin (see **Figure 3-10**). Additional groundwater storage could be utilized, with the foremost assumption that withdrawals and reduction are followed by commensurate recharge and recovery. This could occur as part of enhanced conjunctive use programs.

6.3.4. Potential Effects on Beneficial Uses and Users

Groundwater is a source of water supply in the GSP Area and supplies wells for municipal, industrial, and other beneficial uses. Reduction of groundwater storage would reduce access to that supply with adverse effects on the community, economy, and environmental setting of the Basin. However, groundwater has been and is being used for the beneficial uses, even during drought.

6.3.5. Sustainable Management Criteria for Groundwater Storage

The general approach to defining sustainability criteria for groundwater storage has involved review of historical cumulative change in storage and expected future storage declines during droughts. Review of historical change in storage is revealing about how much storage has been used in the Basin, effectively defining an *operating storage*. Similarly, the approach focuses on the beneficial uses of the Basin and acknowledges much of the pumping occurs in larger municipal wells with dynamic operations. Sustainability criteria for groundwater levels also take into account historical ranges and the management of dynamic operation of municipal wells.

6.3.5.1. Description of Change in Storage: Historical and Future Conditions

Figure 5-10 shows the cumulative change in storage for historical conditions (1990 through 2017), the baseline future scenario, and the growth plus climate change future scenario as simulated by the numerical model. Starting from an assigned value of zero at the end of 1989, the storage change in each year is added to the cumulative total of the preceding years. Wet periods appear as upward trends or relative peaks in the cumulative total and droughts appear as downward trends or relative lows. Cumulative storage reached its minimum in 2016, corresponding with the 2014 to 2017 drought period. While the historical period shows a declining trend in storage over the period, the main causes of these declines, including severe dry climatic conditions and high pumping early in the simulation, are not expected to continue in the future.

Table 5-4 shows the average change in storage for the historical period (1993 through 2017), baseline, and the simulated future conditions (baseline and with future demand and supply assumptions).

The cumulative storage declined slightly in the historical period (1993 through 2017) due to increased groundwater pumping and reduced imported water, with an average loss of storage of 194 acre-feet per year (AFY) in the Temescal Basin. Simulated groundwater storage mostly recovered during the one to two years following droughts, but still showed a general decrease in groundwater storage due to increased groundwater production over the same time. Under the future baseline conditions, the average annual change in storage in the Basin is expected to be nearly balanced, with a very slight decrease of 65AFY resulting in stable storage conditions for the Basin over the period. While the overall change in storage is slightly negative, the annual change in storage shows that expected inflows and outflows are evenly balanced. In the future growth plus climate change scenario, the average annual change in storage is an increase of 34 AFY, very slightly larger than baseline conditions as urban growth increases municipal irrigation return flows. Adaptive management will be key to respond to changing conditions including unexpected decreases to natural inflows or unexpected increases in groundwater pumping.

Given the relative stability of storage in the most recent period (2008 to 2017), and future simulations showing expected increases in storage, the current groundwater management practices will likely continue to increase groundwater storage on average and recover from short term droughts on the order of one to five years.

6.3.6. Minimum Threshold

Undesirable results relative to groundwater storage have not occurred in the Basin and numerical modeling of future conditions indicate that groundwater storage can continue to be operated within historical limits. Nonetheless, the potential for reduction of groundwater storage exists (probably involving disruption of imported water supply) and thus this section considers minimum thresholds for storage. According to GSP Regulations, the minimum threshold for storage is to be defined as the maximum groundwater volume that can be withdrawn without leading to undesirable results.

However, GSP Regulations allow the use of the groundwater level sustainability criteria (MTs and MOs) as a proxy for groundwater storage, provided that the GSP demonstrates a correlation between groundwater levels and storage. Groundwater levels and storage are closely related. This is demonstrated by comparison of groundwater level and storage trends, which reveal the same patterns of historical response to drought and recovery. The relationship of levels and storage is embodied in the calibrated numerical model.

The rationale for using groundwater levels as a proxy metric for groundwater storage is that the groundwater level MTs and MOs are sufficiently protective to ensure prevention of significant and unreasonable results relating to storage. In brief, groundwater level MTs have been defined to protect supply wells (see Section 6.2.6) and are based on the following:

- A broad geographic distribution of Key Wells that are representative of Basin production wells
- MTs that are based on historical minimum groundwater levels, consistent with analyses of storage change

- Analysis of existing wells with construction information
- MTs are relatively shallow; as shown in **Table 6-1**, all MTs are relatively shallow in comparison to production well depths
- Groundwater level MTs include two consecutive exceedances in each of two years, providing early warning for storage changes, while also involving sixty percent or more of the Key Wells in the Basin, thus involving a broad area, consistent with storage change

As a practical matter, the availability of groundwater storage will be constrained by water levels (including groundwater level proxies for depletion of interconnected surface water) and given all the above, the MTs for groundwater levels are more than sufficiently protective of groundwater storage.

To summarize for the Basin:

> The **Minimum Threshold** for storage is fulfilled by the minimum threshold for groundwater levels. The **Minimum Threshold** for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well (two consecutive quarters in two years, providing early warning for storage changes, in 60 percent or more of the Key Wells).

The Sustainability Goal for the Basin includes an objective to provide reliable storage for water supply resilience during droughts and shortages. Use of groundwater levels as a proxy also fulfills that objective. No additional MT definition is needed.

6.3.6.1. Relationship of Minimum Threshold to Other Sustainability Indicators

- **Water Levels.** The minimum thresholds for groundwater levels are protective of the beneficial use of the Basin – municipal and industrial water supply; therefore, these levels are protective of and serve as a proxy for groundwater storage and the provision of reliable storage for drought and shortage.
- **Seawater Intrusion.** There is no possibility of seawater intrusion in the Basin. Accordingly, there is no minimum threshold and no relationship with other minimum thresholds.
- **Subsidence.** Subsidence is linked to groundwater levels. Because the storage reduction minimum threshold would not cause water levels to drop below their minimum thresholds, it would not interfere with the subsidence minimum threshold.
- **Water Quality.** Maintenance of groundwater storage within historical ranges would minimize any effects on water quality relative to water quality minimum thresholds. Groundwater quality issues in the Basin are associated primarily with salt and nutrient loading and not likely to be affected by groundwater storage within historical ranges.
- **Interconnected Surface Water.** The minimum thresholds for interconnected surface water are shallow groundwater levels in the southern portion of the Prado

Wetlands. The storage reduction minimum threshold does not propose decreased groundwater elevations below historical levels, so groundwater levels are expected to remain within the historical range. This means that water table depths in the Prado Wetlands will remain within the historical range, which was adequate to maintain the vegetation in good health.

6.3.6.2. Effect of Minimum Threshold on Sustainability in Adjacent Areas

As noted in Section 6.2.6.3, the Basin borders portions of the Bedford-Coldwater Basin to the south, the Riverside-Arlington Basin along the Arlington Gap to the east, the Chino Basin on the north, and Coastal Plain of Orange County Basin at the west where the Santa Ana River exists the Basin. The groundwater level MTs would support maintenance of groundwater levels above their respective MTs throughout the Basin. This in turn will support maintenance of groundwater levels and storage in all four neighboring basins.

6.3.6.3. Effect of Minimum Threshold on Beneficial Uses and Users

Beneficial uses and users of groundwater storage include maintenance of interconnected surface water and associated GDEs and municipal, industrial and other groundwater users. The MTs for groundwater levels are based on historical minima, which recognizes that groundwater has been and is being used reasonably for the range of beneficial uses even during droughts. The storage minimum threshold is consistent with the water level minimum threshold, which means that available storage will be adequate to supply beneficial uses as long as water levels remain above their minimum thresholds.

6.3.6.4. Relationship of Minimum Threshold to Regulatory Standards

Other than SGMA, no federal, state or local standards exist for reduction of groundwater storage.

6.3.6.5. How Management Areas Can Operate without Causing Undesirable Results

Management areas have not been defined for the Basin so the establishment of MTs has been consistently conceived and applied to the entire Basin.

6.3.6.6. How the Minimum Threshold will be Monitored

Monitoring for the groundwater levels MT, which is the proxy for storage, will be part of the GSA groundwater level monitoring program (see Chapter 7). Data and analytical results, including assessment of change in storage, will be presented in GSP Annual Reports.

6.3.7. Measurable Objectives

MOs would be defined as an operating range of groundwater storage, allowing changes in groundwater storage with varying hydrologic and surface water supply conditions and as with conjunctive management of surface water and groundwater. The groundwater level MTs provide a protective level that corresponds to the minimum threshold for storage, which would keep groundwater storage within the historical operating range. The Five-Year GSP Update could include consideration of using more of this storage locally as part of ongoing conjunctive use while also protecting shallow wells.

The **Measurable Objective** for storage is fulfilled by the MT for groundwater levels, which maintains groundwater levels above the historical maximum groundwater depths in each Key Well (as quantified in **Table 6-1**).

Groundwater conditions with respect to depletion of groundwater storage are already sustainable. Therefore, no interim milestones are needed to achieve sustainability by 2042.

6.3.7.1. Discussion of Monitoring and Management Measures to be Implemented

Monitoring and management actions to prevent chronic reduction of groundwater storage and to provide groundwater reserves for drought will be the same as those for maintenance of groundwater levels. No other specific management actions for storage have been identified and no specific implementation is warranted.

6.4. SEAWATER INTRUSION

Seawater intrusion does not occur in the Basin because of its inland location. According to the GSP Regulations, the GSP is not required to establish criteria for such undesirable results that are not likely to occur. Accordingly, the remaining discussion in this section does not address seawater intrusion.

6.5. LAND SUBSIDENCE

Subsidence has not been a known issue in the Basin and undesirable results have not been reported. Nonetheless, the potential has been recognized that subsidence could occur as a result of groundwater pumping and groundwater level declines, typically in areas underlain by thick layers of fine-grained alluvial sediments.

As described in Section 4.3, available information on vertical land displacement (subsidence) includes estimates from InSAR satellite data systems. InSAR data provides mapping of ground surface elevations across the Basin, presented at regular (typically monthly) intervals.

InSAR data are made available by DWR from the TRE Altamira InSAR Dataset with vertical displacement data beginning in June 2015 and in monthly intervals thereafter until September 2019. The accuracy of the InSAR ground surface elevation change estimates is reported to be ±16 millimeters (mm), or ±0.052 feet (Towill 2020). While these data do currently represent a relatively short period of record, the InSAR data do not show significant changes in ground surface elevation in the Basin. The Basin shows small rise and fall within the margin of error throughout. Given the short records of these datasets and small vertical displacements, these data have not been analyzed systematically to identify specific areas that might be subject to long-term subsidence. As datasets are updated, that may be warranted in the future.

Data are limited not only on groundwater-related subsidence, but also potentially associated pumping and groundwater levels. SGMA allows groundwater level data to be used as a proxy for subsidence; however, relationships between pumping, groundwater

levels, and subsidence have not been determined to support that. Subsidence information from DWR InSAR data will be reviewed as it becomes available.

6.5.1. Description of Undesirable Results

Land subsidence is the differential lowering of the ground surface, which can damage structures, roadways, and hinder surface water drainage. Subsidence remains a potential risk and inelastic subsidence is irreversible. Potential undesirable results associated with land subsidence due to groundwater withdrawals include the following:

- Potential damage to building structures and foundations, including water facilities, due to variations in vertical displacement causing potential cracking, compromised structural integrity, safety concerns and even collapse.
- Potential differential subsidence affecting the gradient of surface drainage channels, locally reducing the capacity to convey floodwater and causing potential drainage problems and ponding.
- Potential differential subsidence affecting the grade or drainage of other infrastructure such as railroads, roads, and sewers.
- Potential subsidence around a production well, disrupting wellhead facilities or resulting in casing failure.
- Potential non-recoverable loss of groundwater storage as fine-grained layers collapse.

None of these undesirable results has been observed in the Basin. However, subsidence may be subtle and cumulative over time. Accordingly, the potential for future subsidence cannot be ruled out if regional groundwater levels were to decline below historical lows and minimum thresholds.

6.5.2. Potential Causes of Undesirable Results

As described in Section 4.3, changes in ground surface elevations may be caused by regional tectonism or by subsidence related to declines in groundwater elevations due to pumping. Regarding the former, the InSAR data shows a general rising trend in the western portion of the Basin suggesting possible regional tectonic rise. In contrast, inelastic subsidence associated with groundwater pumping and level declines would generally show a long-term downward trend, with greater subsidence occurring during times of groundwater level decline (e.g., drought) and a flattening trend with no recovery during times of rising groundwater levels and reduced pumping (e.g., wet years).

In brief, as groundwater levels decline in the subsurface, dewatering and compaction of predominantly fine-grained deposits (such as clay and silt) can cause the overlying ground surface to settle. Land subsidence due to groundwater withdrawals can be temporary (elastic) or permanent (inelastic). While elastic deformation is relatively minor, fully recoverable, and not an undesirable result, inelastic deformation involves a permanent compaction of clay layers that occurs when groundwater levels in a groundwater basin

decline below historical lows. This causes not only subsidence of the ground surface, but also compaction of sediments and loss of storage capacity.

Given the above, the potential for problematic land subsidence is affected by the proportion, overall thickness, and configuration of fine-grained sediments (with greater proportions and thicknesses suggesting greater potential). Because of the variability of local sediments, subsidence also is likely to be geographically variable. Moreover, the potential for subsidence is affected by the history of groundwater level fluctuations, such that areas with previous groundwater level declines may have already experienced some compaction and subsidence.

The potential for subsidence is possible, especially in the deeper portions of the Basin where there is more pumping, but there is no indication that permanent inelastic subsidence has occurred.

6.5.3. Potential Effects on Beneficial Uses and Users

The lack of any reports of undesirable results is an indication of no noticeable effects. However, there is a general awareness in the Basin of subsidence problems in the Central Valley that cause the above listed effects. Nonetheless, some subsidence could have occurred because of historical groundwater level declines without being noticed and could have contributed to drainage or flooding problems, which are also affected by multiple and sometimes more noticeable factors including variable weather, changes in streams and drainage systems, land use changes in the watershed, erosion and sedimentation. Accordingly, continued tracking of subsidence is warranted.

6.5.4. Minimum Threshold

According to the GSP regulations Section 354.28(c)(5) the minimum threshold for land subsidence is defined as the rate and extent of subsidence that substantially interferes with surface land uses. This section first addresses the rate at which subsidence substantially interferes with surface land uses and then describes how available InSAR data can be used to measure rate and extent across the Basin.

> The M**inimum Threshold** for subsidence is defined as a cumulative decline equal to or greater than one foot since 2015, which represents current conditions and the SGMA start date. This corresponds to a rate of decline equal to or greater than 0.2 feet in any five-year period.

The 1-foot criterion is reasonable based on standards for flooding and drainage and on empirical data for well casing collapse:

- In the southwestern part of the Sacramento Valley, where documented cumulative subsidence has reached several feet, video surveys of 88 undamaged wells and 80 damaged wells showed that casing damage was uncommon in wells where subsidence was less than 1 foot (Borchers and Carpenter 2014).

- Ground floor elevations are recommended or required to be at least 1 foot above the Base Flood Elevation in some jurisdictions (see for example FEMA 2011 and City of Temecula 2020). Subsidence above 1 foot may cause some buildings to become flooded.
- The minimum freeboard along roadside ditches is often required to be 1 foot above the maximum anticipated water level (see for example San Diego County 2005). Greater subsidence may cause sewer and stormwater flows to flow in unintended directions.

Subsidence impacts can be relatively rapid and noticeable. However, in the Basin any subsidence in the future is likely to be gradually cumulative as would be its undesirable results. Accordingly, the 0.2 feet per 5-year rate of decline is an appropriate criterion, with the understanding that it will be re-evaluated in the 2027 GSP Update.

Based on available data and using the above criterion, significant and unreasonable subsidence has not occurred since 2015 in the Basin. Moreover, it is unlikely that the criterion will be exceeded in the future as groundwater pumping will be constrained with the MT set for groundwater levels and storage.

The extent of cumulative subsidence across the Basin will be monitored using the InSAR satellite-based data that DWR has been providing on the SGMA Data Portal website. The data consist of a closely spaced grid of elevation points and are characterized by considerable "noise," meaning that adjacent points often have very different readings at the scale of 1 to 2 inches. These data will be smoothed to provide results at a spatial scale at which subsidence would plausibly occur. These values for cumulative elevation change will then be compared annually with the minimum threshold criterion.

6.5.4.1. Relationship of Minimum Threshold to Other Sustainability Indicators

Subsidence is closely linked to groundwater levels. It is unlikely that significant inelastic subsidence would occur if groundwater levels remain above historical levels, which have been used to define groundwater level MOs. In addition, the operationally defined MT levels will prohibit significant pumping if water levels decline below historical lows. Accordingly, the minimum threshold for groundwater levels is consistent with and supportive of the objective to prevent subsidence undesirable results.

The subsidence MT would have little or no effect on other MTs. Specifically, subsidence MTs would not result in significant or unreasonable groundwater elevations, would not affect pumping and change in storage, would not affect groundwater quality, or result in undesirable effects on connected surface water.

6.5.4.2. Effect of Minimum Threshold on Sustainability in Adjacent Areas

As noted in Section 6.2.6.3, the Basin borders portions of the Bedford-Coldwater Basin to the south, the Riverside-Arlington Basin along the Arlington Gap to the east, the Chino Basin on the north, and Coastal Plain of Orange County Basin at the west where the Santa Ana River exists in the Basin. The groundwater level MTs would support maintenance of

groundwater levels above their respective MTs throughout the Basin. This in turn will support maintenance of groundwater levels above historical minima and, thus, subsidence affecting other basins is not expected to occur.

6.5.4.3. Effect of Minimum Threshold on Beneficial Uses and Users

Subsidence problems have not been reported in the Basin, but subsidence remains a potential undesirable result that may contribute incrementally to reduced drainage, increased flooding, or other undesirable results. The effects of establishing the numerical subsidence MT are beneficial because they support a greater chance of detecting subsidence, supporting management actions to maintain groundwater levels, and preventing significant subsidence.

6.5.4.4. Relationship of Minimum Threshold to Regulatory Standards

There are no federal, state or local standards specifically addressing subsidence. There are standards for flood depth, floodplain encroachment, freeboard in ditches and canals and slopes of gravity-flow plumbing pipes. These vary somewhat from jurisdiction to jurisdiction, but they are generally similar and were used as the basis for selecting the MT.

6.5.4.5. How Management Areas Can Operate without Causing Undesirable Results

Management areas have not been defined for the Basin so the establishment of MTs has been consistently conceived and applied to the entire Basin.

6.5.4.6. How the Minimum Threshold will be Monitored

The minimum threshold will be monitored using InSAR areal data. Cumulative subsidence will be monitored using the InSAR satellite-based geodetic data that DWR has been providing on the SGMA Data Portal website. The data are “raster” data sets consisting of a grid of elevation points spaced approximately 300 feet apart. The InSAR data will be evaluated to identify any occurrence and areal extent of subsidence. As data are provided over the next few years, this evaluation will involve review of temporal InSAR data to discern seasonal elastic fluctuations and potential inelastic declines. In addition, any areal extent will be examined; this may involve smoothing of elevation changes over the InSAR grid to summarize the results to a spatial scale at which subsidence would plausibly occur. The cell values for cumulative elevation change will then be compared with the minimum threshold criterion.

6.5.5. Measurable Objectives

The Sustainability Goal includes the objective to prevent subsidence. Accordingly, the MO is zero subsidence. Undesirable subsidence results have not occurred, and accordingly, no interim milestones are defined.

6.5.5.1. Representative Monitoring

It is assumed that the InSAR subsidence monitoring programs will continue for the foreseeable future and InSAR data will be available from the DWR website. The GSP monitoring program for subsidence will involve annual download of InSAR data with analysis for signs of cumulative inelastic subsidence.

6.5.5.2. Discussion of Management Actions to be Implemented

Management actions to prevent subsidence will be coordinated with actions relative to maintenance of groundwater levels. These actions involve maintaining groundwater levels above historical low water levels and will prevent significant inelastic subsidence. No other specific management actions for subsidence have been identified and no specific implementation is warranted.

6.6. DEGRADATION OF WATER QUALITY

Degraded water quality can impair water supply and affect human health and the environment. Impacts to drinking water supply wells can result in increased sampling and monitoring, increased treatment costs, use of bottled water, and the loss of wells. As described in Groundwater Conditions Sections 4.5 and 4.6, elevated concentrations in drinking water of some constituents, such as nitrate, can adversely affect human health. Impacts to agricultural supply can include reduced yields, the need to change irrigation methods/sources, and other economic effects. Discharge of degraded groundwater can harm ponds, wetlands, and associated ecosystems (e.g., eutrophication).

Consideration of the causes and circumstances of water quality conditions is important in the Basin because general mineral quality (e.g., TDS, etc.) is naturally poor throughout much of the Basin, has been poor for decades, and nonetheless has been used for beneficial purposes including irrigation, municipal, and domestic purposes. The main beneficial use in the Basin is municipal supply and Corona uses blending with imported water and treatment to meet federal, state, and local drinking water guidelines.

Sustainable management is about use and management of groundwater without causing undesirable results but does not necessarily include reversing natural undesirable conditions. According to SGMA (§10727.2(b)(4)), a GSP may—but is not required to—address undesirable results that occurred before and have not been corrected by the SGMA benchmark date of January 1, 2015.

Given all that, the sustainability goal—to protect groundwater quality—is not to reverse undesirable water quality conditions by 2042 but rather to prevent circumstances wherein future management activities might make water quality worse and insofar as possible to improve water quality in the long run. Implementation of management actions is recognized as needed now and, whether or not the results are perceptible in the short term, such actions will be helpful in the long term.

6.6.1. Potential Causes of Undesirable Results

The quality of groundwater in the Basin is characterized as somewhat mineralized, reflecting natural hydrogeologic processes (see Groundwater Conditions Section 4.4). Groundwater also has been affected by human activities including agricultural, rural, urban, and industrial land uses. While contaminant sources of groundwater quality degradation exist, these are effectively regulated as described in Groundwater Conditions Section 4.6 and regularly tracked as part of the GSA's monitoring program.

As described in the Groundwater Conditions section, total dissolved solids (TDS) and nitrate are constituents of concern for the Basin. While there are elevated natural background TDS concentrations in groundwater, TDS also is an indicator of human impacts including infiltration of urban runoff, agricultural return flows, and wastewater disposal. Natural nitrate levels in groundwater are generally very low, and elevated concentrations are associated with agricultural activities, septic systems, landscape fertilization, and wastewater treatment facility discharges.

Other constituents have been documented (see Groundwater Conditions Section 4.8) but occurrences of these are either under regulation by RWQCB (e.g., perchlorate) or are naturally occurring with no recent exceedances of MCLs and limited potential for mobilization due to management actions (e.g., arsenic, chromium, iron, and manganese).

6.6.2. Description of Undesirable Results

The processes and criteria relied on to define Undesirable Results included review of available data and information summarized in the Plan Area and Groundwater Conditions sections and discussions with Temescal Basin stakeholders and local agency representatives.

Undesirable Results are defined in the GSP Regulations (§354.26) as occurring when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the Basin. The GSA is not responsible for local problems or degradation caused by others. While the Basin includes regulated facilities with soil and groundwater contamination (see Groundwater Conditions Sections 4.4 and 4.7), these sites are under regulatory oversight by State agencies; the GSA does not have the mandate or authority to duplicate these programs. Nonetheless, the GSA plans to regularly cooperate with these agencies and check regulator files regularly as part of its water quality monitoring program. In addition, this GSP avoids management actions that would spread groundwater contamination through managed aquifer recharge, pumping, or other activities.

In fact, the GSA agencies have historically conducted management actions and programs (often in cooperation with other agencies) to improve groundwater quality. These activities have included treatment of groundwater and imported surface water for municipal use (which improves wastewater quality), wastewater treatment plant improvement and water recycling, and programs to reduce urban and agricultural salt and nutrient loading.

6.6.3. Potential Effects on Beneficial Uses and Users

Groundwater is a source of supply in the GSP Area and supports a range of beneficial uses: agricultural, municipal, rural, and environmental. Beneficial uses of water and respective water quality objectives are defined by the RWQCB in the Santa Ana Basin Water Quality Control Plan (Basin Plan). For TDS and nitrate, these are tabulated in the GSP Groundwater Conditions (Section 4.5 Key Constituents of Concern); this section indicates that water quality in the Basin is naturally mineralized and affected by human activities and has not been shown to change significantly. It is recognized that groundwater has been and is being used for the range of beneficial uses with reasonable accommodation by users. Blending

and treatment of groundwater for municipal supply has been successful to provide drinking water to the Basin. This recognition does not preclude or ignore a desire by the community or intent of local agencies including the GSA to improve local groundwater quality.

6.6.4. Sustainable Management Criteria for Groundwater Quality

The definition of an Undesirable Result due to degraded water quality—TDS and nitrate concentrations—was evaluated in the context of regulatory objectives in the Basin.

GSP regulations require that the minimum threshold for degraded water quality be based on "the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the agency to be of concern for the basin" (§354.28(4)). The number of supply wells are considered here for the minimum threshold. This is because the issues of concern in the Basin are focused on regional nitrate and salt loading, data are insufficient to define plumes or volumes of water, and the position of an isocontour is not applicable.

6.6.4.1. Temescal Water Quality Monitoring Program

The GSA agencies established a water quality monitoring program for the protection of beneficial uses, understanding of human and natural factors that affect water quality, and support for groundwater management decisions. The City of Corona (Corona) has been the primary agency implementing this program in the Basin and regularly monitors groundwater production wells as well as select dedicated monitoring wells. The network of wells historically has been focused on the Channel Aquifer where Corona pumps most of its water for municipal supply. The wells generally are sampled quarterly with lab analysis for general minerals, physical parameters, and selected constituents of concern. Accordingly, this data set can be used to detect a range of problems quickly, to track trends, allow geochemical investigation, and support focused management actions.

In addition, the GSA will regularly compile, reviews, and summarizes all available information on water quality in the Basin from the groundwater ambient monitoring program (GAMA) Groundwater Information System (SWRCB 2020b).

Limitations of this data set include the uneven and potentially shifting distribution of sampled wells across the Basin, lack of information on the vertical zone being sampled (well construction information), relatively less frequent sampling schedule and absence of historical record, variable data availability on specific constituents and parameters, and multiple sources of information from programs with differing objectives and procedures. These limitations present significant uncertainties to the GSA and stakeholders who are required to establish quantitative, measurable criteria and then comply with them, with real-world consequences.

6.6.5. Minimum Thresholds

Minimum Thresholds (MTs) are presented for nitrate and TDS using the best available information, namely data generated by the Water Quality Monitoring Program and compiled data. As summarized above, the limitations of this data set are recognized, and

additional investigations and monitoring program improvements will be presented in this GSP for planned implementation. With adaptive management in mind, MTs may be revised to rely more on the GSA in the future as needed.

The MTs for nitrate and TDS quantify current conditions (2015 through 2019) based on available monitoring data. Water quality monitoring serves two useful purposes. First, it will eventually confirm whether concentrations begin leveling off as intended. Second, it can detect local sources of degradation that impact groundwater quality more strongly and rapidly than the slow, dispersed loading from agricultural activities. Early detection of local impacts can enable appropriate actions to halt further contamination before the impacts become severe or widespread.

6.6.5.1. Minimum Threshold for Nitrate (NO_3)

Table 6-2 summarizes current conditions for nitrate in reference to the maximum contaminant level (MCL) for nitrate as nitrate (NO_3) in drinking water, 45 mg/L, which also is the Basin Plan Objective for municipal use. Current conditions are expressed in terms of the percent of wells with concentrations over 45 mg/L. To compute the percent of wells, nitrate sampling results were compiled for each well over the period 2015 through 2019. For wells with one sample, the single value was used; for wells with two samples, the average value was used; and for wells with three or more values, the average value was used. Accordingly, each well was represented by one value. This was followed by computation of the percentage of wells with concentrations exceeding 45 mg/L.

This process of summarizing current conditions makes use of all available data. It also is recognized that the data are not representative of water supply conditions throughout the Basin because the geographic distribution of wells is uneven and information from shallow and deep wells are combined. Monitoring program improvements will be implemented as part of the GSP to improve the data set (see Section 6.6.6.2) and provide a more reasonable basis for sustainability criteria.

Table 6-2. Summary of Current Conditions for Nitrate (NO_3) and TDS

Water Quality Parameter	Minimum Threshold (MT)	Total Wells	Number of Wells Exceeding MT	Percent of Wells Exceeding MT
Nitrate as Nitrate (NO_3)	45 mg/L	24	12	50 percent
TDS	1,000 mg/L	23	6	26 percent

As documented in **Table 6-2**, there are wells in the Basin yielding water with nitrate concentrations exceeding the MCL. While recognizing the number of wells affected by high nitrate concentrations, there has been historical and ongoing groundwater use with reasonable accommodation by users and accordingly, these conditions are considered sustainable.

Despite the significant uncertainties, the following MT is presented as a starting point for maintenance and planned improvement of groundwater quality for the 2042 deadline for sustainability.

> The **Minimum Threshold** for nitrate is defined initially as the percentage of wells with concentrations exceeding the nitrate MCL (45 mg/L) based on current conditions (2015-2019).

Given the above definition, the MT for nitrate is expressed in **Table 6-2**. This MT refers to the numeric MCL and Basin Plan objective, honors the non-degradation policy, and quantifies current conditions based on available data. As described in the following section, Measurable Objectives, the approach is to implement management actions that will maintain or reduce nitrate concentrations in the future.

6.6.5.2. Minimum Threshold for Total Dissolved Solids

Table 6-2 summarizes current conditions for TDS with reference to the 1,000 mg/L secondary maximum contaminant level (SMCL). This value is far from ideal, but reflects the widespread conditions of elevated TDS concentrations in groundwater. The main beneficial use in the Basin is municipal supply and Corona uses blending with imported water and treatment to meet federal, state, and local drinking water guidelines.

As with nitrate, computation of the percent of wells in **Table 6-2** involved compilation of sampling results for each well over the period 2015 through 2019. For wells with one sample, the single value was used; for wells with two samples, the average was used; and for wells with multiple values, the average was used, such that each well was represented by one value. This was followed by computation of the percent of wells with concentrations exceeding 1,000 mg/L.

This process makes use of all available data. The data are not representative of water supply conditions throughout the Basin because the depths and geographic distribution of wells is uneven. Monitoring program improvements will be implemented as part of the GSP to improve the data set and provide a more reasonable basis for sustainability criteria.

Despite the uncertainties, the following MT is presented as a starting point for maintenance and planned improvement of groundwater quality for the 2042 deadline for sustainability.

> The **Minimum Threshold for TDS** is defined initially as the percentage of wells with concentrations exceeding the TDS value of 1,000 mg/L based on current conditions (2015-2019).

As with nitrate, this MT is presented with full recognition of data gaps and uncertainties, and with the commitment incorporated in this GSP to investigate nitrate and salt loading under current conditions and to expedite management actions for reduction of nitrate and salt loading.

Accordingly, the TDS MT is expressed in **Table 6-2**. This MT refers to the numeric Basin Plan objective, honors the non-degradation policy, and quantifies current conditions based on available data. Given historical and ongoing groundwater use, these conditions are

considered sustainable. As described in the following section, Measurable Objectives, the approach is to implement management actions that will maintain or reduce nitrate concentrations in the future.

6.6.5.3. Relationship of Minimum Threshold to Other Sustainability Indicators

Three of the other sustainability indicators (groundwater level declines, storage depletion, subsidence) are directly linked to groundwater levels, while the sustainability indicator for connected surface water-groundwater dependent ecosystems is related to a rate or volume of surface water depletion, also linked to groundwater levels. The MTs for water quality are not known to be directly related to specific groundwater levels or fluctuations in groundwater levels. Nonetheless, general relationships are recognized, for example that contaminants may be mobilized by changing groundwater levels or flow patterns. Accordingly, the water quality MTs will help guide potential projects that alter groundwater levels or flow.

6.6.5.4. Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Basin borders portions of the Bedford-Coldwater Basin to the south, the Riverside-Arlington Basin along the Arlington Gap to the east, the Chino Basin on the north, and Coastal Plain of Orange County Basin at the west where the Santa Ana River exists in the Basin. The MTs for the Basin represent current conditions; establishment of MTs and maintenance of such conditions, which reflect native conditions, would not affect the ability of the neighboring basins to achieve or maintain sustainability.

As consideration beyond the requirements of this section, some management actions to improve groundwater quality in the Basin (for example enhancing outflow of poor-quality groundwater) could potentially have adverse impacts downstream. However, potential impacts of management actions and projects will be addressed through the California Environmental Quality Act (CEQA). Overall improvement of the Basin groundwater quality through other management actions (e.g., increased CVP percolation with maintenance of outflow) would be beneficial.

6.6.5.5. Effect of Minimum Threshold on Beneficial Uses and Users

The establishment of the MTs reflects the current condition of the Basin relative to nitrate and TDS concentrations, insofar as available data and monitoring allow us to know. Establishing the MTs represents no change and recognizes that groundwater has been and is being used reasonably for the range of beneficial uses. The MTs represent a quantified starting point for protection of groundwater quality and for projects and management actions to improve groundwater quality, consistent with a best management practices approach.

6.6.5.6. Relationship of Minimum Threshold to Regulatory Standards

The MTs have been established with direct reference to regulatory standards, most notably the Maximum Contaminant Levels, drinking water standards set by the State of California, while recognizing that current nitrate and TDS concentrations in many wells do not meet regulatory standards. It should be noted all water delivered to users in the Basin met all drinking water standards, as achieved through blending and treatment.

6.6.5.7. How Management Areas Can Operate without Causing Undesirable Results

Management areas have not been defined for the Basin so the establishment of MTs has been consistently conceived and applied to the entire Basin.

6.6.5.8. How the Minimum Threshold will be Monitored

The GSP is using the best available information, namely data from the GSA's Water Quality Monitoring Program and available data from GAMA. The GSA's Water Quality Monitoring Program, along with its regular sampling schedule, historical records, and data on specific constituents and parameters will be the primary basis for MT tracking with reference to GSP 5-year updates.

6.6.6. Measurable Objectives

The sustainability goal is to protect groundwater quality, with general objectives of maintaining groundwater quality, preventing circumstances where future management activities might make water quality worse, and improving groundwater quality in the long run. In setting Measurable Objectives (MOs), a key issue is legacy loading, where the amount of historical loading is not known nor is the rate at which it is moving down to affect deep pumping zones. Because of the uncertainties associated with legacy loading, the use of water quality monitoring to track or verify sustainability needs to be tempered with a broad margin of operational flexibility. This margin should acknowledge the possibility (and even likelihood) that monitoring could indicate undesirable results—those stemming from past practices—while present reductions in loading are not yet perceptible.

6.6.6.1. Description of Measurable Objectives

Measurable Objectives are defined in this GSP using the same metrics and monitoring data as used to define Minimum Thresholds and are established to maintain or improve groundwater quality. Given the significant uncertainties presented by legacy loading and by data limitations, a reasonable margin of safety includes the possibility of "negative" monitoring results while positive progress is being made.

> The **Measurable Objective for nitrate** is defined as maintaining or reducing the percentage of wells with average concentrations exceeding the nitrate MCL (45 mg/L) based on conditions documented in GSP 5-year updates.
>
> The **Measurable Objective for TDS** is defined as maintaining or reducing the percentage of wells with average concentrations exceeding the TDS value of 1,000 mg/L based on conditions documented in the GSP 5-year updates.

Measurable Objectives will be evaluated in increments of five years and the numeric values will be presented with comparison to the Current Conditions. This comparison will be discussed in the context of actual progress in implementing measures to improve monitoring and management.

6.6.6.2. Discussion of Monitoring and Management Measures to be Implemented

The strategy of this GSP is to identify and implement monitoring and management measures to reduce nitrate and salt loading. Monitoring and management actions already undertaken

are summarized in Plan Area Section 2 and would be continued, most notably including the following:

- Corona water treatment that continues to use imported water and thereby improve wastewater quality.
- Corona wastewater treatment improvements (nitrate reduction) and water recycling.

Additional **management measures** include the following:

- Development of a stormwater recharge program including cooperation with local agencies to prepare a Storm Water Resource Plan, with identification of opportunities to increase recharge using local storm runoff.
- Analysis of Basin outflows relative to salt management.
- Enhanced outreach to Temescal Basin stakeholders (including disadvantaged communities) on groundwater quality issues.

6.6.6.3. Description of Reasonable Pathway

Implementation of this GSP will include regular updates on a five-year basis. This will include evaluation of Measurable Objectives with comparison to Current Conditions (2015-2019). Because groundwater quality conditions are considered sustainable, interim milestones toward sustainability are not relevant. These comparisons will be discussed in the context of actual progress in implementing measures to improve monitoring and management.

A first step along the pathway will be analysis of the triennial data set used to establish criteria. A subset of the wells will be selected considering factors such as: uniform geographic representation, availability of well depth information, and continuity from one triennial period to the next. This first step will be completed during the first five years of GSP implementation.

The Management Actions and Implementation Plan sections of this GSP are intended to provide additional detail on the scope, scheduling, and estimated costs of the measures to be implemented.

6.7. DEPLETIONS OF INTERCONNECTED SURFACE WATER

This section builds and extends the discussion of interconnection of surface water and groundwater presented in in Section 4. That section provided information on surface water-groundwater connections (both seasonally and with wet years and drought), identification of potential groundwater dependent ecosystems (GDEs), distribution of riparian vegetation, and assessment of animal species that rely on groundwater-supported streamflow. Briefly, the analysis found that the only location within the Basin where pumping might affect surface flow or vegetation is along the southern edge of Prado Wetlands. Small patches of riparian vegetation in canyons where tributary streams enter the west side of the Basin are supplied by groundwater discharging from bedrock uplands and are not affected by pumping in the Basin. No isolated springs or seeps are located in the Basin.

6.7.1. Description of Undesirable Results

If a stream is hydraulically connected to groundwater, pumping from nearby wells can reduce the amount of stream flow by intercepting groundwater that would have discharged into the stream or by inducing seepage from the stream. Undesirable results associated with stream flow depletion include reduced quality and quantity of aquatic and riparian habitats and reduced water supply to downstream users. Areas of interconnected surface water can also contain riparian vegetation that relies on shallow groundwater as an important source of water. Conceptually, adverse impacts for stream and riparian habitat can result from decreased rainfall, decreased stream flow, and lowered groundwater levels. These variables are highly correlated in time: droughts include rainfall reductions, decreased stream flows, and lowered groundwater levels at a time when habitat impacts are usually the most severe. Furthermore, droughts and wet periods are a natural feature of California's climate and are associated with waxing and waning of habitat conditions.

6.7.2. Potential Causes of Undesirable Results

Depletion of interconnected surface water by groundwater pumping can impact a variety of beneficial uses of surface water. A systematic evaluation of each potential impact is warranted, including impacts on downstream water users, and plants and animals that rely on flow or shallow water table conditions along streams.

6.7.2.1. Surface Water Users

There are no known diverters of surface water from Temescal Wash in the Basin. However, the Wash is tributary to the Santa Ana River, which is a source of supply to Orange County Water District downstream of Prado Dam. Pursuant to a 1968 agreement with Western Municipal Water District (WMWD), the Corona is required to discharge 1,625 acre-feet (AF) of water from Temescal Wash into the Prado Wetlands. That amount is equivalent to a continuous flow of 2.25 cubic feet per second (cfs) and has always been met by discharges of recycled water from Water Reclamation Facility 1 (WRF-1) to the lined reach of Temescal Wash upstream of the wetlands.

Groundwater discharge into the Prado Wetlands is apparently not viewed as a significant source of supply to downstream surface water users, based on active efforts over the past two decades to eliminate groundwater discharge into the wetlands from the Chino Basin. The Regional Water Quality Control Board mandated that the Chino Basin be operated to achieve "hydraulic control", which means eliminating groundwater discharge into the Wetlands (WEI 2019). The objective is to prevent saline groundwater in the area from seeping into the Santa Ana River. Beginning in 2000 and increasing in stages since then, the Chino Desalter Wells now pump approximately 30,000 AFY of groundwater, most of which would otherwise discharge into the Prado Wetlands. This decrease in groundwater inflow has been offset by increases in surface water inflow, primarily discharges of reclaimed water from treatment plants along the Santa Ana River and its tributaries.

The expectation that flow requirements of Prado Wetlands and downstream water users will be met by surface inflows to the Wetlands rather than groundwater inflow is echoed in the Upper Santa Ana River Habitat Conservation Plan (SARHCP, ICF 2020). The plan notes

that simulations using a regional groundwater model project about 5 feet of groundwater decline in the Prado Wetland area by 2030. However, no mitigation measures or management actions related to groundwater are included in the plan.

Groundwater discharge from the Basin into the Prado Wetlands is not expected to decrease in the future because groundwater levels are not expected to decrease. This assertion stems from the lack of long-term declines in water levels since at least 2005 (see **Figure 4-23**) and the selection of minimum historical water levels as the minimum thresholds for water levels in this GSP (see Section 6.2.6). However, the preceding discussion indicates that an increase in groundwater pumping resulting in slightly lowered groundwater levels and reduced groundwater discharge into Prado Wetlands would not cause an undesirable result for downstream water users.

6.7.2.2. Animals Dependent on Groundwater

The primary animal species that depend on groundwater in the Basin are birds that inhabit riparian vegetation in the Prado Wetlands, including several listed species. The nexus between groundwater and those species is via the extent and health of riparian vegetation, discussed below.

6.7.2.3. Riparian Vegetation

The beneficial use of interconnected surface water with the greatest potential to be impacted by groundwater pumping is riparian vegetation along the southern edge of the Prado Wetlands, where the Basin groundwater discharges into the Wetlands. As described above (Section 6.7.2.1 Surface Water Users), the Wetlands are presently sustained almost entirely by surface water inflow rather than groundwater discharge. Although substantial or long-term decreases in groundwater discharge from the Basin into the Prado Wetlands are not expected, they would tend to cause vegetation die-back along the southern fringe of the Wetlands by lowering the water table to a depth beyond the reach of vegetation roots.

6.7.3. Definition of Undesirable Results

The Sustainability Goal includes an objective to support beneficial uses in the Basin, and specifically those related to interconnected surface water. Consistent with that objective, undesirable results of excessive depletion of surface water are:

> Riparian vegetation die-back or mortality during droughts of a magnitude that disrupts ecological functions or causes substantial reductions in populations of riparian-associated species.

6.7.4. Potential Effects on Beneficial Uses and Users

The analysis presented in this section demonstrates that groundwater conditions are currently sustainable with respect to interconnected surface water and GDEs. There are no users of surface water in the Basin, and the needs of Santa Ana River users downstream of the Basin appear to be met by surface inflows to the Prado Wetlands and past Prado Dam. Although lowering of the water table in the Prado Wetlands could stress or kill riparian

vegetation, the extent and health of riparian vegetation do not appear to be correlated with groundwater levels in water supply wells in the Basin (see Section 4.10.4).

6.7.5. Sustainable Management Criteria for Interconnected Surface Water

SGMA requires that the minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results (§354.28(c)(6)). However, GSP Regulations allow GSAs to use groundwater elevation as a proxy metric for any of the sustainability indicators when setting minimum thresholds and measurable objectives (23 CCR § 354.28(d) and 23 CCR § 354.30(d)).

It would be difficult to define a minimum threshold in terms of flow depletion in this Basin because phreatophytic riparian vegetation in the Prado Wetlands is more dependent on surface inflows from outside the Basin (that is, from the Santa Ana River) than from groundwater discharge within the Basin. Also, groundwater does not need to discharge at the land surface to support vegetation; it only needs to rise up to the root zone. Thus, it is reasonable to define the minimum threshold in terms of water levels instead of flow.

6.7.6. Minimum Threshold

Given the above, the minimum threshold is defined here by groundwater levels. As noted previously, wells in the groundwater level monitoring program are production wells with relatively deep screens that have not been sited and designed for tracking surface water-groundwater interactions or water table depths in areas of riparian vegetation. The lack of such shallow monitoring wells is a data gap and a source of uncertainty. Hence, the minimum threshold described here is initial. Nonetheless, it is intended to be protective of GDEs until the monitoring program can be refined to better represent water-table depths along the southern edge of the Prado Wetlands.

Therefore, in the Basin:

> The **Minimum Threshold** for depletion of interconnected surface water is the amount of depletion that occurs when the depth to the water along the southern edge of the Prado Wetlands is greater than 15 feet for a period exceeding one year.

This threshold corresponds approximately to the maximum depth to water measured in shallow monitoring wells in the northern part of the Prado Wetlands.

Undesirable results are considered to commence if the water-table depth along the southern edge of the Prado Wetlands declines below the MT and the decline correlates with declining water levels in production wells in the Basin.

6.7.6.1. Relationship of Minimum Threshold to Other Sustainability Indicators

- **Groundwater Levels.** The water level MTs are set to equal the minimum historical water levels in existing monitored wells, all of which are over 1 mile from the Wetlands. The now-destroyed Butterfield Park Well was much closer to the Wetlands than the other monitored wells, and its water levels indicated that

groundwater elevations and depths to water decreased continuously from the production wells in the center of the Basin to the Prado Wetlands. Assuming hydraulic connection between those two locations, the water level MT should prevent the water table at the edge of the Wetlands from declining below the historical minimum. Water levels in shallow monitoring wells in the northern part of the Prado Wetlands either did not decline much during the 2013 to 2015 drought or declined slightly to reach their lowest historical levels. There did not appear to be widespread die-back of vegetation in the Prado Wetlands during the 2013 to 2015 drought. Historical aerial photos confirmed a substantial reduction in riparian tree/shrub canopy coverage along the lowermost reach of Temescal Wash, where it enters the Prado Wetlands (a roughly 8,300-foot reach from North Lincoln Avenue to below West Rincon Avenue) (McMichael 2021). However, the decrease in vegetation appeared to start around 2009 (before the drought) and has been attributed to decreased base flow in Temescal Wash (McMichael 2021). The period of record for the Butterfield Park Well is only 2011 through 2017, so it is not possible to correlate the change in vegetation with groundwater levels over the entire period of interest. However, the MT for interconnected surface water is consistent with the water-level MT in that they both avoid water levels lower than historical minimum levels, which in most wells occurred during the 2013 to 2015 drought. Thus, the two MTs are consistent, and managing for one would not impact managing for the other.

- **Groundwater Storage.** The minimum threshold for interconnected surface water would similarly be consistent with the minimum threshold for groundwater storage near GDE reaches, because the latter is functionally the same as the minimum threshold for water levels.
- **Seawater Intrusion.** Seawater intrusion would not occur in the Basin due to its inland location. No minimum threshold was defined and there is no consistency issue.
- **Land Subsidence.** Significant land subsidence is only likely to occur with groundwater levels below historical minimum levels. The levels specified as minimum thresholds for interconnected surface water are thought to be within the historical range and thus unlikely to cause subsidence.
- **Water Quality.** Water quality issues in the Basin are primarily associated with dispersed loading of nitrate and salinity and long-term increases in ambient concentrations of those constituents. Those processes are generally independent of groundwater levels.

6.7.6.2. Effect of Minimum Threshold on Sustainability of Adjacent Areas

The Basin is separated from the Bedford-Coldwater Basin by a reach of Temescal Wash that flows over bedrock. Changes in groundwater-surface water interactions in the Basin would not propagate upstream to the Bedford-Coldwater Basin. The hydraulic connection between the Basin and the Arlington Basin is small and far from the Prado Wetlands. Water levels at

the edge of the Wetlands would not affect flow across that boundary. The Chino Basin abuts the Basin beneath the Prado Wetlands. The Chino Basin does not rely on northward flow of groundwater from the Basin. On the contrary, basin operation in the Chino Basin seeks to minimize southward groundwater flow. The adjacent area with the greatest potential to be affected is Orange County downstream of Prado Dam. However, those areas are not heavily reliant on groundwater outflow from the Basin (see Section 6.7.2.1 Surface Water Users), and the minimum threshold for interconnected surface water would ensure that outflow does not drop below the historical minimum in any case.

6.7.6.3. Effect of Minimum Threshold on Beneficial Uses

Surface diversions are not a source of supply in the Basin; all water uses are supported by imported water or groundwater. With respect to groundwater, this GSP does not propose decreased groundwater elevations below historical levels, so groundwater levels are expected to remain within the historical range. This means that water table depths in the Prado Wetlands will remain within the historical range, which was adequate to maintain the vegetation in good health.

Riparian vegetation along Wardlow Wash would not be adversely affected if groundwater levels dropped to the groundwater elevation MT or the interconnected surface water MT because Wardlow Wash is far from the location of intensive pumping in the Basin (the Channel Aquifer) and on the opposite side of one or more faults that appear to sustain high groundwater levels along Wardlow Wash.

6.7.6.4. Relationship of Minimum Threshold to Regulatory Standards

Other than SGMA, there are no local, state, or federal regulations that specifically address stream flow depletion by groundwater pumping. The California and federal Endangered Species Acts protect species listed as threatened or endangered, including least Bell's vireo and Southwestern Willow Flycatcher. The minimum threshold for depletion of surface water is designed to prevent groundwater conditions from impacting those species beyond the level of impact that has historically occurred.

6.7.6.5. How the Minimum Threshold Will Be Monitored

There presently are no shallow monitoring wells in the southern part of the Prado Wetlands; all of them are in the northern part. This is a data gap that will be filled during the first 5-year implementation period of this GSP. In the meantime, if water levels in the Basin unexpectedly drop below their MT elevations, the levels will be evaluated in conjunction with shallow-well water levels in the northern part of the Wetlands to estimate whether the depth to water near the southern edge of the Wetlands might be increasing to more than 15 feet.

6.7.7. Measurable Objective

The Measurable Objective for interconnected surface water is a depth to the water table along the southern edge of the Prado Wetlands that is less than the MT of 15 feet. Groundwater conditions with respect to interconnected surface water and most GDE

parameters are currently sustainable. Therefore, no interim milestones are needed to achieve sustainability at this time.

6.7.8. Data Gaps

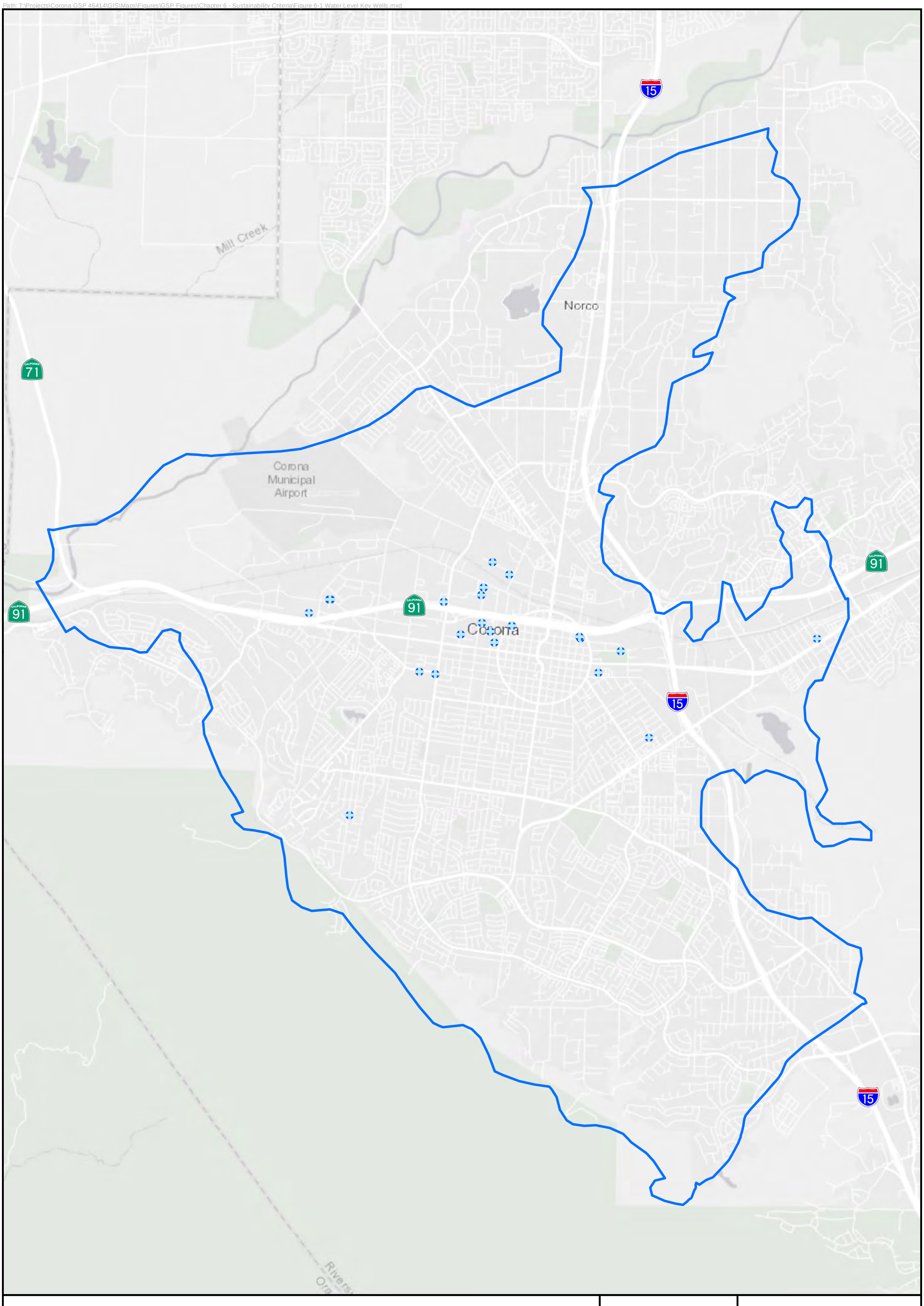
The primary data gap for interconnected surface water is the lack of shallow wells to monitor water table depth along the southern edge of the Prado Wetlands. Orange County Water District (OCWD) recently installed several shallow monitoring wells in the southern Prado Wetlands and has plans to install more in the near future. Water levels from these OWCD wells and additional wells that will be installed by the GSA (see Chapter 8) will be incorporated into the GSAs monitoring program as they become available, which will fill this data gap.

6.7.8.1. Discussion of Monitoring and Management Measures to be Implemented

The primary management action that will be implemented during the first 5-year implementation period will be to install two to four shallow piezometers along the southern edge of the Prado Wetlands, between the wetlands and the major production wells in Corona. These would consist of 2-inch polyvinyl chloride (PVC) casings and screens extending below the water level at the time of drilling to capture seasonal and long-term fluctuations in shallow groundwater levels. Reference point elevations at the well heads will be surveyed so that water levels can be tied to sea level.

Basin pumping and water levels are not expected to adversely impact riparian vegetation in the Prado Wetlands. In the unlikely event that such an impact does occur, Corona has various potential options available that could be temporarily implemented to minimize or mitigate impacts during droughts. These include reducing total pumping, shifting pumping to wells farther from the Wetlands, or temporarily increasing reclaimed water discharges down Temescal Wash to the Wetlands. Corona will select the most effective response based on the circumstances of the impact.

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 6 - Sustainability Criteria\Figure 6-1 Water Level Key Wells.mxd



Sustainability Criteria Key Well

Temescal Basin

N

0 0.5 1

Miles

Figure 6-1
Water Level Key Wells

TODD GROUNDWATER

7. MONITORING NETWORK

The overall objective of the monitoring network for this Groundwater Sustainability Plan (GSP) is to yield representative information about water conditions in the Temescal Subbasin (Basin) as necessary to guide and evaluate GSP implementation. Specifically, monitoring network objectives are to:

- Build on the existing monitoring network data to represent the entire Basin,
- Reduce uncertainty and provide better data to guide management actions, document the water budget, and better understand how the surface water/groundwater system works,
- Monitor groundwater conditions relative to sustainability criteria, and
- Identify and track potential impacts on groundwater users/uses and better communicate the state of the Basin.

With the intent to provide sufficient data for demonstrating short-term, seasonal, and long-term trends in groundwater and related surface conditions, this GSP builds on existing monitoring programs (summarized in Chapter 2, Plan Area) that provide historical information and a context for monitoring. Data gaps are addressed in terms of information needed for understanding the basin setting, evaluation of the efficacy of GSP implementation, and the ability to assess whether the Basin is being sustainably managed.

This GSP section describes the monitoring network as enhanced to fulfill Sustainable Groundwater Management Act (SGMA) requirements and explains how it will be implemented. This includes description of the monitoring protocols for data collection, the development and maintenance of Temescal Groundwater Sustainability Agency (GSA) data management system (DMS), and the regular assessment and improvement of the monitoring program.

7.1. DESCRIPTION OF MONITORING NETWORK

The monitoring network for GSP implementation has been established to document groundwater and related surface conditions as relevant to the sustainability indicators: groundwater levels, storage, land subsidence, water quality, and interconnected surface water[6]. The components of the monitoring network are presented in **Table 7-1**.

[6] Seawater intrusion is noted, but no risk of seawater intrusion exists in this inland basin.

Table 7.1 - Temescal GSP Monitoring Program Summary

Monitored Variable	Type of Measurement	Locations	Data Interval	Data Collection Agency	Database Storage Agency	Notes
Groundwater levels						
Temescal Basin	Depth to water, feet	37 monitored wells (see Table 7-2)	Continuous to Annual	City of Corona	Temescal GSA	Data from all sources compiled into unified groundwater elevation database
Groundwater storage						
Rainfall	Rain gauge, daily total, inches	Lake Elsinore, Santiago Peak, and Riverside	Daily and Monthly	NOAA, Orange County, and UC Riverside CIMIS	Temescal GSA	Download from web annually for annual water budget and model update
Rainfall (Interpolated)	Interoplated spatially from point data	Basin-wide		PRISM Climate Group	Temescal GSA	Rainfall gauges are not within the basin, and PRISM data helps interpolate in regions with climatic variation
Reference ET (ET_0)	Daily ETo, inches	Lake Elsinore and Riverside	Daily	NOAA, UC Riverside CIMIS	DWR	Download from web
Stream flow	Daily average flow, cfs	Two active USGS gages near Temescal	Daily	USGS	USGS	Download from web
Wastewater pond water budgets	WRF effluent discharge, evaporation, percolation, AF	Corona	Monthly	City of Corona	Temescal GSA	
Wastewater/ Recycled Water percolation	WRF/RW percolation volume, AF	Corona	Monthly	City of Corona	Temescal GSA	
Recycled water use	Recycled water delivery, AF	Basin-wide	Monthly	City of Corona	Temescal GSA	Recycled water use is a relatively small but increasing supply
Imported Water	Volume imported water AF	Imported to Temescal	Monthly	City of Corona	Temescal GSA	
Crop patterns	Map of farmland use by category	Basin-wide	Annual	DWR	DWR	Field scale annual agricultural land use mapping data from remote sensing
Land Use Maps	Maps of Land Use	Basin-wide		DWR (2014) and Riverside County (1993 and 2000)	DWR and Riverside County	DWR data is statewide
Municipal Water Use	Metered water use by sector	Corona, Home Gardens and Norco	Monthly	City of Corona, Norco	Temescal GSA	Annual data reported in Annual Report: CVP, groundwater, recycled water use (AFY)
Groundwater pumping						
Community Water Systems	Estimated	Basin-wide	Annual	DDW		
Groundwater Production	Annual Volume, AFY	Basin-wide	Annual	City of Corona	Western Municipal Water District as Watermaster and Temescal GSA	
Rural domestic, commercial, industrial	Estimated	Basin-wide	Annual	City of Corona	Western Municipal Water District as Watermaster and Temescal GSA	Annual estimates provided in water budget updates of Annual Report
Subsidence						
Subsidence	InSAR satellite mapping of ground displacement	Basin-wide	Annual change	DWR (InSAR)	DWR SGMA Data Portal	Download annually, smooth InSAR raster data sets (see Section 4.2.3.1), compare cumulative elevation change since 2015 against Minimum Threshold criterion.
Groundwater quality						
Groundwater Quality	Major and minor ions and contaminants	27 currently monitored wells	Quarterly/ Semi-annual	City of Corona , DDW, RWQCB	Temescal GSA	Wells with water qualtiy data may be added or removed over time
Interconnected Surface Water and GDEs						
Groundwater Depth to Water	Depth to water, feet	Multiple monitored wells outside the Basin, three new wells will be installed in the future	Annual	City of Corona	Temescal GSA	Groundwater in the Prado Management Area is shallow enough to support riprarian vegetation. Water levels in wells within the Prado area will be used.

7.1.1. Chronic Lowering of Groundwater Levels

As described in Plan Area Section 2, there are wells in the Basin with elevation data that are monitored by the City of Corona (Corona) and other agencies. The wells in the groundwater level monitoring program are shown on **Figure 7-1** and listed in **Table 7-2**. The distribution of existing monitoring wells is uneven, with most monitoring wells clustered in the Channel Aquifer. All of the wells in the GSP monitoring network listed in **Table 7-2** will continue to be monitored by the GSA.

Data for GSP implementation collected by Corona, with support from the other GSA members, will be compiled into the DMS developed as part of the GSP. Benefits of these efforts will accrue over the next few years and will support review and update of the monitoring program in the 2027 GSP evaluation and update.

7.1.1.1. Spatial and Vertical Coverage

Well density has been a consideration in identifying new dedicated monitoring well sites and adding existing wells to the monitoring program. California Department of Water Resources (DWR) guidance (DWR 2016d) generally recommends a monitoring well density of 4 wells per 100 mi^2, which would equate to 1.48 wells for the 37 mi^2 Basin. The Temescal Basin monitoring program is consistent with this guidance. Many of the active wells are clustered in the Channel Aquifer, the principal aquifer. This is appropriate because most of the pumping for beneficial uses occurs in the Channel Aquifer and monitoring is needed to assess the sustainability management criteria.

Data on vertical groundwater gradients generally are lacking, as discussed in the Hydrogeologic Conceptual Model, Chapter 3. Vertical gradients also have not been distinguished because most monitoring data is from public supply wells, which generally have long screen zones and have not been designed to assess or monitor vertical gradients either locally or Basin-wide.

7.1.1.2. Monitoring Frequency

SGMA and the California Statewide Groundwater Elevation Monitoring (CASGEM) program require collection of static groundwater elevation measurements at least two times per year to represent seasonal low and seasonal high groundwater conditions (DWR 2010). Currently, the water level wells in the monitoring network are monitored at least quarterly, and most are monitored either monthly or continuously.

7.1.2. Reduction of Groundwater in Storage

As described in GSP Section 6.3, groundwater level Minimum Thresholds (MTs) are used as a proxy metric for groundwater in storage. Accordingly, the monitoring of groundwater levels described above in Section 7.1.1 also pertains to tracking sustainability for groundwater in storage.

In addition, GSP Regulations require annual evaluation and reporting of change in groundwater in storage.

Table 7-2. Wells in the Temescal Groundwater Sustainability Agency Monitoring Network

Local Well Name	X Coordinate (feet State Plane CA Zone 6, NAD 83)	Y Coordinate (feet State Plane CA Zone 6, NAD 83)	Production or Monitoring Well	Water Level Monitoring Well (Yes/No)	Water Level Key Well (Yes/No)	Water Quality Monitoring Well (Yes/No)
Corona 6	6164825.949	2263859.333	Monitoring	Yes	No	No
Corona 7	6164856.185	2263922.413	Production	Yes	No	Yes
Corona 7A	6164825.605	2263909.491	Production	Yes	Yes	Yes
Corona 8	6163919.615	2265638.126	Monitoring	Yes	Yes	No
Corona 8A	6163885.958	2265713.322	Production	Yes	Yes	Yes
Corona 9A	6159626.551	2265408.669	Production	Yes	Yes	Yes
Corona 11	6151398.941	2267565.162	Monitoring	Yes	Yes	No
Corona 11A	6151465.535	2267567.378	Production	Yes	Yes	Yes
Corona 12A	6150373.592	2266916.031	Production	Yes	Yes	Yes
Corona 13	6167356.423	2260664.289	Production	Yes	Yes	Yes
Corona 14	6155892.961	2263969.337	Production	Yes	Yes	Yes
Corona 15	6157114.482	2267464.919	Production	Yes	Yes	Yes
Corona 16	6151422.875	2267564.036	Monitoring	Yes	Yes	No
Corona 17A	6165945.52	2265005.116	Production	Yes	Yes	Yes
Corona 19	6160509.305	2266247.265	Production	Yes	Yes	Yes
Corona 22	6157958.891	2265844.063	Production	Yes	Yes	Yes
Corona 25	6159434.755	2265962.111	Production	Yes	Yes	Yes
Corona 26	6160385.783	2268810.243	Production	Yes	Yes	Yes
Corona 27	6152402.182	2256818.413	Production	Yes	Yes	Yes
Corona 28	6158978.97	2267786.881	Production	Yes	Yes	Yes
Corona 29	6159105.364	2268178.328	Production	Yes	Yes	Yes
Corona 30	6159542.311	2269428.52	Monitoring	Yes	Yes	No
Corona 31	6159001.737	2266396.339	Production	Yes	Yes	Yes
Corona 32	6175760.31	2265603.84	Monitoring	Yes	No	Yes
Corona 33	6175779.012	2265597.015	Production	Yes	Yes	No
Corona 10th/Lincoln	6156682.367	2263845.603	Monitoring	Yes	Yes	No

For the GSP, the numerical groundwater model has been used to quantify the water budget and change in storage (see Water Budget, Chapter 5) using available information from the Monitoring Well Network. The numerical model (described in GSP **Appendix J**) fulfills data and reporting standards described in SGMA Section 352.4.

As described in Plan Area Section 2.4 and summarized in **Table 7-1**, the Temescal GSA monitoring program provides information needed to update the water budget and assess annual change in groundwater storage. This program compiles and reviews information on climate (rainfall and evapotranspiration), stream flow, imported water deliveries, wastewater percolation and water recycling, and groundwater pumping (municipal, industrial, and other). Groundwater in storage will be assessed annually using the numerical model, which will be recalibrated during each five-year GSP update.

7.1.2.1. Spatial Coverage

Evaluation of change in groundwater in storage involves several of the monitored variables listed in **Table 7-1**; monitoring locations are described in the table. **Table 7-1** indicates locations of climate stations and stream gage locations.

7.1.2.2. Surface Water Monitoring

Temescal Wash is the main drainage in the Basin, originating at Lake Elsinore, 17 miles upstream of Basin. It passes from south to north through the Bedford-Coldwater Subbasin and then through the Basin before discharging into the Prado Management Area. There are two stream gages on Temescal Wash, one below Lee Lake at the upstream end of the Bedford-Coldwater Subbasin (Temescal Wash at Corona Lake; USGS 11071900) and one at Main Street downstream of the water reclamation facility in Corona (Temescal Creek above Main Street at Corona; USGS 11072100). These stream gages are operated and maintained by the United States Geological Survey (USGS 2020a).

7.1.2.3. Monitoring Frequency

Table 7-1 describes the data interval for the monitored variables that contribute to evaluation of groundwater in storage. Groundwater in storage will be assessed annually using the numerical model, which will be recalibrated during each five-year GSP update.

7.1.3. Seawater Intrusion

There is no monitoring for seawater intrusion and no gaging of tidal influence. The Basin is located over 20 miles inland from the Pacific Ocean, and its lowest elevations are around 1,000 feet above sea level. No risk of seawater intrusion exists in the Basin given its location and therefore no monitoring is needed.

7.1.4. Subsidence

The monitoring program will review Interferometric Synthetic Aperture Radar (InSAR) satellite-based data to identify and evaluate land subsidence in the Basin (see **Table 7-1**). These data will be used to monitor rate and extent of ground surface elevation change as applicable and with reference to the MT and Measurable Objective (MO), which are described in Sustainability Criteria Section 6.5. These data represent measurements of

ground surface displacement and thus are directly applicable to scientific assessment of potential subsidence.

7.1.4.1. Spatial Coverage

The InSAR data provide adequate coverage of the Temescal Basin. As described in Groundwater Conditions Section 4.3 and Sustainability Criteria Section 6.5. InSAR data are available for the entire Basin (and beyond), as shown with recent InSAR information from DWR on **Figure 4-13**. InSAR data will be cross-checked, and in conjunction with local groundwater level and pumping data, will be used to assess relationships between levels, pumping, and subsidence data.

7.1.4.2. Monitoring Frequency

Assuming continued data availability, the monitoring program will involve annual download of InSAR data with analysis for any signs (rate and extent) of cumulative inelastic subsidence. To date there have been no reports or other indications of subsidence in the Basin. While data will be reviewed annually, at this time detailed analysis relative to the Minimum Threshold and Measurable Objective is planned as part of the five-year GSP update. The reporting will be consistent with GSP Regulations.

7.1.5. Degraded Water Quality

In addition to the general monitoring objectives listed above, specific objectives for the GSP water quality monitoring program include the following:

- Collect groundwater quality data from the principal aquifer to identify and track trends of any water quality degradation,
- Map the movement of degraded water quality,
- Define the three-dimensional extent of any existing degraded water quality impact,
- Assess groundwater quality impacts to beneficial uses and users, and
- Evaluate whether management activities are contributing to water quality degradation.

Figure 7-2 shows the location of the existing wells that are sampled for water quality. The existing water quality monitoring programs for the Basin are described in Plan Area Section 2.4 Groundwater Conditions Section 4, and Sustainability Criteria Section 6.6. To summarize, the Temescal Basin monitoring program relies on annual or semi-annual measurements from Corona wells, the Santa Ana Regional Water Quality Control Board (RWQCB), and State Water Resources Control Board Division of Drinking Water (SWRCB-DDW). Corona currently monitors wells periodically for general minerals, physical parameters, and selected constituents of concern. These wells are shown on **Figure 7-2** and listed in **Table 7-2**. As described in Groundwater Conditions Section 4 and discussed in depth in Section 6.6, a broad suite of inorganic constituents is sampled and analyzed and known regulated contamination sites are tracked. Total dissolved solids (TDS) and nitrate have been identified as the key constituents of concern for which sustainability criteria have been defined.

7.1.5.1. Spatial and Vertical Coverage

The current monitoring network in the Basin is focused in the Channel Aquifer and is limited in other areas of the Basin. **Figure 7-2** shows the spatial distribution of wells currently monitored. As with the groundwater level monitoring program, existing wells monitored by the GSA for groundwater quality will be evaluated relative to SGMA Section 352.4 requirements for well information. Also similar to the groundwater level monitoring program, the focus of monitoring is the Channel Aquifer as this is the primary source for municipal drinking water, a critical beneficial use of the Basin.

Vertical coverage is discussed in Groundwater Conditions Section 4.8, which indicates that the water quality monitoring programs in the Basin do not reveal vertical differences in water quality. Otherwise, vertical differences in water quality are uncertain; this reflects the fact that most monitored wells are pumping wells with long screens.

As stated in Section 6.6, the GSA will continue to improve and expanded the monitoring program to address spatial and vertical coverage.

7.1.6. Depletion of Interconnected Surface Water

The minimum threshold defined for depletion of interconnected surface water is defined by groundwater levels monitored near the Prado Management Area. At this time, wells in the groundwater level monitoring program are production wells with relatively deep screens that have not been sited and designed for tracking surface water-groundwater interactions. The lack of shallow monitoring wells has been identified as a data gap.

Improvement of the surface water-groundwater monitoring program includes addition of three dedicated shallow monitoring wells, implemented as part of the projects and management actions outlined in this GSP.

Benefits of the new wells will accrue over the next few years and support characterization of the spatial and temporal exchanges between surface water and groundwater, plus identification of thresholds for undesirable results relating to riparian vegetation, which will be evaluated as part of the 2027 GSP evaluation and update.

7.1.6.1. Spatial and Vertical Coverage

As noted above, the existing monitoring network does not provide adequate coverage for monitoring interconnected surface water. New shallow monitoring wells will be installed to fill this data gap, as described in Chapter 8.

7.1.6.2. Temporal Coverage and Monitoring Frequency

Groundwater level monitoring in the new shallow monitoring wells will be implemented as part of the overall groundwater level monitoring program as described in Section 7.1.1. Once sited and installed, the periods of record for new dedicated shallow wells will be established. Groundwater level data will be reviewed annually (for each annual report). Detailed analyses of the relationships among deep and shallow groundwater level data, stream flow, and riparian conditions will be provided in the 2027 GSP evaluation and update (or sooner if extreme drought conditions and riparian mortality occur; see GSP Section 6.7).

7.2. PROTOCOLS FOR DATA COLLECTION AND MONITORING

This section focuses on groundwater level monitoring (including regional and surface water-oriented) and groundwater quality sampling by the GSA. Other data (e.g., climate, streamflow, municipal pumping, subsidence) are compiled by other agencies.

This section describes general procedures for documenting wells in the monitoring program and for collecting consistent high-quality groundwater elevation and groundwater quality data. In general, the methods for establishing location coordinates (and reference point elevations for elevation monitoring) follow the data and reporting standards described in the GSP Regulations (Section 352.4) and the guidelines presented in USGS Groundwater Technical Procedures (Cunningham and Schalk 2011 and USGS 2021). These procedures are summarized below.

7.2.1. Field Methods for Monitoring Well Data

Background data for each monitoring well is required for its inclusion in the monitoring program. These data are generally available for wells in the network described in **Table 7-2** and shown on **Figures 7-1**. As part of GSP implementation, location and elevation data will be acquired where missing, revised if conditions at a monitored well change, and added when new wells are brought into the program. The methods for acquiring these data follow:

- Location coordinates will be surveyed with a survey grade global positioning system (GPS) device. The coordinates will be in Latitude/Longitude decimal degrees and reference the North American Datum of 1983 (NAD83).
- Reference point elevations will also be surveyed with a survey grade GPS with elevation accuracy of approximately 0.5 feet.
    - During surveying, the elevations of the reference point and ground surface near the well will be measured to the nearest 0.5 foot.
    - All elevation measurements will reference North American Vertical Datum of 1988 (NAVD88).

7.2.2. Field Methods for Groundwater Elevation Monitoring

Reference points and ground surface elevations will be documented as described above prior to groundwater elevation monitoring in the field. Field methods for collection of depth-to-water measurements are described below:

1. Measurements in all wells will be collected within a three-day window whenever possible.
2. Active production wells should be turned off prior to collecting a depth to water measurement.
3. The standard period of time that a well needs to be off before a static measurement is taken is 48 hours.
4. To verify that the wells are ready for measurement, agency staff (from Corona, the City of Norco [Norco], and Home Gardens County Water District [HGCWD]) will coordinate with well operators and/or owners as necessary.

5. Coordination with well operators/owners should occur approximately four days prior to the expected measurement date.
6. Depth to groundwater measurements collected by either electric sounding tape (Solinst or Powers type sounders) or by steel tape methods. Depth-to-water measurement methods are described in DWR's *Groundwater Elevation Monitoring Guidelines* (DWR 2010). Depth to groundwater will be measured and reported in feet to at least 0.1 foot.

7.2.3. Field Methods for Groundwater Quality Monitoring

Groundwater sampling is conducted by trained professionals from the GSA. Sampling follows standard monitoring well sampling guidelines such as those presented in the National Field Manual for the Collection of Water-Quality Data (USGS 2021).

Generally, the wells have been pumped prior to sample collection, or are purged. Purging is conducted until field instruments indicate that water quality parameters (pH, oxidation-reduction potential (ORP), specific conductance, and temperature) have stabilized and turbidity measurements are below five Nephelometric Turbidity Unit (NTUs). The pumping or purging demonstrate that the sample collected is representative of formation water and not stagnant water in the well casing or well filter pack. For groundwater, field temperature and conductivity are recorded while the well is being purged to ensure that physical parameters have stabilized before collecting a sample.

All groundwater samples are collected in laboratory-supplied, pre-labeled containers and include prescribed preservatives.

All field measurements are recorded in a field logbook or worksheets and the sample containers are labeled correctly and recorded on the chain-of-custody form. The applicable chain-of-custody sections are completed and forwarded with the samples to the laboratory. Upon receipt of the samples at the laboratory, laboratory personnel complete the chain-of-custody.

Quality assurance and quality control (QA/QC) assessment of field sampling includes use of field blanks. Field blanks identify sample contamination that is associated with the field environment and sample handling. These samples are prepared in the field by filling the appropriate sample containers with the distilled water used for cleaning and decontamination of all field equipment. One field blank per sampling event is collected.

Samples are sent to a State-certified laboratory that has a documented analytical QA/QC program including procedures to reduce variability and errors, identify and correct measurement problems, and provide a statistical measure of data quality. The laboratory conducts all QA/QC procedures in accordance with its QA/QC program. All QA/QC data are reported in the laboratory analytical report, including: the method, equipment, and analytical detection limits, the recovery rates, an explanation for any recovery rate that is less than 80 percent, the results of equipment and method blanks, the results of spiked and surrogate samples, the frequency of quality control analysis, and the name of the person(s) performing the analyses. Sample results are reported unadjusted for blank results or spike recovery.

7.3. REPRESENTATIVE MONITORING

To allow quantification and tracking of sustainability criteria, representative monitoring sites, or wells, have been identified for 1) regional groundwater level monitoring and 2) monitoring shallow groundwater conditions where surface water-groundwater connection is likely and tied to groundwater dependent ecosystems (GDEs). These Key Wells are shown on **Figure 7-1** and listed in **Table 7-2**. These have been designated by the GSA as the point at which sustainability indicators are monitored. Information on the quantitative values for minimum thresholds, measurable objectives, and interim milestones is included in Sustainability Criteria Section 6.

As discussed in Sustainability Criteria Section 6.3, change in groundwater in storage is closely related to groundwater levels, which can serve as a proxy for monitoring change in storage. Moreover, groundwater level MTs and MOs are sufficiently protective to ensure prevention of significant and unreasonable results relating to storage. Accordingly, continued monitoring of wells for groundwater levels also serve to track sustainability for storage.

As discussed in Section 6.5, the definition of undesirable results and the quantification of the MT and MO for subsidence are based on InSAR information on vertical displacement of the ground surface; these spatial and temporal data are publicly available from DWR.

Section 6.4 discusses seawater intrusion, which is not possible in this inland basin.

Section 6.6 describes undesirable results and defines sustainability criteria for water quality. MTs and MOs are quantified in terms of the percentage of wells with concentrations exceeding the local and state goals for nitrate and TDS based on current conditions. The GSP water quality monitoring wells shown on **Figure 7-2** and listed in **Table 7-2** are sampled regularly to identify water quality problems and to track water quality trends.

7.4. DATA MANAGEMENT SYSTEM (DMS)

The GSA has been collecting and compiling groundwater data including water levels, water quality, and water use for the GSP. Before the creation of the GSA, the individual agencies of (Corona, Norco, and HGCWD) monitored water levels and water quality independently. These data are compiled in relational databases, which consists of Access databases and ESRI geodatabases that have the capabilities for queries to quickly check and summarize data. As part of the GSP, the DMS has been modified to be practicable, usable, and intuitive for the purpose of GSP preparation and implementation. **Appendix L** details the final DMS. The databases include easy to update tables and other datasets that assist in comparison of real time conditions and sustainability goals.

7.5. ASSESSMENT AND IMPROVEMENT OF MONITORING NETWORK

The GSA has actively engaged in assessment and improvement of its monitoring network. This process has been intensified as part of the GSP, given the need to identify data gaps and to assess uncertainty in setting and tracking sustainability criteria. Monitoring

improvements are a major part of GSP implementation and will be reviewed and updated for each five-year GSP evaluation.

7.5.1. Identification and Description of Data Gaps

Data gaps are identified in **Table 7-3** according to major monitored variable and described in terms of insufficient number of monitoring sites and utilization of monitoring sites that are unreliable (including those that do not satisfy minimum standards). Data gaps also are described in terms of the location and reason for data gaps in the monitoring network, and local issues and circumstances that limit or prevent monitoring. Data gaps listed in **Table 7-3** do not include gaps in understanding, which build on the monitoring network but also require investigation and analysis. These planned studies are described as Management Actions in GSP Chapter 8.

Table 7-3. Identification and Description of Data Gaps

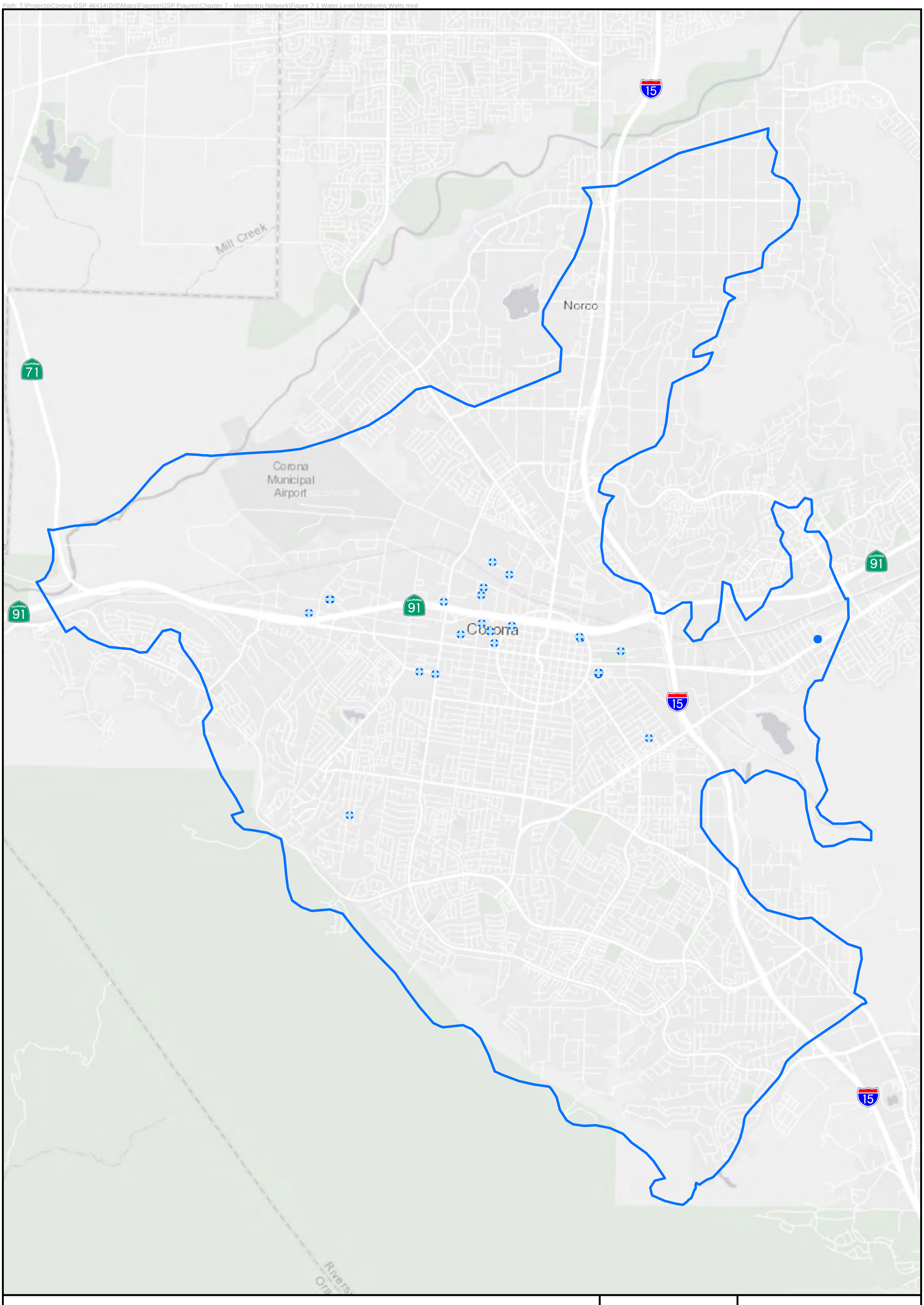
Monitored Variable	Insufficient Sites	Local Issues
Regional groundwater levels	No	The water level network has historically relied largely on production wells.
Stream flow	No	There are gages on the major streams in the Basin.
Groundwater extraction	No	Most pumping is reported, there may be unreported pumping but it is assumed to be de minimis.
Groundwater quality	No	Water quality sampling in the Basin is typically tied to regulatory requirements, the GSA will perform regular monitoring of the well network and collect water quality data from all available sources.
Shallow groundwater levels	Yes	No shallow dedicated groundwater monitoring wells are currently in the Basin. Long well screens in monitoring wells limit vertical groundwater quality characterization. New shallow monitoring wells are included as a project in Chapter 8.

7.5.2. Description of Steps to Fill Data Gaps

Monitoring data gaps have been identified for surface water and shallow groundwater level measurements.

Additional shallow groundwater level monitoring is required to better monitor interconnected surface water and GDEs in the Basin. Corona will locate and install three new shallow water level monitoring wells/piezometers adjacent to Prado Management Area, as described in Chapter 8, Projects and Management Actions.

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 7 - Monitoring Network\Figure 7-1 Water Level Monitoring Wells.mxd



Water Level Monitoring Well

Sustainability Criteria Key Well

Temescal Basin

N

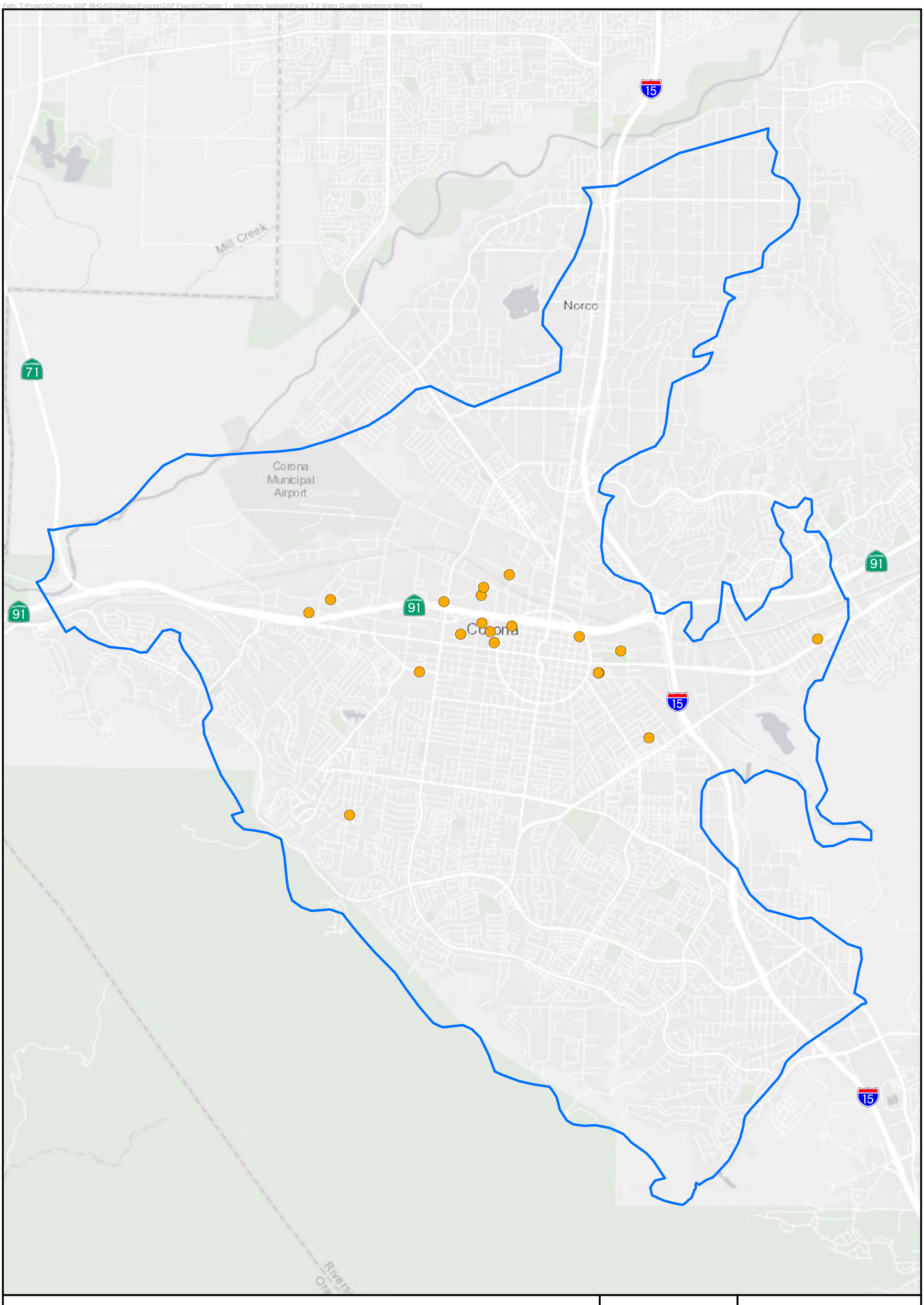
0 0.5 1

Miles

Figure 7-1
Groundwater Level Monitoring Wells

TODD GROUNDWATER

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 7 - Monitoring Network\Figure 7-2 Water Quality Monitoring Wells.mxd



Water Quality Monitoring Well

Temescal Basin

N

0 0.5 1

Miles

Figure 7-2
Water Quality Monitoring Wells

TODD GROUNDWATER

8. PROJECTS AND MANAGEMENT ACTIONS

This chapter of the Groundwater Sustainability Plan (GSP) includes projects and management actions aimed at achieving sustainability goals and responding to changing conditions in the Temescal Subbasin (Basin). The projects and management actions are divided into three groups:

- Group 1 - Existing or established projects and management actions
- Group 2 - Projects and management actions that have been or are under development
- Group 3 - Conceptual projects and management actions that can be considered in the future if any Group 2 projects fail to be implemented or additional intervention is required to achieve basin sustainability goals.

A summary of the projects and management actions in each of the groups is presented in **Table 8-1**. Additional discussion of each project is included in the sections that follow.

Table 8 1. Summary of Projects and Management Actions

Description	Agency	Category	Status	Anticipated Timeframe
Group 1 - Existing or established projects and management actions				
Groundwater Treatment	City of Corona	Project	Ongoing	Implemented
WRF Percolation Ponds	City of Corona	Project	Ongoing	Implemented
Water Level QA/QC	City of Corona	Project	Ongoing	Implemented
Water Shortage Contingency Plans	Cities of Corona and Norco	Management Action	Ongoing	Implemented
Water Conservation Programs	Cities of Corona and Norco	Management Action	Ongoing	Implemented
Western Municipal Water District - IRWMP	10 local cities/agencies including the GSA	Management Action	Ongoing	Implemented
Western Riverside County Regional Wastewater Authority (WRCRWA)	GSA, Jurupa Community Services District, and WMWD	Project	Ongoing coordination	Pending coordination with WRCRWA and partner agencies
Santa Ana Watershed Involvement	GSA, Santa Ana Watershed Project Authority (SAWPA), and Santa Ana River Dischargers Association (SARDA) members	Management Action	Ongoing	Implemented
Group 2 – Projects and management actions have been developed or are under development				
Interconnected Surface Water Monitoring Wells Implementation	GSA	Project	In planning	Well implementation within the first year of GSP adoption
Potable Reuse Feasibility Study	GSA	Project	Not started	Study initiation within the second year of GSP adoption
Mountain Runoff Capture Investigation	GSA and RCFCWCD	Project	Not started	Study initiation within five years of GSP adoption
Group 3 – Conceptual future projects and management actions				
Future Groundwater Treatment	GSA	Project	Not started	No current anticipated timeline
Stormwater Capture, Treatment and Recharge	GSA	Project	Not started	No current anticipated timeline
Santa Ana River Wastewater Discharge Coordination for Shallow Groundwater Conditions	GSA, SAWPA, and SARDA members	Management Action	Not started	No current anticipated timeline

8.1. GROUP 1 PROJECTS

Group 1 projects and management actions are considered existing or established commitments by the City of Corona (Corona), other agencies within the Temescal Groundwater Sustainability Agency (GSA), and/or affiliated agencies. Group 1 projects are either already in operation or are currently being implemented with anticipated near-term operation.

8.1.1. Groundwater Treatment

Corona relies on groundwater from the Temescal and Bedford-Coldwater Basins for up to 50 percent of its potable water supply. **Table 8-2** shows Corona's current and projected annual groundwater extraction volumes from these basins. As shown in the table, the Temescal Basin is responsible for most of Corona's current and future groundwater supply.

Table 8-2. Existing and Projected Corona Groundwater Extraction Volumes (AFY)

Basin	2020	2025	2030	2035	2040	2045
Bedford-Coldwater	0	2,112	2,112	2,112	2,112	2,112
Temescal	16,239	13,000	13,000	13,000	13,000	13,000

Data Source: 2020 Urban Water Management Plan (Michael Baker 2021)

Approximately half of the groundwater pumped in Corona is treated at the Temescal Desalter Facility, a city-owned, reverse osmosis (RO) facility. This facility reduces nitrates, per- and polyfluoroalkyl substances (PFAS), 1,2,3-Trichloropropane (TCP), perchlorates, and total suspended and dissolved solids (TSS and TDS) from water pumped from the Temescal Basin. In addition, ammonium hydroxide and sodium hypochlorite is added to the treated groundwater to act as a disinfectant and mitigate the formation of disinfection byproducts (DBPs) (Michael Baker 2021). The Temescal Desalter produces 10 million gallons per day (mgd) on average.

Corona maintains five continuously monitored blending facilities that blend the treated groundwater with both surface water and non-Desalter treated, locally produced groundwater. A portion of the groundwater utilized at the blend station that has not been treated by the Desalter is treated with sodium hypochlorite and ammonium hydroxide. This blend reduces the elevated amounts of fluoride, nitrate, and perchlorates found in the groundwater to a safe, consumable level.

The City of Norco (Norco) and Home Gardens County Water District (HGCWD) have service areas that overlie the Basin. The two entities do not currently pump groundwater from the Basin; however, should they utilize it for future supply they would likely require implementation of similar treatment.

8.1.2. Water Reclamation Facility (WRF) Percolation Ponds

Wastewater is treated at three Corona-owned and operated Water Reclamation Facilities (WRF-1, WRF-2 and WRF-3). The average annual production of treated wastewater (effluent) from these sources is approximately 11.35 mgd, or 12,700 acre-feet per year (AFY). Supply is anticipated to increase incrementally due to population growth by an additional 0.88 mgd through 2040 (about 7.8 percent).

WRF effluent is allocated to three end uses: 1) discharge to the Santa Ana River Watershed (SWRCB 2021), 2) reuse via the reclaimed water distribution system, and 3) discharge to offsite percolation ponds. WRF-1 and WRF-2 both contribute effluent to all of these end uses while WRF-3 only contributes effluent to the reclaimed water system. The three offsite percolation ponds overlie the Basin and allow for recharge. One of the ponds is located along Lincoln Avenue and the other two at the end of Rincon Street near Cota Street. **Table 8-3** shows the total annual effluent sent to the percolation ponds in the last five years.

Table 8-3. WRF Annual Percolation Pond Contributions (AFY)

Facility	2016	2017	2018	2019	2020
WRF-1	1,364	5,273	4,493	5,026	4,987
WRF-2	734	1,207	1,306	1,462	1,774

Data Source: 2020 Urban Water Management Plan (Michael Baker 2021)

8.1.3. Water Level Quality Assurance and Quality Control (QA/QC)

Corona is conducting water level quality assurance and quality control (QA/QC) activities to maintain and increase the integrity and reliability of ongoing groundwater elevation data collection. Static and pumping water level depths are collected, by Corona water operators, once a month from each groundwater well location identified in Chapter 7, Monitoring Network.

The current QA/QC process practiced by Corona involves the following activities:

- The data is entered into Corona's database at the end of the water operator's shift.
- The data is also written on a whiteboard in the Drinking Water staff crew room.

Corona is updating their QA/QC policies to ensure manual entry errors are minimized by creating "Alert" pop up boxes in their database.

- The minimum, maximum, average, and standard deviation static and pumping water level depths are calculated for each monitored well.
- The "Alert" pop up will appear if the data entered is greater than the upper limit or less than the lower limit for any monitoring event.
    - The upper limit for each well will be the standard deviation times two plus the average.
    - The lower limit will be the average minus two times the standard deviation.

- The Alert pop up still allows the operator to enter the data but makes them aware that the data being entered is outside the range of the historical measurements.
- It will be up to the water operator to recheck the data being entered, and either confirm or correct the measurement.
- A report including the most recent static and pumping water levels for each monitored well will be created once a month, and this report will be reviewed by operators and management to identify data collection errors and/or trends in water levels.

8.1.4. Water Shortage Contingency Plans

Corona's 2020 Urban Water Management Plan (UWMP) estimated the available supply from imported water, groundwater, and reclaimed water at a total of 50,000 AFY. Using this baseline supply, a water shortage contingency plan (WSCP) was developed. The WSCP has six shortage stages based on available supply and associated deficit. Each stage has associated response actions to ensure appropriate reductions in water use (Michael Baker 2021). **Table 8-4** shows each of the stages and associated supply. Note that the Ordinance 2962 Water Conservation Stage column will be discussed further in Section 8.1.5. Detailed information on response actions for a given stage can be found in the 2020 UWMP and is discussed further in Section 8.1.5.

Table 8-4. WSCP Shortage Level Determination

WSCP Stage	Ordinance 2962 Water Conservation Stage	Condition	Available Supply (AFY)	Deficit (AFY)
0	1	No Shortage	50,000	None
1	1	10 percent Shortage	45,000	None
2	1	20 percent Shortage	40,000	None
3	2	30 percent Shortage	35,000	5,000
4	3	40 percent Shortage	30,000	10,000
5	4	50 percent Shortage	25,000	15,000
6	5	> 50 percent Shortage	< 25,000	> 15,000

Data Source: 2020 Urban Water Management Plan (Michael Baker 2021)

Norco has developed their own respective WSCP based on the six stages and respective percent shortage condition as well (Norco 2021).

8.1.5. Water Conservation Program

In 2009, Corona implemented Ordinance No. 2962, amending the Corona Municipal Code to provide framework for water conservation and drought response measures. The Ordinance defines five stages of water conservation, corresponding water consumption objectives (10 percent to 40 percent or greater), and associated conservation and drought response

measures. **Table 8-4**, above, shows the five stages and associated storage condition and available supply. The following is a summary of the shortage response actions to be taken at each water conservation stage (per Ordinance No. 2962), more detailed information can be found in the 2020 UWMP (Michael Baker 2021).

- **Stage 1:** No water shortage, or "normal water supply", applies when Corona is able to fully meet all customer water demands. Normal water efficiency programs will be in effect during this time.
- **Stage 2:** Water customers shall reduce consumption by 10 to 15 percent. Examples of water reduction measures include irrigation limitations and residential car washing and drainage restrictions.
- **Stage 3:** Water customers shall reduce consumption by 16 to 20 percent. This includes all restrictions in Stages 1 and 2 and adds additional restrictions, such as limiting new construction water meters and prohibiting ornamental fountains or similar structures.
- **Stage 4:** Water customers shall reduce consumption by 21 to 40 percent. This includes all restrictions in Stages 1, 2, and 3 and adds additional restrictions, such as prohibiting the issuance of new construction water meters and prohibiting issuance of new building permits.
- **Stage 5:** Water customers shall reduce consumption by at least 41 percent. This includes all restrictions in Stages 1, 2, 3, and 4 and adds additional restrictions, such as prohibiting all outdoor watering, except for recycled water use for fruit tree irrigation.

Norco has developed their own respective conservation plan based more directly on the WSCP stages discussed in the prior section (Norco 2021).

8.1.6. Participation in Integrated Regional Water Management Plans (IRWMP)

The Western Municipal Water District (WMWD) Integrated Regional Water Management Plan (IRWMP) was prepared in 2008 (KJ 2008). The purpose of the plan was to address long range water quantity, quality, and environmental planning needs within the WMWD service area. The IRWMP was prepared in cooperation with the ten cities/water districts receiving water from WMWD, including the cities of Corona and Norco. The creation of the IRWMP provided a coordinated water management strategy to make sure water resources are being used responsibly throughout the region.

More recently, in 2018, the Santa Ana River Watershed Project Authority (SAWPA) developed the One Water One Watershed (OWOW) Plan Update to serve as the IRWMP for the Santa Ana River Watershed (SAWPA 2018). The OWOW Plan was initially developed in 2010 and has been subsequently updated in 2014 and 2019. The OWOW Plan was prepared with engagement from over 4,000 stakeholders. Including 120 water agencies and 63 incorporated cities within the watershed. All three GSA members were involved in the planning process.

The goals of the 2019 OWOW Plan are to achieve resilient water supply, improve water quality, preserve natural spaces, improve data integration and tracking, diminish environmental injustices, and educate visitors within the Santa Ana River Watershed.

8.1.7. Western Riverside County Regional Wastewater Authority (WRCRWA)

The Western Riverside County Regional Wastewater Authority (WRCRWA) is a joint powers authority (JPA) consisting of the cities of Norco and Corona, Jurupa Community Services District, Home Gardens Sanitary District, and WMWD. The WRCRWA Plant has a 14 mgd capacity and will soon produce recycled water for local irrigation use.

As JPA partners, Corona and Norco will be entitled to up to 2 and 2.7 mgd respectively of recycled water allocated for use in their service areas, reducing local pumping from the Temescal Basin.

8.1.8. Santa Ana Watershed Involvement

SAWPA is a JPA formed to develop and maintain regional plans and projects that will protect the Santa Ana River Basin and associated water resources. Corona participates in the task forces and working groups within the watershed noted in **Table 8-5**.

Table 8-5. City of Corona Santa Ana Watershed Task Forces/Groups

Name	Brief Description
SAWPA – Emerging Constituents Task Force	In 2007, a workgroup was formed among the water recharging agencies and publicly owned treatment works (POTWs) to address a characterization program for emerging constituents. SAWPA was requested to administer the development of a 2-phase approach.
SARDA – Santa Ana River Discharge Agencies	Working group of Santa Ana River (SAR) discharge agencies jointly implementing the annual mercury monitoring in the SAR.
SAWPA – Basin Monitoring Task Force	As an outgrowth of the Nitrogen/TDS Task Force, the agencies responsible for implementing the Basin Plan Amendments formed the Basin Monitoring Task Force, and SAWPA was identified to administer/facilitate that effort.
SAWPA – Imported Water Recharge Workgroup	The purpose of this Workgroup is to undertake tasks defined in a Cooperative Agreement among the water recharging agencies to assure that the water quality (Nitrogen and TDS) in groundwater is protected. These tasks include regular reporting on the amount and quality of water recharged, the ambient water quality in each groundwater management zone, and 20-year groundwater flow and quality model projections for each groundwater management zone that is recharged. All reports are provided to the Regional Water Quality Control Board.

In addition, Corona discharges treated wastewater from one of their three water reclamation plants (WRF-1) to Temescal Wash within the Santa Ana River Watershed. Corona discharged an average of approximately 2,000 AFY to the watershed from WRF-1 (Michael Baker 2021). The discharged water serves a dual purpose of maintaining riparian habitat as well as recharging the Basin via percolation.

8.2. GROUP 2 PROJECTS

Group 2 projects will be implemented to meet Basin sustainability goals, in conjunction with Group 1 projects.

8.2.1. Shallow Monitoring Well Installation

A total of three shallow monitoring wells will be drilled in the Prado Management Area. The wells will be approximately 40 to 60 feet in depth and 2-inches in diameter. **Figure 8-1** shows the proposed, approximate locations of these monitoring wells.

The approximate locations have been identified based on existing groundwater conditions, land access, and the ongoing construction of the new Prado Dike. Areas north of the Prado Dike will potentially be inundated in the future, and future monitoring wells need to be located outside the area of inundation. The locations shown on **Figure 8-1** are above 545-feet mean sea level (msl) elevation. The existing spillway elevation of the Prado Dam is 543-feet msl, so these monitoring well locations should be above the future area of inundation.

8.2.1.1. Measurable Objective Expected to Benefit from Project or Management Action

The project will allow for continuous monitoring at representative sites in the Prado Management Area. This will allow Corona to track groundwater levels in the southern part of the Management Area along with the rest of the Basin. Groundwater levels in these wells will be incorporated into the interconnected surface water sustainable management criteria in the 5-year GSP update. Once established, the sustainable management criteria for these wells will help guide future management actions required by upstream Santa Ana River Watershed partners.

8.2.1.2. Circumstances for Implementation

Corona has already initiated the planning process to install these monitoring wells. It is anticipated that these can be implemented with existing on-call contracts.

8.2.1.3. Public Noticing

The public will be notified per California Environmental Quality Act (CEQA)requirements.

8.2.1.4. Permitting and regulatory process

Wells will be drilled on private or City of Corona property. The project will comply with all CEQA, Riverside County, and discharge permitting requirements. Corona will coordinate with the Santa Ana Regional Water Quality Control Board (RWQCB) to plan for discharging any and all water in accordance with RWQCB general permits.

8.2.1.5. Project Timetable

The monitoring wells will be installed within two years of GSP implementation.

8.2.1.6. Plan for Project Implementation

Three monitoring wells will be drilled in areas in the Prado Management Area. The wells will be approximately 40 to 60 feet deep and will be 2-inches in diameter with polyvinyl chloride (PVC) casings and screens, bentonite seals, and cement sanitary seals. The well drilling process will be completed with existing Corona on-call contracts.

8.2.1.7. Expected Benefits

The installation of three monitoring wells will allow Corona to track groundwater levels in the Prado Management Area and identify timing and triggers for future management actions, if needed.

8.2.1.8. Legal Authority

By California state law, water districts and land use jurisdictions have the authority to take action to ensure sufficient water supply is available for present or future beneficial use within their service areas.

8.2.1.9. Estimated Costs and Funding Plan

Costs are anticipated to be $40,000 to $50,000 in total for the installation of the three wells. The project will be financed from existing Corona budgets.

8.2.1.10. Management of Project

The project will be managed by the City of Corona Department of Water and Power with support from other staff and outside technical experts, as necessary.

8.2.1.11. Relationship to Additional GSP Elements

The addition of three new monitoring wells in the Basin will identify future management actions required by upstream Santa Ana River Watershed partners. This is discussed in further detail in Group 3.

8.2.2. Potable Reuse Feasibility Study

As noted in the Group 1 project section, the WRCRWA facility is near-future reclaimed water supply source for Corona. Corona will conduct a potable reuse feasibility study to evaluate various potable reuse strategies and opportunities for optimizing use of reclaimed water supply in conjunction with existing reclaimed water supply from WRF-1, 2, and 3. This study would likely involve looking at specific end uses, water supply benefits, regulatory requirements, treatment requirements, infrastructure requirements, and associated costs.

8.2.2.1. Measurable Objective Expected to Benefit from Project or Management Action

Corona is exploring future options to optimize use of recycled water in the Basin in order to reduce groundwater dependence.

8.2.2.2. Circumstances for Implementation

Corona is currently exploring a wide range of options to increase their water supply portfolio.

8.2.2.3. Public Noticing

Public noticing is not required for this project. Should potable reuse projects be recommended for the region, Corona may choose to adopt a comprehensive outreach and education program to solicit public input.

8.2.2.4. Permitting and regulatory process

Permits are not required for this project. This study will evaluate potential potable reuse projects and will consider potential regulatory requirements for implementation.

8.2.2.5. Project Timetable

The study is anticipated to be one year in duration, initiating approximately two years after adoption of the GSP.

8.2.2.6. Plan for Project Implementation

Corona would need to develop a study scope, issue a project solicitation, and hire a technical consultant to perform the evaluation.

8.2.2.7. Expected Benefits

This study will evaluate and recommend future potable reuse projects to be implemented in the region.

8.2.2.8. Legal Authority

Legal authority is not required to perform a feasibility study.

8.2.2.9. Estimated Costs and Funding Plan

The study is anticipated to cost between $150,000 to $200,000 and will likely be funded through City of Corona sources. Grant funding is available through the State Water Resources Control Board (SWRCB) and the United States Bureau of Reclamation (USBR) should Corona choose to pursue alternate means of funding.

8.2.2.10. Management of Project

The project will be managed by the City of Corona Department of Water and Power with support from other staff and outside technical experts, as necessary.

8.2.2.11. Relationship to Additional GSP Elements

Because this project is a feasibility study, it is not anticipated to have any impact on other GSP projects or management actions described in this chapter. Future potable reuse projects recommended as a result of this study will reduce groundwater dependence in the region.

8.2.3. Mountain Runoff Capture Feasibility Study

Riverside County Flood Control and Water Conservation District (RCFCWCD) operates major flood control facilities such as dams, flood basins, levees, open channels, and major (36-inch or larger) underground storm drains in a 2,700 square mile service area in the western portion of Riverside County. Rainwater runoff from the Santa Ana Mountains flows into RCFCWCD flood basins during storm events to mitigate downstream flood damage. A Mountain Runoff Capture Feasibility Study would explore options for operational changes that would provide the dual benefit of flood control and groundwater recharge.

8.2.3.1. Measurable Objective Expected to Benefit from Project or Management Action

Although this study would yield no direct measurable objectives, future recommended projects would help to raise groundwater levels in the Basin and reduce the threat of land subsidence.

8.2.3.2. Circumstances for Implementation

Corona is currently exploring options to increase groundwater recharge. An initial study would be conducted to establish a basis for inter-agency coordination between RCFCWCD and Corona on the subsequent feasibility study.

8.2.3.3. Public Noticing

Public noticing is not required for this project. Should implementation projects be recommended for the region, Corona may choose to adopt a comprehensive outreach and education program to solicit public input.

8.2.3.4. Permitting and regulatory process

Permits are not required for this project. This study will evaluate potential runoff capture projects and will consider potential regulatory requirements for implementation.

8.2.3.5. Project Timetable

The initial study would be undertaken within the first five years of GSP adoption and be approximately three months in duration. After appropriate inter-agency coordination, the subsequent feasibility study is anticipated to be approximately six months in duration.

8.2.3.6. Plan for Project Implementation

RCFCWCD owns and operates this infrastructure. Interagency discussion should be conducted during the initial study to coordinate on development of the feasibility study.

8.2.3.7. Expected Benefits

This study will evaluate and recommend operational changes to the RCFCWCD flood basins that would enable the system to be used for both flood control and groundwater recharge to the Basin.

8.2.3.8. Legal Authority

Legal authority is not required to perform a feasibility study.

8.2.3.9. Estimated Costs and Funding Plan

The study is anticipated to cost approximately $75,000. Corona could explore potential funding sources through the California Department of Water Resources (DWR).

8.2.3.10. Management of Project

The project will be managed by the City of Corona Department of Water and Power with support from other staff and outside technical experts, as necessary.

8.2.3.11. Relationship to Additional GSP Elements

Because this project is a feasibility study, it is not anticipated to have any impact on other GSP projects or management actions described in this chapter. Future projects implemented as a result of this study will reduce groundwater dependence in the region.

8.3. GROUP 3 PROJECTS

Group 3 projects are conceptual activities that can be considered in the future if any Group 2 projects fail to be implemented or additional intervention is required to achieve basin sustainability goals. These projects are not planned for near-term implementation and have been developed to a lesser degree than Group 2 projects but will be evaluated further, as needed, should a given Group 3 project be deemed critical for Basin sustainability.

8.3.1. Groundwater Treatment

A study conducted in 2016 focused on the detection of PFAS in Corona wells as well as potential treatment options (Carollo 2017). Subsequently, Corona initiated an ongoing PFAS study likely to be complete in mid to late 2021.

Corona has future interests in advanced groundwater treatment to treat for previously detected PFAS as well as addressing TDS, nitrate, and TCP. Groundwater treated to remove these contaminants could potentially be recharged back into the Basin, improving water quality.

8.3.2. Stormwater Capture, Treatment, and Recharge

Harvesting of urban stormwater has a potential benefit of reducing the loss of water from the Basin. There are a number of different approaches to stormwater capture and use including:

- Onsite rain barrels to promote reuse and reduce generation of urban runoff
- Larger scale capture in stormwater vaults/cisterns and reuse
- Capture and infiltration approaches including infiltration basins, bioretention, and permeable pavement
- Dry wells for capture and recharge
- Diversion to WRFs for treatment and reuse.

Corona has conducted a preliminary investigation on capture of stormwater from a lined channel on Oak Avenue and transfer to the existing percolation ponds (Todd 2011).

It is anticipated that a future study would explore potential sources of urban runoff, estimated yield, mechanisms for augmenting or offsetting water supplies, treatment needs, capital costs, and operation and maintenance (O&M) costs. An initial investigation would establish the basis for further exploration of the feasibility of specific stormwater capture approaches and projects.

8.3.3. Santa Ana River Wastewater Discharge Coordination for Shallow Groundwater Conditions

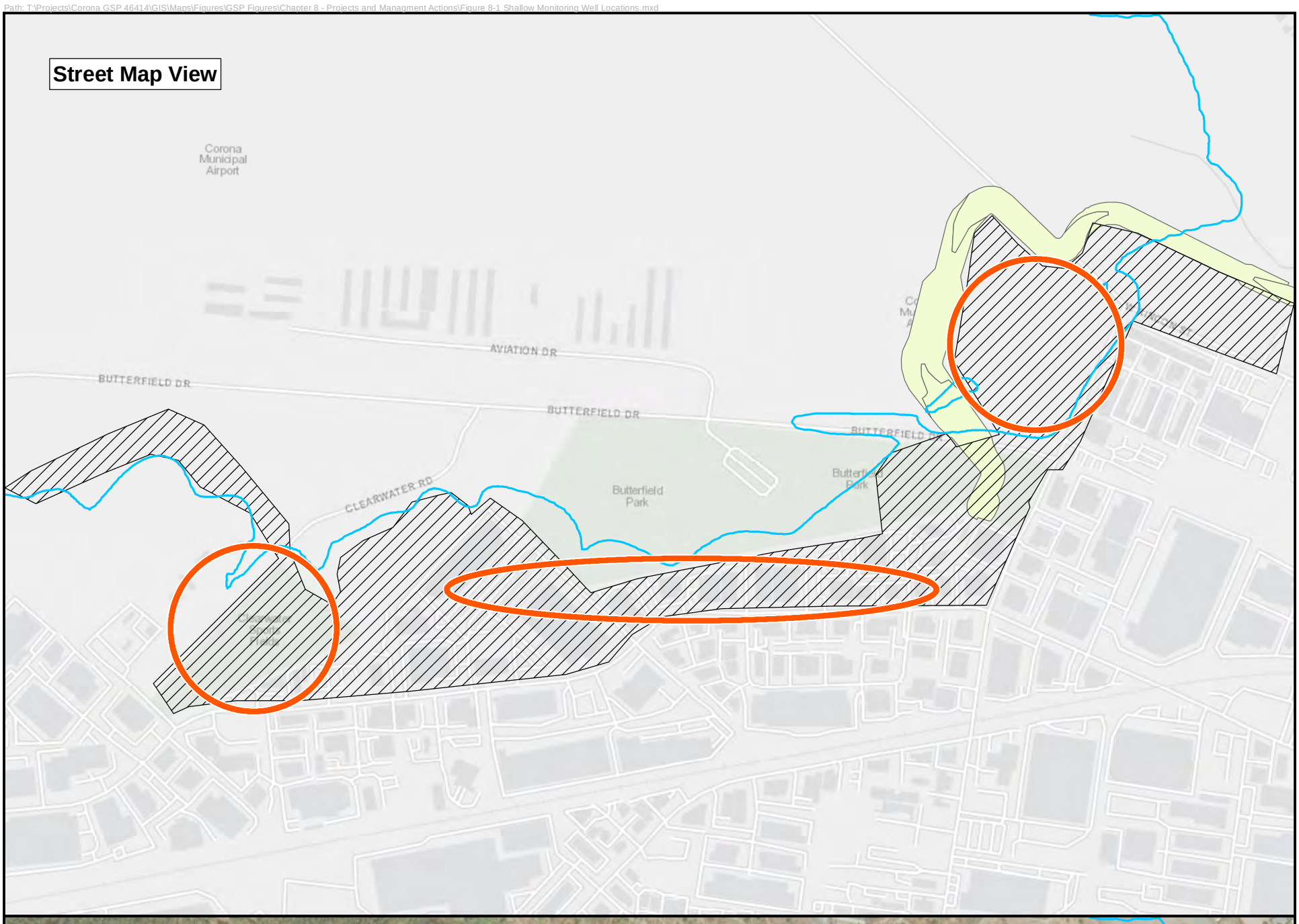
This project would be implemented contingent on the outcome of the Prado Management Area monitoring well installation, a previously discussed Group 2 project. The Prado Management Area is currently maintained by wastewater discharge from upstream parties. If monitoring well data indicates that groundwater elevations are falling, it is likely due to reduction of wastewater discharge flow.

The project approach would be two-fold and encompass the following:

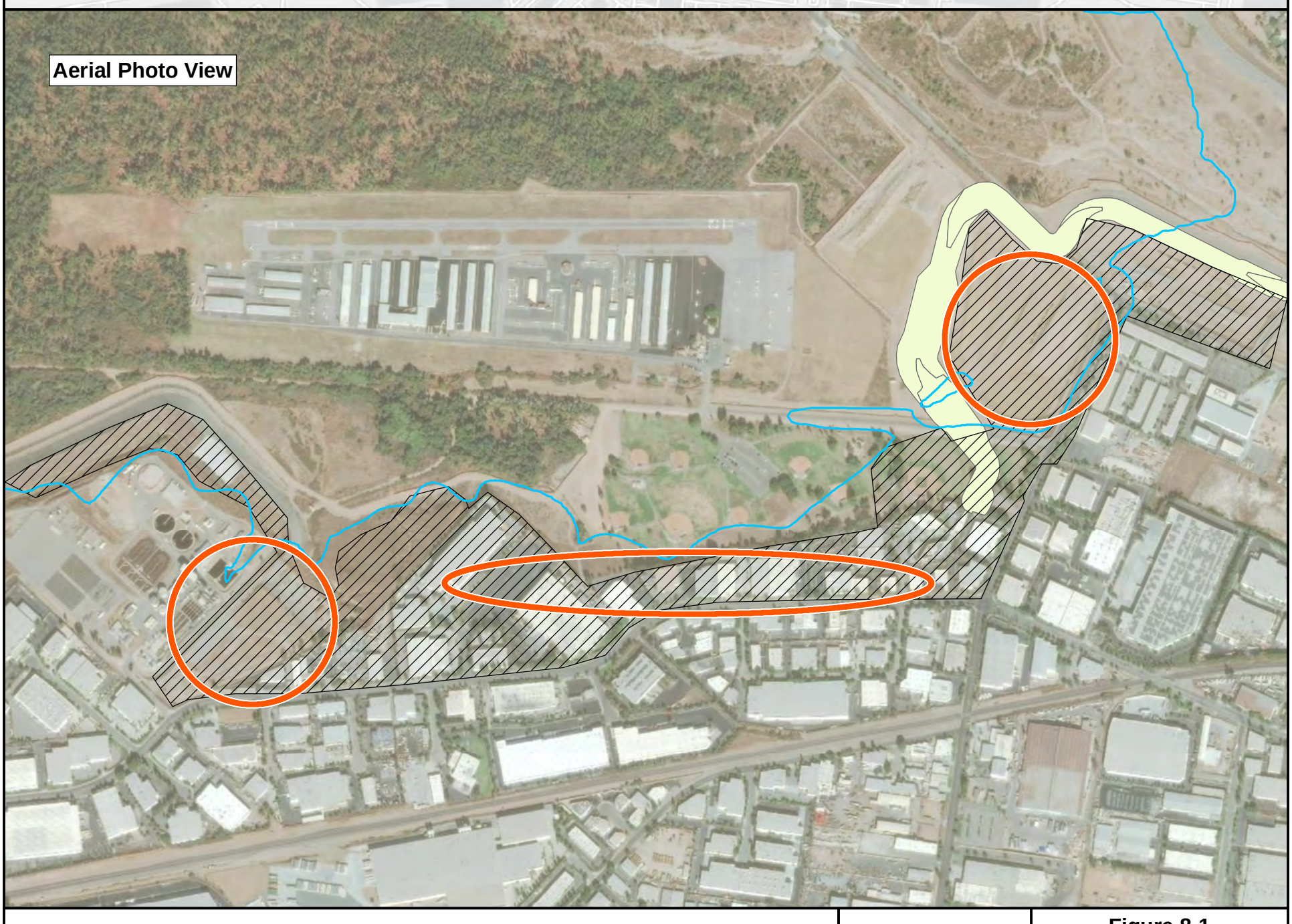
1. Evaluation and examination of current wastewater discharges into the Prado Management Area from contributing parties including SAWPA member agencies (Eastern Municipal Water District, Inland Empire Utilities Agency, Orange County Water District, San Bernardino Valley Municipal Water District, and Western Municipal Water District).
2. Coordinate with partners to identify solutions to falling groundwater water levels in the Prado Management Area.

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Chapter 8 - Projects and Managment Actions\Figure 8-1 Shallow Monitoring Well Locations.mxd

Street Map View



Aerial Photo View



Approximate 545 foot Ground Surface Elevation Contour

Recommended Shallow Monitoring Well General Search Area

Focused Shallow Well Search Area

Planned Prado Dike

N

0 800

Feet

Figure 8-1
Potential Shallow Monitoring Well Locations

TODD GROUNDWATER

9. IMPLEMENTATION PLAN

While the Temescal Subbasin (Basin) is considered to be sustainably managed, this status is by no means taken for granted. Potential effects of growth and climate change have been evaluated by means of modeling simulations, but effects are likely to be cumulative, and thereby present challenges to sustainability. Accordingly, additional projects and actions must be continued or implemented to satisfy the Sustainability Goal to the foreseeable planning horizon. Implementation of the Groundwater Sustainability Plan (GSP) by the Temescal Groundwater Sustainability Agency (GSA) will begin following adoption of the plan by the GSA in 2022 and continue through 2042. The GSP will be implemented to sustainably manage groundwater in the Basin under the authority of the GSA and its member agencies the City of Corona (Corona), the City of Norco (Norco), and the Home Gardens County Water District (HGCWD) as provided by the Sustainable Groundwater Management Act (SGMA).

After submittal of the GSP to the California Department of Water Resources (DWR) and during the DWR review period, the GSA will begin implementing the projects and management actions described in Chapter 8 and will communicate with stakeholders throughout implementation.

9.1. PLAN IMPLEMENTATION RESOURCES AND RESPONSIBILITIES

Resources to implement the GSP will be derived from funds and personnel from the GSA parties (Corona, Norco, and HGCWD) and qualified firms contracted to perform specific specialized services.

Personnel from the three GSA parties will be responsible for collection of information from their respective facilities or within their area of influence in the Basin. This will include depth to groundwater measurements, collection of groundwater quality samples, groundwater extractions, use of surface water supplies, and total water use. This information will be maintained by each GSA party for inclusion in annual reports, GSP updates, and storage in the Data Management System (DMS).

Annual GSP reporting, specialized activities included in projects and/or management actions, and periodic GSP updates will be contracted by the GSA to specific specialized firms with relevant experience and expertise. Individual parties within the GSA may be responsible for developing requests for proposals (RFPs), contracting, and managing these activities with contractors and/or consultants.

9.2. ANNUAL REPORTING

The GSA is required to submit annual reports to DWR by April 1st of each year following adoption of the GSP. The first annual report will be due April 1, 2022. Each annual report will include the following components for the preceding water year as described in GSP Regulations:

- General information – Executive summary, location map.

- Detailed description and graphical representation of the following components of the Basin:
    - Groundwater elevation data from monitoring wells within the monitoring network.
    - Groundwater extraction data for the preceding water year.
    - Surface water supply used or available for use.
    - Total water use.
    - Change in groundwater storage.
- Description of progress towards implementing the GSP – implementation of projects or management actions since the previous annual report.

The first annual report will be prepared to include data and information from the end of the period included in this GSP (end of water year 2018) through to the end of water year 2021. The costs associated with producing annual reports will be incorporated into the Corona annual budget.

9.3. NEW INFORMATION AND CHANGES

The GSP has been developed based on the best available information. However, it is recognized that during implementation of the GSP, new information on groundwater conditions, changes in land use or climate, and or changes in the regulatory environment can be expected. Changes in GSP administration may also be appropriate based on experience. When these changes occur, the GSA will react with appropriate changes in GSP administration, data collection, and/or groundwater management methods. If the changes are significant, stakeholders and the GSA will be kept informed of these changes via the Corona GSP website and emails to stakeholders.

9.4. PERIODIC EVALUATIONS

The GSA will evaluate the GSP at least every five years and provide an assessment to DWR as required by GSP Regulations. This will include an update on the progress of achieving sustainability goals in the Basin and assessment of the following:

- Current groundwater conditions for each sustainability indicator applicable to the Basin relative to measurable objectives and minimum thresholds.
- The implementation of any projects or management actions and their effect on groundwater conditions.
- Revisions to the basin setting, management areas, or the identification of undesirable results and the setting of minimum thresholds and measurable objectives resulting from significant changes, new information, or changes in water use.
- The monitoring network within the Basin, including any data gaps and areas of the Basin that are represented by data that does not satisfy the requirements of SGMA requirements.
- Significant new information that has been made available since GSP adoption, amendment, or last assessment.

- Relevant actions taken by the GSA, including a summary of regulations or ordinances related to the GSP.
- Any enforcement or legal actions taken by the GSA to continue the sustainability goals of the Basin.
- Completed or proposed GSP amendments.

The cost of the periodic updates is dependent on the complexity of changes occurring in the Basin since adoption of the GSP but are estimated to be $250,000 per update (2021 dollars).

9.5. PROJECTS AND MANAGEMENT ACTIONS

Projects and management actions are described in Chapter 8, each in terms of technical description, feasibility and implementation, benefits, costs and financing, and timeline. The Projects and Management Actions are listed below in the same order as presented in Chapter 8.

Group 1 - Existing or established projects and management actions

- Groundwater Treatment
- Water Reclamation Facility (WRF) Percolation Ponds
- Water Level Quality Assurance and Quality Control (QA/QC)
- Water Shortage Contingency Plans (WSCPs)
- Water Conservation Programs
- Western Municipal Water District Integrated Regional Water Management Plan (IRWMP)
- Western Riverside County Regional Wastewater Authority (WRCRWA)
- Santa Ana Watershed Involvement

Group 2 – Projects and management actions that have been or are under development

- Interconnected Surface Water Monitoring Wells Implementation
- Potable Reuse Feasibility Study
- Mountain Runoff Capture Investigation

Group 3 – Conceptual future projects and management actions

- Future Groundwater Treatment
- Stormwater Capture, Treatment and Recharge
- Santa Ana River Wastewater Discharge Coordination for Shallow Groundwater Conditions

The projects and management actions described here work together toward the sustainability goal and objectives, namely: to provide a reliable and efficient groundwater supply, to provide reliable storage, to protect groundwater quality, to support beneficial uses of interconnected surface waters, and to support integrated and cooperative water resource management.

9.6. SCHEDULE FOR IMPLEMENTATION

Table 9-1 is an estimated timeline for implementation. The timeline columns include the individual years 2021 through 2025, which are followed by five-year intervals to 2040 to 2045. With implementation officially starting in 2022, the last interval includes the 2042 deadline for the 20-year implementation to achieve the sustainability goal.

The projects and management actions, and GSP Administration, Monitoring, and Reporting are listed in rows and as warranted. As shown, most projects and management actions have been ongoing. Some will be initiated following GSP adoption and continued during implementation.

Table 9 1. Estimated Timeline for Projects and Management Actions

Description	GSP Implementation Period								
	2021	2022	2023	2024	2025	2026-2030	2031-2035	2036-2040	2041-2045
Group 1 - Existing or established projects and management actions									
Groundwater Treatment									
WRF Percolation Ponds									
Water Level QA/QC									
Water Shortage Contingency Plans									
Water Conservation Programs									
Western Municipal Water District - IRWMP									
Western Riverside County Regional Wastewater Authority (WRCRWA)									
Santa Ana Watershed Involvement									
Group 2 – Projects and management actions that have been or are under development									
Interconnected Surface Water Monitoring Wells Implementation									
Potable Reuse Feasibility Study									
Mountain Runoff Capture Investigation									
Group 3 – Conceptual future projects and management actions									
Future Groundwater Treatment	(to be determined)								
Stormwater Capture, Treatment and Recharge	(to be determined)								
Coordination with Upstream Santa Ana River Partners	(to be determined)								
GSP Administration, Monitoring, and Reporting									
GSP Administration									
Ongoing Monitoring									
Annual Reporting									
Periodic GSP Evaluation and Updates									

9.7. GSP IMPLEMENTATION COSTS

Implementation costs include costs to continue monitoring as described in Chapter 7, implement management actions and projects as described in Chapter 8, and complete annual reports and periodic GSP evaluation and updates as required by SGMA. As summarized in **Table 9-2**, total annual costs (2021 dollars) are estimated at $100,000 per year for GSP administration and annual reporting. Costs for previously implemented existing ongoing Group 1 management actions and project and monitoring activities are not included in this total. Estimated single occurrence costs for activities anticipated to occur in the first 5 years of GSP implementation and the first periodic GSP evaluation and update total $515,000 to $575,000 (2021 dollars). Costs for conceptual future Group 3 projects and management actions are not included in this total.

Table 9-2. GSP Implementation Cost Estimates

Management Actions, Projects, and GSP Administration	Estimated Costs
GSP Administration and Annual Reporting	$100,000/year
Total Estimated Annual Implementation Costs	**$100,000/year**
Interconnected Surface Water Monitoring Wells Implementation	$40,000 to $50,000
Potable Reuse Feasibility Study	$150,000 to $200,000
Mountain Runoff Capture Investigation	$75,000
First Periodic Evaluation and GSP Update (2027)	$250,000
Total Estimated One-Occurrence Costs (First 5 years)	**$515,000 to $575,000**
Future Groundwater Treatment	To be decided
Stormwater Capture, Treatment and Recharge	To be decided
Coordination with Upstream Santa Ana River Partners	To be decided

9.7.1. Funding Methods

The funding method for operating expenses and GSP implementation costs is by contributions by GSA member agencies (Corona, Norco, and HGCWD). This is the same mechanism utilized to fund development of the GSP (with significant supplemental contribution though California Proposition 1 Grant funding). Corona will be responsible for most of the ongoing implementation costs, which are within budget projections for the next several years.

Sources of funding have and will continue to vary according to the project or management action (see Chapter 8). Funding for planning and implementation of some projects and management actions may be achieved with local, state, and federal sources. The local agencies track opportunities for outside financing (grants or loans) from state water programs and federal infrastructure funding. For local financing, the agencies update their financial plans and rates as needed.

10. REFERENCES

Ballau Grundwater, Inc., 2018, Shallow groundwater and evapotranspiration assessment, presentation slides included as Appendix E in Geoscience Support Services, Inc. April 29, 2020 Upper Santa Ana River Integrated Model summary report, prepared for San Bernardino Valley Municipal Water District, San Bernardino, CA, February 7.

Behrooz, Mehrnoosh (Mona), 2020, Status of PFAS Investigations in Santa Ana Region, presentation for the Groundwater Resources Association, https://www.grac.org/files/2177/, April.

Borchers, J.W. and M. Carpenter, 2014, Land Subsidence from Groundwater Use, April, available at: https://cawaterlibrary.net/wp-content/uploads/2017/04/1397858208-SUBSIDENCEFULLREPORT_FINAL.pdf, last accessed November 2020.

California Department of Water Resources (DWR), 2010, California Statewide Groundwater Elevation Monitoring (CASGEM) Program Procedures for Monitoring Entity Reporting, December 2010, available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/CASGEM/Files/CASGEM-Procedures-for-Monitoring-Entity-Reporting-Final-121610_ay_19.pdf

California Department of Water Resources (DWR), 2016a, Groundwater Sustainability Plan (GSP) Annotated Outline, December 2016, available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Groundwater-Sustainability-Plans/Files/GSP/GSP-Annotated-Outline.pdf

California Department of Water Resources (DWR), 2016b, Bulletin 118, Interim Update 2016, California's Groundwater, Working Toward Sustainability, December 22, available at: https://data.cnra.ca.gov/dataset/75eb6072-6810-471d-ba73-d8eadec36564/resource/2b9cbe00-55f6-420e-9aa7-8e61cb5ee1fc/download/b118-interim-update-2016_ay_19.pdf

California Department of Water Resources (DWR), 2016c, Best Management Practices for the Sustainable Management of Groundwater, Water Budget, December 30, available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-4-Water-Budget_ay_19.pdf

California Department of Water Resources (DWR), 2016d, Best Management Practices for the Sustainable Management of Groundwater, Monitoring Networks and Identification of Data Gaps, December 30, available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps_ay_19.pdf

California Department of Water Resources (DWR), 2017, California DWR Land Use Viewer, available at: https://gis.water.ca.gov/app/CADWRLandUseViewer/, last accessed September 2019.

California Department of Water Resources (DWR), 2020, SGMA Data Viewer TRE ALTAMIRA InSAR Dataset, last accessed July 2020, available at: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub.

California Department of Water Resources (DWR), 2021, State of California Household Water Supply Shortage Reporting System, available at: https://mydrywatersupply.water.ca.gov/report/publicpage, last accessed July 2021.

California Department of Water Resources (DWR), California Department of Fish and Wildlife, and The Nature Conservancy, 2020, Natural communities commonly associated with groundwater (NCCAG), Statewide digital vegetation maps of vegetation and wetlands overlying groundwater basins, available at: https://gis.water.ca.gov/app/NCDatasetViewer/, last accessed July 2021.

California State Water Resources Control Board (SWRCB), 2012, Order Canceling Protest, Approving Change in Purpose of Use, Place of Use, and Discharge Quantity, City of Corona Wastewater Petition WW-56,August 15, available at: https://www.google.com/url?client=internal-element-se&cx=001779225245372747843:6ygtx6llvco&q=https://www.waterboards.ca.gov/waterrights/water_issues/programs/applications/wastewater_petition_orders/docs/ww0056.pdf&sa=U&ved=2ahUKEwjg2d_D5szyAhXlN30KHUf9CsAQFjAAegQIARAB&usg=AOvVaw2or-FncqPEr6YNksWq3rfu.

California State Water Resources Control Board (SWRCB), 2020a, Santa Ana River Basin Plan, last modified May 22, 2020, available at: https://www.waterboards.ca.gov/santaana/water_issues/programs/basin_plan/.

California State Water Resources Control Board (SWRCB), 2020b, Groundwater Ambient Monitoring and Assessment (GAMA) Program Groundwater Information System online map and database, available at: https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/, last accessed December 2020.

California State Water Resources Control Board (SWRCB), 2020c, White Paper Discussion On: Economic Feasibility Analysis In Consideration of a Hexavalent Chromium MCL, February, https://www.waterboards.ca.gov/drinking_water/programs/documents/cr6econwp.pdf.

California State Water Resources Control Board (SWRCB), 2020d, 1,2,3,-Trichloropropane (1,2,3 - TCP), https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/123TCP.html, Updated September.

California State Water Resources Control Board (SWRCB), 2020e, Per-and Polyfluoroalkyl Substances (PFAS). https://www.waterboards.ca.gov/pfas/, last accessed July 2020.

California State Water Resources Control Board (SWRCB), 2021, State Water Resources Control Board GeoTracker, https://geotracker.waterboards.ca.gov/, last accessed January 2021.

Carollo Engineers, 2017, City of Corona Perfluorinated Compounds Removal Study, December.

City of Corona, 2018, 2018 Reclaimed Water Master Plan, https://www.coronaca.gov/home/showpublisheddocument/18442/637248910333670000.

City of Corona, 2019, 2019 Consumer Confidence Report, https://www.coronaca.gov/home/showpublisheddocument/16524/636971420515830000.

City of Corona, 2021, City of Corona General Plan 2020-2040, available at: https://www.coronaca.gov/government/departments-divisions/planning-division/general-plan-update, last accessed May 2021.

City of Norco, 2009, City of Norco General Plan Land Use, available at: http://www.norco.ca.us/depts/planning/general.asp

City of Norco, 2014, General Plan – Conservation Element 2014 Update, adopted by City Council, resolution no. 2014-71 on December 17, 2014, http://www.norco.ca.us/depts/planning/general.as.

City of Norco, 2021, Draft Urban Water Management Plan, May, http://www.norco.ca.us/depts/pw/urban_water_management_plan.asp.

City of Temecula, 2020, Municipal Code Title 15, May, available at: http://qcode.us/codes/temecula/view.php?topic=15-15_10.

Cunningham, W.L., and Schalk, C.W., comps., 2011, Groundwater technical procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods, April, available at: https://pubs.usgs.gov/tm/1a1/.

Drever, J.I., 1988, The Geochemistry of Natural Waters, 2nd Edition, Prentice-Hall.

Federal Emergency Management Agency (FEMA), 2011, NFIP Flood Insurance Manual, May 1, available at: https://www.fema.gov/sites/default/files/2020-09/fema_flood-insurance-manual-full-edition_april-oct2020.pdf

Feeney, M. B., 1994, Hydrogeologic investigation, Arroyo Seco Cone, Staal, Gardner & Dunne, Inc, Prepared for Monterey County Water Resources Agency, April, https://digitalcommons.csumb.edu/hornbeck_cgb_6_b/5/.

Galloway et al., 1999, Land Subsidence in the United States, United States Geological Survey, Circular 1182, available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwj5hI-KnvXyAhXUrZ4KHQ_9BP4QFnoECAYQAQ&url=https%3A%2F%2Fpubs.er.usgs.gov%2Fpublication%2Fcir1182&usg=AOvVaw1PyxPiYMJHThc0uNB7ZZpq

Google Earth, 2021, Historical aerial imagery online maps and data, available at: https://earth.google.com/web/, last accessed July 2021.

ICF, Inc., 2020, Upper Santa Ana River habitat conservation plan, stakeholder draft, prepared for San Bernardino Valley Water District, San Bernardino, CA, available at: http://www.uppersarhcp.com/Additional.aspx, last accessed December 2020.

Jurgens, B. C., Fram, M. S., Belitz, K., Burow, K. R., & Landon, M. K., 2010, Effects of groundwater development on uranium: Central Valley, California, USA. *Groundwater*, *48*(6), 913-928, https://ca.water.usgs.gov/pubs/2010/JurgensEtAl2010.pdf.

Kennedy/Jenks Consultant (K/J), 2008, Western Municipal Water District Integrated Regional Water Management Plan 2008 Update, prepared for the Western Municipal Water District, May, https://www.wmwd.com/214/Integrated-Regional-Water-Management-Pla.

KWC Engineers, 2016, City of Corona 2015 Urban Water Management Plan, July, available at: https://www.coronaca.gov/home/showdocument?id=4318

Luhdorff and Scalmanini Consulting Engineers (LSCE), Borchers JW, Grabert VK, Carpenter M, Dalgish B, Cannon D, 2014, Land subsidence from groundwater use in California, report prepared by LSCE with support by the California Water Foundation, http://californiawaterfoundation.org/wp-content/uploads/PDF/1397858208-SUBSIDENCEFULLREPORT_FINAL.pdf, accessed July 2020.

McMichael, David, 2021, Temescal Creek Riparian Habitat Timeline, prepared for Orange County Water District, December, included in Appendix I.

Michael Baker International, 2021, City of Corona 2020 Urban Water Management Plan, Volume 1, Draft, June https://www.coronaca.gov/home/showpublisheddocument/20172/637576204172900000.

Natural Resources Conservation Service (NRCS), 2020, SSURGO soil survey online map database available at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx, last accessed July 2020.

PBS&J and Ron Barto, Ground Water Consultant, 2004, Surface Disposal Pilot Project for the City of Corona, July.

Riverside County Department of Environmental Health (RCDEH), 2020, Wells Services Website, available at https://www.rivcoeh.org/OurServices/Wells, last accessed July 2020.

Riverside County Planning Department, 2015, County of Riverside General Plan, December 8, available at: https://planning.rctlma.org/General-Plan-Zoning/General-Plan

Riverside County Regional Conservation Authority (RCRCA), 2020, Western Riverside County multispecies habitat conservation plan, available at: https://www.wrc-rca.org/rcamaps/, last accessed July 2020.

Russell, Kerwin, 2020, Natural Resources Manager, Riverside-Corona Resource Conservation District, e-mails to Gus Yates, Todd Groundwater, August 1 and 3.

San Diego County, 2005, Drainage Design Manual, July, available at: http://www.sandiegocounty.gov/dpw/floodcontrol/floodcontrolpdf/drainage-designmanual05.pdf

Santa Ana Watershed Project Authority (SAWPA), 2018, One Water One Watershed Plan Update 2018, January, http://www.sawpa.org/wp-content/uploads/2018/11/OWOW-Plan-Update-2018-PRD.pdf.

Shaw, Ryan, 2020, Inter-Basin Coordination Meeting with Ryan Shaw and Temescal GSA, November 30, Included in Appendix H.

The Nature Conservancy (TNC), 2020, GDE Pulse online map database available at https://gde.codefornature.org/#/map, last accessed July 2020.

Thomasson, H.G., Jr., F.H. Olmsted and E.F. LeRoux, 1960, Geology, water resources and usable ground-water storage capacity of part of Solano County, California. Water-Supply Paper 1464. U.S. Geological Survey, https://pubs.usgs.gov/wsp/1464/report.pdf.

Todd Engineers (Todd), 2011, Technical Study of Potential Stormwater and Surface Water Diversions for Recharge, prepared for the City of Corona and Riverside County, January 31.

Todd Engineers and AKM Consulting Engineers (Todd and AKM), 2008, AB3030 Groundwater Management Plan, prepared for the City of Corona, June.

Todd Groundwater (Todd), H&H Water Resources (H&H), and Stantec, 2021, Groundwater Sustainability Plan, Bedford-Coldwater Basin, May, https://www.bedfordcoldwatergsa.com/wp-content/uploads/2021/06/Public-Draft-Bedford-Coldwater-GSP-20210528.pdf.

Towill, Inc. 2020, InSAR Data Accuracy for California Groundwater Basins CGPS Data Comparative Analysis, January 2015 to September 2019, March 23, available at https://data.cnra.ca.gov/dataset/5e2d49e1-9ed0-425e-9f3e-2cda4a213c26/resource/a1949b59-2435-4e5d-bb29-7a8d432454f5/download/insar-data-accuracy-report-towill.pdf.

United States Department of Health and Human Services (USDHHS), 2015, Federal Panel on Community Water Fluoridation, US Public Health Service recommendation for fluoride concentration in drinking water for the prevention of dental caries. *Public Health Reports*, *130*(4), 318-331, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4547570/.

United States Environmental Protection Agency (USEPA), 2019, Contaminants of Emerging Concern including Pharmaceuticals and Personal Care Products, updated August 19, 2019, https://www.epa.gov/wqc/contaminants-emerging-concern-including-pharmaceuticals-and-personal-care-products, last accessed July 2020.

United States Geological Survey (USGS), 2004, Preliminary Digital Geologic Map of the Santa Ana 30' x 60' Quadrangle, Southern California, Version 2.0 compiled by D.M. Morton, Open-File Report 99-172, http://pubs.usgs.gov/of/1999/of99-172/.

United States Geological Survey (USGS), 2006, Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangles, California, Version 1.0 compiled by Douglas M. Morton and Fred K. Miller, Open-File Report 2006-1217, http://pubs.usgs.gov/of/2006/1217/.

United States Geological Survey (USGS), 2020a, National Water Information System (USGS NWIS), http://waterdata.usgs.gov/nwis/sw, last accessed July 2020.

United States Geological Survey (USGS), 2020b, Arsenic and Drinking Water, https://www.usgs.gov/mission-areas/water-resources/science/arsenic-and-drinking-water?qt-science_center_objects=0#qt-science_center_objects, last accessed July 2020.

United States Geological Survey (USGS), 2021, National Field Manual for the Collection of Water-Quality Data (NFM), available online at: https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm?qt-science_center_objects=0#qt-science_center_objects, last accessed February 2021.

Water Systems Consulting, Inc. (WSC), Western Municipal Water District 2020 Urban Water Management Plan, June 16, available at: https://www.wmwd.com/DocumentCenter/View/5433

Wildermuth Environmental, Inc. (WEI), 2005, Chino Basin Optimum Basin Management Program, State of the Basin Report – 2004, prepared for the Chino Basin Watermaster, July, available at: http://www.cbwm.org/docs/engdocs/isob/ISOB_Final_FullVersion.pdf.

Wildermuth Environmental, Inc. (WEI), 2013, Recharge Master Plan for the Temescal Basin, prepared for the City of Corona, September.

Wildermuth Environmental, Inc. (WEI), 2015, Draft Feasibility Investigation (Phase I) to Develop a Potable Water-Supply from the Bedford Basin, prepared for the City of Corona, Elsinore Valley Water District, and Lee Lake Water District, August.

Wildermuth Environmental, Inc. (WEI), 2016, 2016 Adaptive Management Plan for the Prado Basin Habitat Sustainability Program, prepared for Inland Empire Utilities Agency and Chino Basin Watermaster, August 1.

Wildermuth Environmental, Inc. (WEI), 2017, Salt and Nutrient Management Plan for the Upper Temescal Valley, submitted by Elsinore Valley Municipal Water District and Eastern Municipal Water District, September.

Wildermuth Environmental, Inc. (WEI), 2019, Chino Basin Optimum Basin Management Program, 2018 State of the Basin Report, prepared for the Chino Basin Watermaster, June.

Wildermuth Environmental, Inc. (WEI), 2020, Annual report of the Prado Basin Habitat Sustainability Program, Water year 2019, prepared for Inland Empire Utilities Agency and Chino Basin Watermaster.

APPENDIX A

Memorandum of Understanding forming the Temescal Groundwater Sustainability Agency

MEMORANDUM OF UNDERSTANDING
(TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY)

1. PARTIES AND DATE.

This Memorandum of Understanding ("**MOU**") is made and entered into by and between the City of Corona, a municipal corporation organized under the laws of the State of California with its principal place of business at 400 South Vicentia Avenue, Corona, California 92882 ("**Corona**"), the City of Norco, a municipal corporation organized under the laws of the State of California with its principal place of business at 2870 Clark Avenue, Norco, California 92860 ("**Norco**") and the Home Gardens County Water District, a county water district with its principal place of business at 3832 Grant Street, Corona, CA 92879 ("**HGCWD**"). Corona, Norco and HGCWD are sometimes individually referred to as "Party" and collectively as "Parties" in this MOU.

2. RECITALS.

2.1 Adoption of SGMA. On September 16, 2014, Governor Jerry Brown signed into law Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act ("**SGMA**").

2.2 Purpose of SGMA. The purpose of SGMA is to create a comprehensive management system in the State of California by creating a structure to manage groundwater at the local level, while providing authority to the State to oversee and regulate, if necessary, the local groundwater management system.

2.3 Groundwater Management Plans. SGMA empowers local agencies to adopt groundwater management plans that are tailored to the resources and needs of their communities to provide a buffer against drought and contribute to reliable water supply for the future.

2.4 Groundwater Sustainability Agencies. Water Code Section 10723.6 authorizes a combination of local agencies overlying a groundwater basin to elect to become a Groundwater Sustainability Agency ("**GSA**") by using a memorandum of understanding or other legal agreement.

2.5 Corona's Authority. Corona is a local agency qualified to become a GSA because Corona manages water, has a water supply, and has land use responsibilities over a portion of the Temescal Sub-Basin of the Upper Santa Ana Valley Groundwater Basin (DWR Basin Number 8-2.09) ("**Sub-Basin**"), which is a DWR-designated medium priority basin.

2.6 Norco's Authority. Norco is also a local agency qualified to become a GSA because Norco manages water, has a water supply, and has land use responsibilities over a portion of the Sub-Basin.

2.7 HGCWD's Authority. HGCWD is also a local agency qualified to become a GSA because HGCWD is a county water district formed and operating pursuant to and in accordance with Division 12 of the California Water Code that manages water, has a water supply and overlies a portion of the Sub-Basin.

2.8 Corona's Election to Join GSA. On March 15, 2017, Corona held a public hearing to determine whether to become a GSA, and adopted Resolution No. 2017-013, electing to jointly become a GSA with Norco and HGCWD, a copy of which (without exhibits) is attached hereto as **Exhibit "A-1"** attached hereto and incorporated herein by reference.

2.9 Norco's Election to Join GSA. On March 15, 2017, Norco held a public hearing to determine whether to become a GSA, and adopted Resolution No. 2017-12, electing to jointly become a GSA with Corona and HGCWD, a copy of which is attached hereto as **Exhibit "A-2"** attached hereto and incorporated herein by reference.

2.10 HGCWD's Election to Join GSA. On March 23, 2017, HGCWD held a public hearing to determine whether to become a GSA, and, by minute action, elected to jointly become a GSA with Corona and Norco.

2.11 Submission of Notice of Decision. Corona, Norco and HGCWD will jointly submit a Notice of Decision to form and be the founding Parties of a GSA, which will cover the Sub-Basin as shown on the map in **Exhibit "B-1"** attached hereto and incorporated herein by reference.

2.12 Boundaries of Sub-Basin. Additional detail identifying boundaries of the Parties and agencies covering the Sub-Basin is shown on the map attached as **Exhibit "B-2"** attached hereto and incorporated herein by reference.

2.13 Preparation of Groundwater Sustainability Plan for Sub-Basin. The Parties will work collaboratively with other interested agencies to develop and implement a Groundwater Sustainability Plan ("**GSP**") to sustainably manage the Sub-Basin pursuant to SGMA.

2.14 Corona Utility Authority. The Parties to this MOU understands that Corona has entered into a Water Enterprise Management Agreement and a Wastewater Enterprise Management Agreement, both dated as of February 6, 2002, with the Corona Utility Authority ("CUA") for the maintenance, management and operation of those utility systems (collectively, the "Corona Management Agreements"). To the extent that this MOU is deemed to be a "material contract" under either of the Corona Management Agreements, Corona enters into this MOU on behalf of the CUA and subject to the terms of the applicable Corona Management Agreement(s).

3. TERMS.

3.1 Purpose. This MOU is entered into by and between the Parties to facilitate a cooperative and ongoing working relationship that will allow compliance with the SGMA and other applicable State law, both as may be amended from time to time.

3.2 Temescal Sub-Basin Groundwater Sustainability Agency. The Parties hereby establish the Temescal Sub-Basin Groundwater Sustainability Agency ("**Temescal GSA**") to manage the portion of the Sub-Basin as set forth in Exhibit **"B-1"** attached hereto and incorporated herein by reference.

3.3 Additional Agencies. Additional agencies with service area boundaries outside the jurisdiction of the Parties may join and incorporate their service area boundaries or portions thereof into the Temescal GSA upon the mutual consent of all Parties. The additional agencies will be added to **Exhibit "C-1"** attached hereto and incorporated herein by reference, as amended from time to time in compliance with SGMA, and the boundaries of the Temescal GSA may be expanded accordingly.

3.4 Powers. In addition to any other action available to develop and implement the SGMA, including a GSP, the Temescal GSA may perform the following functions:

A. Adopt standards for measuring and reporting water use.

B. Develop and implement policies designed to reduce or eliminate overdraft within the boundaries of the GSA.

C. Develop and implement conservation best management practices.

D. Develop and implement metering, monitoring and reporting related to groundwater pumping.

E. Exercise any and all powers described in Part 2.74 of Division 6 of the Water Code, the Sustainable Groundwater Management Act.

3.5 Decision Making Process.

3.5.1 Majority Vote Required. Each party shall have one vote through its representative designated pursuant to Section 3.7 of this MOU. With the exceptions noted herein, it is the preference of the Parties that actions undertaken by the Temescal GSA are done by unanimous consent of the Parties; however, if unanimous consent is not possible, a majority vote of all then current Parties to this MOU is required.

3.5.2 Impasse Procedures. In the event of an impasse or disagreement where a majority vote cannot be reached, the Parties shall use their best efforts to find a mutually agreeable result. To this effect, the Parties shall consult and negotiate with each other in good faith in an attempt to reach a solution that is mutually satisfactory. If the Parties do not reach a solution that is acceptable to a majority of all then current Parties to this MOU, then the matter shall be submitted to non-binding arbitration or mediation within a reasonable period of time.

3.6 Roles and Responsibilities of the Parties.

A. Corona shall have the primary responsibility to develop a GSP within the boundaries of the Temescal GSA and submit the GSP to the California Department of Water Resources ("**DWR**") for review and evaluation. Corona shall also have the primary responsibility to prepare and submit the annual and five year reports to DWR pursuant to SGMA and DWR's implementing regulations.

B. The Parties will work jointly to fulfill the purpose of this MOU within the boundaries of the Temescal GSA.

C. The Parties will meet regularly to discuss SGMA, GSP development and implementation activities, assignments, and ongoing work progress.

D. The Parties may form committees as necessary from time to time to discuss issues that impact the Temescal GSA.

E. Corona is responsible for implementing the GSP in areas of the Temescal GSA that are within Corona's service area boundaries and within Corona's sphere of influence.

F. Norco is responsible for implementing the GSP in areas of the Temescal GSA that are within Norco's service area boundaries.

G. HGCWD is responsible for implementing the GSP in areas of the Temescal GSA that are within HGCWD's service area boundaries.

3.7 Designation of Representatives.

3.7.1 Corona's Representative. Corona hereby designates Tom Moody, or his or her designee, to act as its representative for the performance of this MOU ("Corona's Representative"). Corona's Representative shall have the power to act on behalf of the Corona for all purposes under this MOU. Corona's Representative may be changed at any time by providing notice to the other Parties pursuant to Section 3.12.

3.7.2 Norco's Representative. Norco hereby designates Chad Blais, or his or her designee, to act as its representative for the performance of this MOU ("Norco's Representative"). Norco's Representative shall have the power to act on behalf of the Norco for all purposes under this MOU. Norco's Representative may be changed at any time by providing notice to the other Parties pursuant to Section 3.12.

3.7.3 HGCWD's Representative. HGCWD hereby designates David Vigil, or his or her designee, to act as its representative for the performance of this MOU ("HGCWD's Representative"). HGCWD's Representative shall have the power to act on behalf of HGCWD for all purposes under this MOU. HGCWD's Representative may be changed at any time by providing notice to the other Parties pursuant to Section 3.12.

3.8 Funding. Unless agreed to otherwise, each Party's participation in this MOU is at its sole cost and expense. Each Party shall be financially responsible for collecting data or information from within that Party's service area that is required to be provided for development of the GSP. Norco and HGCWD shall not incur any financial expense related to development of the GSP and submittal of the GSP to the DWR.

3.9 Term and Termination. This MOU shall remain in effect unless terminated by the mutual written consent of the Parties. Any Party may elect to withdraw its participation in the Temescal GSA by providing sixty (60) days' written notice to the other Parties. Additionally, the Parties may mutually agree to terminate this MOU and instead enter into a joint powers agreement pursuant to the Joint Exercise of Powers Act, Government Code Section 6500 *et seq*. for the purpose of creating a separate public agency to serve as the Temescal GSA and carry out all obligations and exercise all powers under SGMA.

3.10 Amending the MOU. This MOU and Exhibits hereto may only be amended by a subsequent writing, approved and signed by all Parties.

3.11 Hold Harmless and Mutual Indemnification. No Party, nor any officer or employee of a Party, shall be responsible for any damage or liability occurring by reason of anything done or omitted to be done by another Party under or in connection with this MOU. Each Party shall defend, indemnify and hold harmless the other Parties and their elected officials, officers, agents and employees from and against any and all claims, demands, judgments or liabilities arising from any and all alleged acts or omissions of the indemnifying Party and its elected officials, officers, agents and employees during those times when said elected officials, officers, agents and employees are acting in connection with this MOU.

3.12 Notices. Except as otherwise expressly provided by law, any and all notices or other communications required or permitted by this MOU to be served on or given to a Party to this MOU shall be in writing and shall be deemed duly served or given when personally delivered to the Party to whom it is directed or to any managing or executive officer or director of that Party. In lieu of personal service, all notices or other communications shall be deemed duly served when sent via electronic mail or when deposited in the United States mail, first class postage prepaid, addressed as follows:

If to Corona:
City of Corona
Attn: Department of Water and Power, General Manager
755 Public Safety Way
Corona, CA 92882
E-mail: Tom.moody@ci.corona.ca.us

If to Norco:
City of Norco
Attn: Public Works Director
2870 Clark Avenue
Norco, CA 92860
E-mail: Cblais@ci.norco.ca.us

If to HGCWD: Home Gardens County Water District
Attn: General Manager
3832 Grant Street
Corona, CA 92879
E-mail: hgcwd@yahoo.com

3.13 Counterparts. This MOU may be signed in counterparts, each of which shall constitute an original.

3.14 Cooperation; Further Acts. The Parties shall fully cooperate with one another, and shall take any additional acts or sign any additional documents as may be necessary, appropriate or convenient to attain the purposes of this MOU.

3.15 Entire Agreement. This MOU contains the entire agreement of the Parties with respect to the subject matter hereof, and supersedes all prior negotiations, understandings or agreements.

3.16 Corona Utility Authority. To the extent that this MOU is deemed to be a "material contract" under either of the Corona Management Agreements, the Parties to this MOU have no right to terminate this MOU, either with or without cause, based upon the existence or non-existence of either or both of the Corona Management Agreements. Therefore, if an applicable Corona Management Agreement expires or terminates for any reason, the Parties to this MOU shall remain fully obligated to perform under this MOU contracting directly with the CUA or another third party contracted by the CUA for the maintenance, management and operation of the applicable utility system.

[SIGNATURES ON FOLLOWING 3 PAGES]

CORONA'S SIGNATURE PAGE FOR

MEMORANDUM OF UNDERSTANDING
(TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY)

CITY OF CORONA

By: _____ Dated: 3/15/17
Dick Haley
Mayor

Attest:

By: _____
Lisa Mobley
City Clerk

Approved as to Form:

By: _____
Dean Derleth
City Attorney

Consent:

_____
Darrell Talbert
Executive Director
Corona Utility Authority

NORCO'S SIGNATURE PAGE FOR
MEMORANDUM OF UNDERSTANDING
(TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY)

CITY OF NORCO

By: _____ Date: March 15, 2017
Greg Newton
Mayor

Attest:

By: _____
Cheryl L. Link, CMC
City Clerk

Approved as to Form:

By: _____
John Harper
City Attorney

HGWD'S SIGNATURE PAGE FOR

MEMORANDUM OF UNDERSTANDING
(TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY)

HOME GARDENS COUNTY WATER DISTRICT

By: _____ Dated: 3/23/17

David Vigil
General Manager

EXHIBIT "A-1"
TO
MEMORANDUM OF UNDERSTANDING
(TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY)

CORONA RESOLUTION ON FORMATION OF THE TEMESCAL SUBBASIN GROUNDWATER SUSTAINABILITY AGENCY

[SEE ATTACHED FOUR (4) PAGES]

RESOLUTION NO. 2017-013

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF CORONA AUTHORIZING THE EXECUTION AND DELIVERY OF A MEMORANDUM OF UNDERSTANDING WITH THE CITY OF NORCO AND THE HOME GARDENS COUNTY WATER DISTRICT FOR THE PURPOSE OF JOINTLY ESTABLISHING AND SERVICING AS THE TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY

WHEREAS, in September 2014, the Governor signed three bills (SB 1168, SB 1319, and AB 1739) into law creating the Sustainable Groundwater Management Act of 2014 ("SGMA"), which generally requires the formation of one or more Groundwater Sustainability Agencies ("GSA") responsible for implementing sustainable groundwater management and preventing "undesirable results" in groundwater basins and sub-basins designated as a medium or high or priority basin by the California Department of Water Resources ("DWR"); and

WHEREAS, DWR has designated the Temescal Sub-Basin of the Upper Santa Ana Valley Groundwater Basin (the "Sub-Basin"), as a medium priority groundwater basin; and

WHEREAS, the City of Corona ("City"), the City of Norco ("Norco") and the Home Gardens County Water District ("HGWD") each overlay a portion of the Sub-Basin and each exercise water management, water supply or land use authority within a portion of the Sub-Basin; and

WHEREAS, under SGMA, a combination of local agencies may elect to form a GSA for all or portions of the Sub-Basin through a memorandum of understanding; and

WHEREAS, the City, Norco and HGWD have negotiated that certain Memorandum of Understanding (Temescal Sub-Basin Groundwater Sustainability Agency) ("MOU") by and between the City of Corona, the City of Norco, and the Home Gardens Water District for the purpose of jointly establishing and servicing as the Temescal Sub-Basin Groundwater Sustainability Agency; and

WHEREAS, the Temescal Sub-Basin Groundwater Sustainability Agency will implement SGMA in the entire Sub-Basin; and

WHEREAS, the City held a public hearing on March 15, 2017 pursuant to California Water Code Section 10723(b), after publication of notice of such hearing pursuant to California Government Code Section 6066.

NOW, THEREFORE, BE IT RESOLVED, by the City Council of the City of

Corona, California, as follows:

SECTION 1. Election to Form GSA. The City of Corona hereby elects, jointly with the City of Norco and the Home Gardens Water District, to become the Temescal Sub-Basin Groundwater Sustainability Agency to serve as the groundwater sustainability agency over the entire Temescal Sub-Basin of the Upper Santa Ana Valley Groundwater Basin pursuant to California Water Code Section 10723.6(a)(2). The Temescal Sub-Basin Groundwater Sustainability Agency shall have all the powers granted to a groundwater sustainability agency pursuant to SGMA. The City, Norco and HGWD will jointly submit to DWR a notice of their decision to form the Temescal Sub-Basin Groundwater Sustainability Agency for the Temescal Sub-Basin of the Upper Santa Ana Valley Groundwater Basin.

SECTION 2. Sub-Basin Boundaries Managed by GSA. The portion of the Temescal Sub-Basin to be managed by the Temescal Sub-Basin Groundwater Sustainability Agency shall be that portion of the Sub-Basin as depicted in Exhibit "A" attached hereto and incorporated herein by reference, which boundary may be modified from time to time.

SECTION 3. Interested Persons. The Temescal Sub-Basin Groundwater Sustainability Agency shall consider the interests of all beneficial users and users of groundwater, as well as those responsible for implementing groundwater sustainability plans, as required by California Water Code Section 10723.2. The Temescal Sub-Basin Groundwater Sustainability Agency shall establish and maintain a list of persons interested in receiving notices regarding preparation of the GSP, meeting announcements, and availability of draft plans, maps, and other documents, as required by California Water Code Section 10723.4.

SECTION 4. Approval of MOU. The City hereby approves the MOU in substantially the form attached hereto as Exhibit "B" and incorporated herein by reference, which provides the governing structure of the Temescal Sub-Basin Groundwater Sustainability Agency.

SECTION 5. Implementation. The Mayor and the City Clerk are hereby authorized and directed to execute and deliver the MOU for and on behalf of the City, and the Mayor and City staff are authorized to take any actions and execute any documents necessary to carry out the stated purposes of this Resolution, including authorizing non-substantive changes to the MOU, which are approved as to form by the City Attorney.

SECTION 6. Severability. If any provision of this Resolution or the application of any such provision to any person or circumstance is held invalid, such invalidity shall not affect other provisions or applications of this Resolution that can be given effect without the invalid provision or application, and to this end the provisions of this Resolution are severable.

SECTION 7. Effective Date. This Resolution shall become effective immediately upon its adoption.

PASSED, APPROVED AND ADOPTED this 15th day of March 2017.

Kara Spiegel
Mayor of the City of Corona, California

ATTEST:

City Clerk of the City of Corona, California

CERTIFICATION

I, Lisa Mobley, City Clerk of the City of Corona, California, do hereby certify that the foregoing Resolution was regularly passed and adopted by the City Council of the City of Corona, California, at a regular meeting thereof held on the 15th day of March 2017, by the following vote:

AYES:	**FOX, MONTANEZ, SCOTT, SPIEGEL**
NOES:	**NONE**
ABSENT:	**HALEY**
ABSTAINED:	**NONE**

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the City of Corona, California, this 15th day of March 2017.

City Clerk of the City of Corona, California

(SEAL)

EXHIBIT "A-2"
TO
MEMORANDUM OF UNDERSTANDING
(TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY)

NORCO RESOLUTION ON FORMATION OF THE TEMESCAL SUBBASIN GROUNDWATER SUSTAINABILITY AGENCY

[SEE ATTACHED TWO (2) PAGES]

RESOLUTION NO. 2017-02

RESOLUTION OF THE CORONA UTILITY AUTHORITY AUTHORIZING THE CITY OF CORONA TO EXECUTE AND DELIVER THE MEMORANDUM OF UNDERSTANDING WITH THE CITY OF NORCO AND THE HOME GARDENS COUNTY WATER DISTRICT FOR THE PURPOSE OF JOINTLY ESTABLISHING AND SERVICING AS THE TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY

WHEREAS, in September 2014, the Governor signed three bills (SB 1168, SB 1319, and AB 1739) into law creating the Sustainable Groundwater Management Act of 2014 ("SGMA"), which generally requires the formation of one or more Groundwater Sustainability Agencies ("GSA") responsible for implementing sustainable groundwater management and preventing "undesirable results" in groundwater basins and sub-basins designated as a medium or high or priority basin by the California Department of Water Resources ("DWR"); and

WHEREAS, DWR has designated the Temescal Sub-Basin of the Upper Santa Ana Valley Groundwater Basin (the "Sub-Basin"), as a medium priority groundwater basin; and

WHEREAS, the City of Corona ("City"), the City of Norco ("Norco") and the Home Gardens County Water District ("HGCWD") each overlay a portion of the Sub-Basin and each exercise water management, water supply or land use authority within a portion of the Sub-Basin; and

WHEREAS, under SGMA, a combination of local agencies may elect to form a GSA for all or portions of the Sub-Basin through a memorandum of understanding; and

WHEREAS, the City, Norco and HGCWD have negotiated that certain Memorandum of Understanding (Temescal Sub-Basin Groundwater Sustainability Agency) ("MOU") by and between the City of Corona, the City of Norco, and the Home Gardens County Water District for the purpose of jointly establishing and servicing as the Temescal Sub-Basin Groundwater Sustainability Agency; and

WHEREAS, the Temescal Sub-Basin Groundwater Sustainability Agency will implement SGMA in the entire Sub-Basin; and

WHEREAS, the City has entered into a Water Enterprise Lease Agreement and a Wastewater Enterprise Management Agreement, both dated as of February 6, 2002, with the Corona Utility Authority (a joint powers agency and a public entity organized under the laws of the State of California) ("CUA") whereby the City has leased the City's water and wastewater systems to the CUA; and

WHEREAS, the City has also entered into a Water Enterprise Management Agreement and a Wastewater Enterprise Management Agreement, both dated as of February 6, 2002, with the CUA for the maintenance, management and operation of said water and wastewater systems (collectively "the CUA Management Agreements"); and

WHEREAS, to the extent that the MOU is deemed to be a "material contract" under the CUA Management Agreements, the CUA desires to authorize and direct the City to execute and deliver the MOU on behalf of the CUA and subject to the terms of the applicable CUA Management Agreements.

NOW, THEREFORE, BE IT RESOLVED, by the Corona Utility Authority, as follows:

SECTION 1. Approval of Agreement. The Corona Utility Authority hereby authorizes the City Council of the City to execute and deliver the MOU in substantially the form attached hereto as Exhibit "A" and incorporated herein by reference.

SECTION 2. City Implementation. The Corona Utility Authority hereby authorizes the City Council of the City to authorize the Mayor and City staff to take any actions and execute any documents necessary to carry out the stated purposes of this Resolution and the City Council's resolution approving the MOU, including authorizing non-substantive changes to the MOU, which are approved as to form by the City Attorney.

SECTION 3. CUA Implementation. The Corona Utility Authority hereby authorizes all officers of the Corona Utility Authority to take any actions and execute any documents necessary to carry out the stated purposes of this Resolution, including authorizing non-substantive changes to the MOU.

SECTION 4. Severability. If any provision of this Resolution or the application of any such provision to any person or circumstance is held invalid, such invalidity shall not affect other provisions or applications of this Resolution that can be given effect without the invalid provision or application, and to this end the provisions of this Resolution are severable.

SECTION 5. Effective Date. This Resolution shall become effective immediately upon its adoption.

PASSED, APPROVED AND ADOPTED this 15th day of March 2017.

Karen Spiegel
President of the Corona Utility Authority

ATTEST:

Secretary of the Corona Utility Authority

CA\JR\06100.30901\10179506.1

CERTIFICATION

I, Lisa Mobley, Secretary of the Corona Utility Authority, do hereby certify that the foregoing Resolution was adopted by the Board of Directors of the Corona Utility Authority, at its regular meeting held on the 15th day of March 2017, by the following vote:

AYES:	**FOX, MONTANEZ, SCOTT, SPIEGEL**
NOES:	**NONE**
ABSENT:	**HALEY**
ABSTAINED:	**NONE**

IN WITNESS WHEREOF, I have hereunto set my hand this 15th day of March 2017.

Secretary of the Corona Utility Authority

[SEAL]

RESOLUTION NO. 2017-12

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF NORCO, CALIFORNIA, APPROVING A MEMORANDUM OF UNDERSTANDING (MOU) BETWEEN THE CITY OF CORONA, HOME GARDENS COUNTY WATER DISTRICT AND THE CITY OF NORCO FOR THE ESTABLISHMENT OF THE TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY, LOCATED IN NORCO, CALIFORNIA

WHEREAS, On September 16, 2014, Governor Jerry Brown signed into law Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act ("SGMA"); and

WHEREAS, the Sustainable Groundwater Management Act (SGMA) is for groundwater to be managed sustainably in California's groundwater basins (California Water Code Sections 10733.2, *et seq*.) requires urban water suppliers to prepare and adopt groundwater sustainability plans (GSPs); and

WHEREAS, the Sustainable Groundwater Management Act requires that groundwater sustainability plans are to be prepared and submitted by January 31, 2020 by medium and priority groundwater basins; and

WHEREAS, the Department of Water Resources has determined the Temescal Basin to be a medium priority basin under the Sustainable Groundwater Management Act; and

WHEREAS, the Temescal Basin is not an adjudicated basin and the City of Norco is required to prepare a groundwater sustainability plan as an individual agency or with all agencies who extract groundwater from the basin as required by the Sustainable Groundwater Management Act; and

WHEREAS, the City of Corona, Home Gardens County Water District and the City of Norco desire to establish the Temescal Sub-Basin Groundwater Sustainability Agency to manage the Temescal groundwater basin; and

NOW, THEREFORE, BE IT RESOLVED that the Council of the City of Norco approve the Memorandum of Understanding to establish the Temescal Sub-Basin Groundwater Sustainability Agency.

PASSED AND ADOPTED by the City Council of the City of Norco at a regular meeting held on March 15, 2017.

Greg Newton, Mayor
City of Norco, California

ATTEST:

Cheryl L. Link, CMC, City Clerk
City of Norco, California

I, Cheryl L. Link, City Clerk of the City of Norco, do hereby certify that the foregoing Resolution was adopted by the City Council of the City of Norco, California at a regular meeting thereof held on March 15, 2017 by the following vote of the City Council:

AYES:	NEWTON, HOFFMAN, BASH, GRUNDMEYER, HANNA
NOES:	NONE
ABSENT:	NONE
ABSTAIN:	NONE

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the City of Norco, California, on March 15, 2017.

Cheryl L. Link, CMC, City Clerk
City of Norco, California

EXHIBIT "B-1"
TO
MEMORANDUM OF UNDERSTANDING
(TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY)

MAP OF TEMESCAL SUB-BASIN

[SEE ATTACHED ONE (1) PAGE]

Path: T:\Projects\Corona 46409-46410\GIS\Maps-2016GSA Formation\Temescal GSA Formation\Figure 2 - Temescal Subbasin Boundary.mxd

N

0 3,000 6,000

Scale in Feet

Temescal Subbasin (8-002 .09)

Legend

- Temescal Subbasin Groundwater Sustainability Agency (GSA)
- Temescal Subbasin of the Upper Santa Ana Valley Groundwater Basin

February 2017

TODD GROUNDWATER

Figure 2
Temescal Subbasin GSA
Subbasin Boundary

EXHIBIT "B-2"
TO
MEMORANDUM OF UNDERSTANDING
(TEMESCAL SUB-BASIN GROUNDWATER SUSTAINABILITY AGENCY)

MAP OF PARTIES' SERVICE AREAS
WITHIN THE TEMESCAL SUB-BASIN

[SEE ATTACHED ONE (1) PAGE]

Path: T:\Projects\Corona 46409-46410\GIS\Maps-2016GSA Formation\Temescal GSA Formation\Figure 1 - Temescal Subbasin GSA Service Areas.mxd

N

0 3,000 6,000

Scale in Feet

City of Norco Service Area

City of Home Gardens Service Area

City of Corona Service Area

Legend

- City of Corona Service Area
- City of Norco Service Area
- City of Home Gardens Service Area

February 2017

TODD GROUNDWATER

Figure 1
Temescal Subbasin GSA Service Areas

APPENDIX B

Temescal GSA Notice of Decision to become a Groundwater Sustainability Agency

PROOF OF PUBLICATION

CITY OF CORONA
OFFICE OF THE CITY CLERK
NOTICE OF PUBLIC HEARING

PUBLIC NOTICE IS HEREBY GIVEN that the City Council of the City of Corona, California, and the Corona Utility Authority will conduct a public hearing in the Council Chambers, at City Hall, 400 South Vicentia Avenue, in said City of Corona,
ON WEDNESDAY, MARCH 15, 2017 AT 6:30 P.M. or thereafter upon the following:

PROPOSED ACTION:

The City Council and the Corona Utility Authority will consider entering into a Memorandum of Understanding ("MOU") with the City of Norco ("Norco") and the Home Gardens Water District ("HGWD") for the purpose of establishing the Temescal Sub-Basin Groundwater Sustainability Agency to serve as the groundwater sustainability agency for the Temescal Sub-Basin of the Upper Santa Ana Valley Groundwater Basin (DWR Basin Number 8-2.09) ("Sub-Basin") pursuant to the requirements of the Sustainable Groundwater Management Act of 2014 ("SGMA"). The primary purpose of a groundwater sustainability agency under SGMA is to develop a groundwater sustainability plan ("GSP") to achieve long-term groundwater sustainability. The parties to the MOU will work jointly and cooperatively to serve as the groundwater sustainability agency and to satisfy the requirements of SGMA. Each party to the MOU will participate at its sole cost and expense and will be financially responsible for collecting data or information from that party's service area. The City of Corona will have the primary responsibility to develop a GSP and submit it to the California Department of Water Resources ("DWR") for review and evaluation.

This is a public hearing and you are invited to attend and comment on the application described above. If you challenge any portion of this project in court, you may be limited to raising only those issues you or someone else raised at the public hearing described in this notice, or in written correspondence delivered at, or prior to, the public hearing. If you have written comments that you wish to be included in the staff report, please deliver them to the City Clerk, on or before the Tuesday prior to the meeting. If you have questions about this notice or the application to be heard, please call Katie Hockett with the Department of Water and Power at (951) 279-3601.

//S// Lisa Mobley, City Clerk
PUBLISHED: March 1, 2017 and March 8, 2017
JOB CC17-019

SENTINEL WEEKLY NEWS
"Adjudicated for City of Corona, Corona Judicial Dist., Riverside County, California"
SWN-2509 JOB CC17-019
MARCH 1, 8, 2017

THIS SPACE RESERVED FOR CLERK / RECORDING STAMP

Sentinel Weekly News
Adjudicated for the City of Corona, California
1307-C West 6th St., Suite 139
Corona, CA. 92882
Tel: (951) 737-9784 / Fax: (951) 737-9785
E-mail: SentinelWeekly@aol.com

PROOF OF PUBLICATION

(2010, 2015.5 C.C.P.)
STATE OF CALIFORNIA
COUNTY OF RIVERSIDE

I am a Citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an Authorized Representative of *SENTINEL WEEKLY NEWS* (formerly known as The Lake Mathews Sentinel), a Newspaper of General Circulation, printed and published weekly in the City of Corona, County of Riverside, and which Newspaper has been Adjudicated a Newspaper of General Circulation by the Superior Court of the County of Riverside, State of California, under the date of March 30, 1995, Case Number 262254; and under the date of December 7, 1999, Case Number 334071; and the Notice, of which the annexed is a printed copy, has been published in said Newspaper in accordance with the instructions of the Person(s) requesting publication, and not in any supplement thereof on the following dates to wit:

(1) ***March 1, 2017***
(2) ***March 8, 2017***
(3)
(4)

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

/S/ _____
Authorized Representative

DATED: ***MARCH 8, 2017***

THE PRESS-ENTERPRISE

1825 Chicago Ave, Suite 100
Riverside, CA 92507
951-684-1200
951-368-9018 FAX

PROOF OF PUBLICATION
(2010, 2015.5 C.C.P)

Publication(s): The Press-Enterprise

PROOF OF PUBLICATION OF

Ad Desc.: /

I am a citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an authorized representative of THE PRESS-ENTERPRISE, a newspaper in general circulation, printed and published daily in the County of Riverside, and which newspaper has been adjudicated a newspaper of general circulation by the Superior Court of the County of Riverside, State of California, under date of April 25, 1952, Case Number 54446, under date of March 29, 1957, Case Number 65673, under date of August 25, 1995, Case Number 267864, and under date of September 16, 2013, Case Number RIC 1309013; that the notice, of which the annexed is a printed copy, has been published in said newspaper in accordance with the instructions of the person(s) requesting publication, and not in any supplement thereof on the following dates, to wit:

03/04/2017

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Date: March 04, 2017
At: Riverside, California

Legal Advertising Representative, The Press-Enterprise

NORCO, CITY OF
2870 CLARK AVE
NORCO, CA 92860-1903

Ad Number: 0010910947-01

P.O. Number:

Ad Copy:

NOTICE OF PUBLIC HEARING

PUBLIC NOTICE IS HEREBY GIVEN that the City Council of the City of Norco, California, will conduct an public hearing in the Council Chambers, 2820 Clark Avenue, in said City on Wednesday, March 15, 2017, at 7:00 p.m. or thereafter, to consider the following:

Appeal Hearing: Conditional Use Permit 2015-28, Modification 1 (DeKruyf): A request to modify a condition of approval in Resolution 2015-73 for development of a service station associated with Site Plan 2015-23.

City staff has determined that the listed project above is consistent with the environmental determination for Site Plan 2015-23 pursuant to the California Environmental Quality Act and the City of Norco Environmental Guidelines and no additional action is needed. Please contact the Norco Planning Division at (951) 270-5682 for more information regarding said items.

Public Hearing: Approval of a Memorandum of Understanding (MOU) to Establish a Groundwater Sustainability Agency ("GSA")

Any person desiring may appear at said public hearing and be heard. Any person unable to attend said public hearing may submit written comments to the City Clerk on or before Wednesday, March 15, 2017, by 5:45 p.m. at Norco City Hall, 2870 Clark Avenue, Norco California 92860.

/S/
Cheryl L. Link, CMC
City Clerk
City of Norco

Posted: March 2, 2017
Published: March 4, 2017

THE PRESS-ENTERPRISE

1825 Chicago Ave, Suite 100
Riverside, CA 92507
951-684-1200
951-368-9018 FAX

PROOF OF PUBLICATION
(2010, 2015.5 C.C.P)

Publication(s): The Press-Enterprise

PROOF OF PUBLICATION OF

Ad Desc.: /

I am a citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an authorized representative of THE PRESS-ENTERPRISE, a newspaper in general circulation, printed and published daily in the County of Riverside, and which newspaper has been adjudicated a newspaper of general circulation by the Superior Court of the County of Riverside, State of California, under date of April 25, 1952, Case Number 54446, under date of March 29, 1957, Case Number 65673, under date of August 25, 1995, Case Number 267864, and under date of September 16, 2013, Case Number RIC 1309013; that the notice, of which the annexed is a printed copy, has been published in said newspaper in accordance with the instructions of the person(s) requesting publication, and not in any supplement thereof on the following dates, to wit:

3/09, 03/16/2017

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Date: March 16, 2017
At: Riverside, California

Legal Advertising Representative, The Press-Enterprise

HOME GARDENS COUNTY WATER DISTRICT
2832 N. GRANT ST.
CORONA, CA 92879

Ad Number: 0010913312-01

P.O. Number:

Ad Copy:

HOME GARDENS COUNTY WATER DISTRICT
NOTICE OF PUBLIC HEARING

PUBLIC NOTICE IS HEREBY GIVEN that the Board of Directors of the Home Gardens County Water District will conduct a public hearing at the District Office, at 3832 N. Grant Street, Corona, CA 92879, on Thursday, March 23rd, 2017 at 6:00 p.m. or thereafter upon the following:

PROPOSED ACTION: The Board of Directors will consider entering into a Memorandum of Understanding ("MOU") with the City of Norco ("Norco") and the City of ("Corona") for the purpose of establishing the Temescal Sub-Basin Groundwater Sustainability Agency to serve as the groundwater sustainability agency for the Temescal Sub-Basin of the Upper Santa Ana Valley Groundwater Basin (DWR Basin Number 8-2.09) ("Sub-Basin") pursuant to the requirements of the Sustainable Groundwater Management Act of 2014 ("SGMA"). The primary purpose of a groundwater sustainability agency under SGMA is to develop a groundwater sustainability plan ("GSP") to achieve long-term groundwater sustainability. The parties to the MOU will work jointly and cooperatively to serve as the groundwater sustainability agency and to satisfy the requirements of SGMA. Each party to the MOU will participate at its sole cost and expense and will be financially responsible for collecting data or information from that party's service area. The City of Corona will have the primary responsibility to develop a GSP and submit it to the California Department of Water Resources ("DWR") for review and evaluation.

This is a public hearing and you are invited to attend and comment on the application described above. If you challenge any portion of this project in court, you may be limited to raising only those issues you or someone else raised at the public hearing described in this notice, or in written correspondence delivered at, or prior to, the public hearing. If you have written comments, please deliver them to the District Office, on or before the Tuesday prior to the meeting. If you have questions about this notice or the application to be heard, please call David Vigil with the Home Gardens County Water District at (951) 737-4741.

David Vigil, Secretary/District Manager

PUBLISHED: March 9th, 2017 and March 16th, 2017

THE PRESS-ENTERPRISE

1825 Chicago Ave, Suite 100
Riverside, CA 92507
951-684-1200
951-368-9018 FAX

PROOF OF PUBLICATION
(2010, 2015.5 C.C.P)

Publication(s): The Press-Enterprise

PROOF OF PUBLICATION OF

Ad Desc.: /

I am a citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an authorized representative of THE PRESS-ENTERPRISE, a newspaper in general circulation, printed and published daily in the County of Riverside, and which newspaper has been adjudicated a newspaper of general circulation by the Superior Court of the County of Riverside, State of California, under date of April 25, 1952, Case Number 54446, under date of March 29, 1957, Case Number 65673, under date of August 25, 1995, Case Number 267864, and under date of September 16, 2013, Case Number RIC 1309013; that the notice, of which the annexed is a printed copy, has been published in said newspaper in accordance with the instructions of the person(s) requesting publication, and not in any supplement thereof on the following dates, to wit:

3/09, 03/16/2017

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Date: March 16, 2017
At: Riverside, California

Legal Advertising Representative, The Press-Enterprise

HOME GARDENS COUNTY WATER DISTRICT
2832 N. GRANT ST.
CORONA, CA 92879

Ad Number: 0010913312-01

P.O. Number:

Ad Copy:

HOME GARDENS COUNTY WATER DISTRICT
NOTICE OF PUBLIC HEARING

PUBLIC NOTICE IS HEREBY GIVEN that the Board of Directors of the Home Gardens County Water District will conduct a public hearing at the District Office, at 3832 N. Grant Street, Corona, CA 92879, on Thursday, March 23rd, 2017 at 6:00 p.m. or thereafter upon the following:

PROPOSED ACTION: The Board of Directors will consider entering into a Memorandum of Understanding ("MOU") with the City of Norco ("Norco") and the City of ("Corona") for the purpose of establishing the Temescal Sub-Basin Groundwater Sustainability Agency to serve as the groundwater sustainability agency for the Temescal Sub-Basin of the Upper Santa Ana Valley Groundwater Basin (DWR Basin Number 8-2.09) ("Sub-Basin") pursuant to the requirements of the Sustainable Groundwater Management Act of 2014 ("SGMA"). The primary purpose of a groundwater sustainability agency under SGMA is to develop a groundwater sustainability plan ("GSP") to achieve long-term groundwater sustainability. The parties to the MOU will work jointly and cooperatively to serve as the groundwater sustainability agency and to satisfy the requirements of SGMA. Each party to the MOU will participate at its sole cost and expense and will be financially responsible for collecting data or information from that party's service area. The City of Corona will have the primary responsibility to develop a GSP and submit it to the California Department of Water Resources ("DWR") for review and evaluation.

This is a public hearing and you are invited to attend and comment on the application described above. If you challenge any portion of this project in court, you may be limited to raising only those issues you or someone else raised at the public hearing described in this notice, or in written correspondence delivered at, or prior to, the public hearing. If you have written comments, please deliver them to the District Office, on or before the Tuesday prior to the meeting. If you have questions about this notice or the application to be heard, please call David Vigil with the Home Gardens County Water District at (951) 737-4741.

David Vigil, Secretary/District Manager

PUBLISHED: March 9th, 2017 and March 16th, 2017

APPENDIX C

Groundwater Sustainability Plan Elements Guide

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.			**Introduction to Plan Contents**					
			This Article describes the required contents of Plans submitted to the Department for evaluation, including administrative information, a description of the basin setting, sustainable management criteria, description of the monitoring network, and projects and management actions.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
SubArticle 1.			**Administrative Information**					
§ 354.2.			**Introduction to Administrative Information**					
			This Subarticle describes information in the Plan relating to administrative and other general information about the Agency that has adopted the Plan and the area covered by the Plan.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.4.			**General Information**					
			Each Plan shall include the following general information:					
(a)			An executive summary written in plain language that provides an overview of the Plan and description of groundwater conditions in the basin.	21:29	ES			
(b)			A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public.	248:253	10			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10733.2 and 10733.4, Water Code.					
§ 354.6.			**Agency Information**					
			When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:					
(a)			The name and mailing address of the Agency.	31:32	1.3			
(b)			The organization and management structure of the Agency, identifying persons with management authority for implementation of the Plan.	32:34	1.4			
(c)			The name and contact information, including the phone number, mailing address and electronic mail address, of the plan manager.	31:32	1.3			
(d)			The legal authority of the Agency, with specific reference to citations setting forth the duties, powers, and responsibilities of the Agency, demonstrating that the Agency has the legal authority to implement the Plan.	33	1.4.3			
(e)			An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.	33:34	1.4.4			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.8, 10727.2, and 10733.2, Water Code.					
§ 354.8.			**Description of Plan Area**					

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
			Each Plan shall include a description of the geographic areas covered, including the following information:					
(a)			One or more maps of the basin that depict the following, as applicable:					
	(1)		The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.	40, 39	2.1	Figure 1-1		
	(2)		Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.	40, 67	2.1	Figure 2-2		
	(3)		Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.	40:42, 67:68	2.2	Figure 2-1, 2-2		
	(4)		Existing land use designations and the identification of water use sector and water source type.	43:46, 49, 69, 75:76	2.4.9, 2.3.3, 2.3.2	Figure 2-4, Figure 2-10, Figure 2-11		
	(5)		The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.	40, 43, 70:73	2.3.2.1	Figures 2-5,2-6, 2-7, 2-8		
(b)			A written description of the Plan area, including a summary of the jurisdictional areas and other features depicted on the map.	40, 67:68	2.1	Figure 2-1, 2-2		
(c)			Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.	46:50	2.4			
(d)			A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.	46:50	2.4			
(e)			A description of conjunctive use programs in the basin.	43:46	2.3.2			
(f)			A plain language description of the land use elements or topic categories of applicable general plans that includes the following:					
	(1)		A summary of general plans and other land use plans governing the basin.	54:59, 73:74	2.6	Figure 2-8, 2-9		
	(2)		A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects	58:59	2.6.4			
	(3)		A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.	59	2.6.5			

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(4)		A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans.	61	2.7.3			
	(5)		To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.	62	2.7.5			
(g)			A description of any of the additional Plan elements included in Water Code Section 10727.4 that the Agency determines to be appropriate.	59:62	2.7			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10720.3, 10727.2, 10727.4, 10733, and 10733.2, Water Code.					
§ 354.10.			**Notice and Communication**					
			Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:					
(a)			A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.	43:46, 85:86, 183, 191, 197, 200:203, 209:210, 304:333	233,3.10, 6.2.4, 6.3.4, 6.5.3, 6.6.3, 6.6.4, 6.6.7, 6.7.4, Appendix D			
(b)			A list of public meetings at which the Plan was discussed or considered by the Agency.	334:335	Appendix E			
(c)			Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.	640:699	Appendix I			
(d)			A communication section of the Plan that includes the following:					
	(1)		An explanation of the Agency's decision-making process.	32, 254:278	Section 1.4.1, Appendix A			
	(2)		Identification of opportunities for public engagement and a discussion of how public input and response will be used.	62:65, 304:639	Section 2.8, Appendices D, E, F, G, and H			
	(3)		A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.	62:65, 304:639	Section 2.8, Appendices D, E, F, G, and H			

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(4)		The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.	62:65, 304:639	Section 2.8, Appendices D, E, F, G, and H			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.8, 10728.4, and 10733.2, Water Code					
SubArticle 2.			**Basin Setting**					
§ 354.12.			**Introduction to Basin Setting**					
			This Subarticle describes the information about the physical setting and characteristics of the basin and current conditions of the basin that shall be part of each Plan, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions. Information provided pursuant to this Subarticle shall be prepared by or under the direction of a professional geologist or professional engineer.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.14.			**Hydrogeologic Conceptual Model**					
(a)			Each Plan shall include a descriptive hydrogeologic conceptual model of the basin based on technical studies and qualified maps that characterizes the physical components and interaction of the surface water and groundwater systems in the basin.	79:98	3	Figures 3-1 through 3-12		
(b)			The hydrogeologic conceptual model shall be summarized in a written description that includes the following:					
	(1)		The regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency.	81, 87:91	Sections 3.4 and 3.5	Figures 3-1 through 3-5		
	(2)		Lateral basin boundaries, including major geologic features that significantly affect groundwater flow.	81:84, 91, 96	3.5, 3.6, and 3.7	Figure 3-5, 3-10		
	(3)		The definable bottom of the basin.	84:85, 97	3.8	Figure 3-11		
	(4)		Principal aquifers and aquitards, including the following information:					
		(A)	Formation names, if defined.	82:84, 91	3.6.1	Figure 3-5		
		(B)	Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.	81:85, 91, 97, 700:788	3.4, 3.5, 3.6, 3.7, 3.8, and Appendix J	Figure 3-5, 3-10, Appendix J		
		(C)	Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.	81:85, 91, 97, 700:788	3.4, 3.5, 3.6, 3.7, 3.8, and Appendix J	Figure 3-5, 3-10, Appendix J		

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
		(D)	General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs.	104:107, 136:137	4.4 and 4.5	Figures 4-15, 4-16		
		(E)	Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply.	46, 85:86	3.10		Table 2-1	
	(5)		Identification of data gaps and uncertainty within the hydrogeologic conceptual model	86	3.11			
(c)			The hydrogeologic conceptual model shall be represented graphically by at least two scaled cross-sections that display the information required by this section and are sufficient to depict major stratigraphic and structural features in the basin.	81:84, 92:95	3.6	Figure 3-6: 3-9		
(d)			Physical characteristics of the basin shall be represented on one or more maps that depict the following:					
	(1)		Topographic information derived from the U.S. Geological Survey or another reliable source.	87		Figure 3-1		
	(2)		Surficial geology derived from a qualified map including the locations of cross-sections required by this Section.	91:92		Figure 3-5 and Figure 3-6		
	(3)		Soil characteristics as described by the appropriate Natural Resources Conservation Service soil survey or other applicable studies.	80, 90	3.2	Figure 3-4		
	(4)		Delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.	96		Figure 3-10		
	(5)		Surface water bodies that are significant to the management of the basin.	88:89		Figure 3-2 and Figure 3-3		
	(6)		The source and point of delivery for imported water supplies.	40, 43:45, 74	2.3.2.1, 2.3.2.3	Figure 2-9		
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10733, and 10733.2, Water Code.					
§ 354.16.			**Groundwater Conditions**					
			Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:					
(a)			Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:					
	(1)		Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin.	131:132		Figure 4-10 and Figure 4-11		
	(2)		Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers.	123:130		Figure 4-2 and Figure 4-9		

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(b)			A graph depicting estimates of the change in groundwater in storage, based on data, demonstrating the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type.	172		Figure 5-6		
(c)			Seawater intrusion conditions in the basin, including maps and cross-sections of the seawater intrusion front for each principal aquifer.	111	4.9			
(d)			Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.	104:111, 135:137	4.4, 4.5, 4.6, 4.7, and 4.8	Figure 4-14 through 4-16		
(e)			The extent, cumulative total, and annual rate of land subsidence, including maps depicting total subsidence, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	103:104, 133:134	4.3	Figure 4-12 and 4-13		
(f)			Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	111:121, 138:144	4.10	Figures 4-17 through 4-23		
(g)			Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	111:121, 138:144	4.10	Figures 4-17 through 4-23		
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10727.4, and 10733.2, Water Code.					
§ 354.18.			**Water Budget**					
(a)			Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.	145, 147:153, 171:172	5.1, 5.5	Figure 5-5 and 5-6		
(b)			The water budget shall quantify the following, either through direct measurements or estimates based on data:					
	(1)		Total surface water entering and leaving a basin by water source type.	154:157, 170	5.6	Figure 5-4	Table 5-3	
	(2)		Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.	160:162, 172	5.7.1	Figure 5-6	Table 5-4	
	(3)		Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.	160, 163, 172	5.7.2	Figure 5-6	Table 5-4	
	(4)		The change in the annual volume of groundwater in storage between seasonal high conditions.	160, 164, 172	5.8, Appendix J	Figure 5-6	Table 5-4	

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(5)		If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.	N/A				No overdraft conditions present
	(6)		The water year type associated with the annual supply, demand, and change in groundwater stored.	145:146, 167	5.2	Figure 5-1		
	(7)		An estimate of sustainable yield for the basin.	164:166	5.9		Table 5-5	
(c)			Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:					
	(1)		Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information.	158:163, 172	5.7	Figure 5-6	Table 5-4	
	(2)		Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:					
		(A)	A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information.	43:45, 158:163, 172, 700:788	Section 2.3.2, 5.7, Appendix J	Figure 5-6	Table 5-4	
		(B)	A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon.	158:163, 172, 700:788	5.7, Appendix J	Figure 5-6	Table 5-4	
		(C)	A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type.	160, 164:167, 172	5.8, 5.9	Figure 5-6, Figure 5-1	Table 5-4	
	(3)		Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:					
		(A)	Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.	146:147, 154:163, 173:174, 176	5.3, 5.6, 5.7	Figures 5-7,5-8,5-10		

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
		(B)	Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.	146:147, 153:163, 173:174, 176	5.3, 5.6, 5.7	Figures 5-7,5-8,5-10	Table 5-2	
		(C)	Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate.	147:163, 173:174, 176, 700:788	5.5, 5.6, 5.7, Appendix J	Figures 5-7,5-8,5-10		
(d)			The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:					
	(1)		Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use.	145:146, 172, 700:788	5.2, Appendix J	Figure 5-6		
	(2)		Current water budget information for temperature, water year type, evapotranspiration, and land use.	145:147, 172, 700:788	5.2,5.3, Appendix J	Figure 5-6		
	(3)		Projected water budget information for population, population growth, climate change, and sea level rise.	149:152, 173:174, 700:788	5.5.3, Appendix J	Figure 5-7 and 5-8		
(e)			Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions.	147:152, 700:788	5.5, 5.6, 5.7, 5.8, Appendix J			
(f)			The Department shall provide the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM) and the Integrated Water Flow Model (IWFM) for use by Agencies in developing the water budget. Each Agency may choose to use a different groundwater and surface water model, pursuant to Section 352.4.	145, 700:788	5.1, Appendix J			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10723.2, 10727.2, 10727.6, 10729, and 10733.2, Water Code.					
§ 354.20.			**Management Areas**					

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(a)			Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.	N/A				No Management Areas defined
(b)			A basin that includes one or more management areas shall describe the following in the Plan:					
	(1)		The reason for the creation of each management area.	N/A				No Management Areas defined
	(2)		The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.	N/A				No Management Areas defined
	(3)		The level of monitoring and analysis appropriate for each management area.	N/A				No Management Areas defined
	(4)		An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.	N/A				No Management Areas defined
(c)			If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.	N/A				No Management Areas defined
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10733.2 and 10733.4, Water Code.					
SubArticle 3.			**Sustainable Management Criteria**					
§ 354.22.			**Introduction to Sustainable Management Criteria**					
			This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.24.			**Sustainability Goal**					
			Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.	178	6.1.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10727, 10727.2, 10733.2, and 10733.8, Water Code.					

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.26.			**Undesirable Results**					
(a)			Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.	181:182, 190, 196, 200:201, 208	6.2.1, 6.3.1, 6.5.1, 6.6.1, 6.7.1			
(b)			The description of undesirable results shall include the following:					
	(1)		The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.	182, 190, 196:197, 201, 208	6.2.2, 6.3.2, 6.5.2, 6.6.2, 6.7.2			
	(2)		The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.	183, 190:191, 197, 201:202, 209	6.2.3, 6.3.3, 6.5.3, 6.6.3, 6.7.3			
	(3)		Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.	183, 191, 197, 202, 209:210	6.2.4, 6.3.4, 6.5.3, 6.6.4, 6.7.4			
(c)			The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.	183:186, 191:192, 197:198	6.2.5, 6.3.5, 6.5.4, 6.6.5, 6.7.5			
(d)			An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.	195	6.4			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10723.2, 10727.2, 10733.2, and 10733.8, Water Code.					
§ 354.28.			**Minimum Thresholds**					
(a)			Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.	185:189, 192:194, 197:199, 206:207, 210:212	6.2.6, 6.3.6, 6.5.4, 6.6.5, 6.7.6			
(b)			The description of minimum thresholds shall include the following:					
	(1)		The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.	183:186, 191:193, 197:199, 202:206, 210	6.2.5, 6.3.5, 6.5.4, 6.6.4, 6.7.5			

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(2)		The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.	185:189, 192:194, 197:199, 206:207, 210:212	6.2.6, 6.3.6, 6.5.4, 6.6.6, 6.7.6			
	(3)		How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.	185:189, 192:194, 197:199, 206:207, 210:212	6.2.6, 6.3.6, 6.5.4, 6.6.6, 6.7.6			
	(4)		How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.	185:189, 192:194, 197:199, 206:207, 210:212	6.2.6, 6.3.6, 6.5.4, 6.6.6, 6.7.6			
	(5)		How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.	185:189, 192:194, 197:199, 206:207, 210:212	6.2.6, 6.3.6, 6.5.4, 6.6.6, 6.7.6			
	(6)		How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.	185:189, 192:194, 197:199, 206:207, 210:212	6.2.6, 6.3.6, 6.5.4, 6.6.6, 6.7.6			
(c)			Minimum thresholds for each sustainability indicator shall be defined as follows:					
	(1)		Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:					
		(A)	The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin.	100:101, 123:130, 181:189, 214	4.1.3, 6.2	Figure 4-2: 4-9, Figure 6-1		
		(B)	Potential effects on other sustainability indicators.	187:188	6.2.6.2			
	(2)		Reduction of Groundwater Storage. The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.	189:195	6.3			

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(3)		Seawater Intrusion. The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following:					
		(A)	Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer.	195	6.4			
		(B)	A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.	195	6.4			
	(4)		Degraded Water Quality. The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.	195:200	6.5			
	(5)		Land Subsidence. The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following:					
		(A)	Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects.	200:207	6.6			
		(B)	Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.	200:207, 131	6.6	Figure 4-10		
	(6)		Depletions of Interconnected Surface Water. The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:					
		(A)	The location, quantity, and timing of depletions of interconnected surface water.	207:213, 138:144	6.7	Figures 4-17 through 4-23		
		(B)	A description of the groundwater and surface water model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.	210, 138:144	6.7.5	Figures 4-17 through 4-23		

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(d)			An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.	189:195	6.3			
(e)			An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.	195	6.4			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10733, 10733.2, and 10733.8, Water Code.					
§ 354.30.			**Measurable Objectives**					
(a)			Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.	189, 194:195, 199:200, 206:207, 212:213	6.2.7, 6.3.7, 6.5.5, 6.6.6, 6.7.7			
(b)			Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.	189, 194:195, 199:200, 206:207, 212:213	6.2.7, 6.3.7, 6.5.5, 6.6.6, 6.7.7			
(c)			Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.	189, 194:195, 199:200, 206:207, 212:213	6.2.7, 6.3.7, 6.5.5, 6.6.6, 6.7.7			
(d)			An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.	194:195	6.3.7			
(e)			Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.	178:181	6.1			
(f)			Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.	189, 194:195, 199:200, 206:207, 212:213	6.2.7, 6.3.7, 6.5.5, 6.6.6, 6.7.7			

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(g)			An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.	189, 194:195, 199:200, 206:207, 212:213	6.2.7, 6.3.7, 6.5.5, 6.6.6, 6.7.7			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					
SubArticle 4.			**Monitoring Networks**					
§ 354.32.			**Introduction to Monitoring Networks**					
			This Subarticle describes the monitoring network that shall be developed for each basin, including monitoring objectives, monitoring protocols, and data reporting requirements. The monitoring network shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.34.			**Monitoring Network**					
(a)			Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation.	215:221	7.1		Table 7-1	
(b)			Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:					
	(1)		Demonstrate progress toward achieving measurable objectives described in the Plan.	215:221	7.1		Table 7-1	
	(2)		Monitor impacts to the beneficial uses or users of groundwater.	215:221	7.1		Table 7-1	
	(3)		Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.	215:221	7.1		Table 7-1	
	(4)		Quantify annual changes in water budget components.	215:221	7.1		Table 7-1	
(c)			Each monitoring network shall be designed to accomplish the following for each sustainability indicator:					
	(1)		Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods:					

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
		(A)	A sufficient density of monitoring wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.	217:221, 226	7.1.1	Figure 7-1	Table 7-2	
		(B)	Static groundwater elevation measurements shall be collected at least two times per year, to represent seasonal low and seasonal high groundwater conditions.	217:221, 226	7.1.1	Figure 7-1	Table 7-2	
	(2)		Reduction of Groundwater Storage. Provide an estimate of the change in annual groundwater in storage.	217:219	7.1.2			
	(3)		Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.	219	7.1.3			
	(4)		Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.	218, 220:221, 226	7.1.5	Figure 7-2	Table 7-2	
	(5)		Land Subsidence. Identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.	219:220	7.1.4			
	(6)		Depletions of Interconnected Surface Water. Monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. The monitoring network shall be able to characterize the following:					
		(A)	Flow conditions including surface water discharge, surface water head, and baseflow contribution.	221	7.1.6			
		(B)	Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.	221	7.1.6			
		(C)	Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.	221	7.1.6			
		(D)	Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.	221	7.1.6			
(d)			The monitoring network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area.	215:221, 226:227	7.1	Figure 7-1 and 7-2		
(e)			A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.	215:221	7.1		Table 7-1	
(f)			The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:					

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(1)		Amount of current and projected groundwater use.	215:221	7.1			
	(2)		Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow.	215:221	7.1			
	(3)		Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.	215:221	7.1			
	(4)		Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response.	215:221	7.1			
(g)			Each Plan shall describe the following information about the monitoring network:					
	(1)		Scientific rationale for the monitoring site selection process.	215:221	7.1			
	(2)		Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.	222:223	7.2			
	(3)		For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.	215:221	7.1			
(h)			The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.	215:221	7.1			
(i)			The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.	222:223	7.2			
(j)			An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.	215:221	7.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10727.4, 10728, 10733, 10733.2, and 10733.8, Water Code					
§ 354.36.			**Representative Monitoring**					
			Each Agency may designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin, as follows:					
(a)			Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined.	224	7.3			

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(b)			(b) Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following:					
	(1)		Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy.	224	7.3			
	(2)		Measurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy.	224	7.3			
(c)			The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area.	224	7.3			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2 and 10733.2, Water Code					
§ 354.38.			**Assessment and Improvement of Monitoring Network**					
(a)			Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.	224:225	7.5		Table 7-3	
(b)			Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.	224:225	7.5		Table 7-3	
(c)			If the monitoring network contains data gaps, the Plan shall include a description of the following:					
	(1)		The location and reason for data gaps in the monitoring network.	225			Table 7-3	
	(2)		Local issues and circumstances that limit or prevent monitoring.	224:225	7.5		Table 7-3	
(d)			Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.	224:225	7.5		Table 7-3	
(e)			Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:					
	(1)		Minimum threshold exceedances.	215:221	7.1			
	(2)		Highly variable spatial or temporal conditions.	215:221	7.1			
	(3)		Adverse impacts to beneficial uses and users of groundwater.	215:221	7.1			
	(4)		The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.	215:221	7.1			
			Note: Authority cited: Section 10733.2, Water Code.					

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
			Reference: Sections 10723.2, 10727.2, 10728.2, 10733, 10733.2, and 10733.8, Water Code					
§ 354.40.			**Reporting Monitoring Data to the Department**					
			Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10728, 10728.2, 10733.2, and 10733.8, Water Code.					
SubArticle 5.			**Projects and Management Actions**					
§ 354.42.			**Introduction to Projects and Management Actions**					
			This Subarticle describes the criteria for projects and management actions to be included in a Plan to meet the sustainability goal for the basin in a manner that can be maintained over the planning and implementation horizon.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.44.			**Projects and Management Actions**					
(a)			Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.	228:240	8			
(b)			Each Plan shall include a description of the projects and management actions that include the following:					
	(1)		A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following:					
		(A)	A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
		(B)	The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
	(2)		If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.	N/A				No overdraft conditions present

Article 5.			Plan Contents for Temescal Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(3)		A summary of the permitting and regulatory process required for each project and management action.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
	(4)		The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
	(5)		An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
	(6)		An explanation of how the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
	(7)		A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
	(8)		A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
	(9)		A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
(c)			Projects and management actions shall be supported by best available information and best available science.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
(d)			An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.	230:240	8.1,8.2,8.3		Tables 8-1 through 8-4	
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					

APPENDIX D

Temescal Groundwater Sustainability Plan
Stakeholder Outreach Plan

Temescal Subbasin Groundwater Sustainability Plan
Outreach and Stakeholder Involvement Communications Plan

July 22, 2020

Prepared for:

City of Corona Department of Water and Power

Prepared by:

Kearns & West, in coordination with Todd Groundwater

Table of Contents

1. Introduction 1
Background 1
Purpose 2
Objectives 2
A Note on Covid-19 2
2. GSA Decision Making Process 3
3. Stakeholders and Potential Interests 4
List of Interested Parties 4
Stakeholder Categories 4
Disadvantaged and Severely Disadvantaged Communities 4
Potential Stakeholder Interests 5
4. Steps for Preparation of the Groundwater Sustainability Plan 6
5. Outreach and Involvement Process 7
Outreach and Involvement Activities 8
Groundwater Sustainability Plan Webpage 8
Pre-Workshop Outreach 8
Focused Outreach 9
Technical Advisory Committee Meetings 9
Public Workshops 10
City Council and Board of Directors Meeting Presentations 10
Public Comment Period 11
Inter-basin Coordination 11
6. Evaluation and Adaptation 11

Appendices

A – Temescal Subbasin Map

B – List of Interested Parties

C – Disadvantaged and Severely Disadvantaged Communities Map

D – Technical Advisory Committee Protocols and Operating Principals

1. Introduction

Background

The State of California Sustainable Groundwater Management Act (SGMA), passed in 2014, calls for the development and implementation of groundwater sustainability plans for all basins determined high and medium priority by the California Department of Water Resources. Under SGMA, these basins should reach sustainability within 20 years of implementing their sustainability plans with a deadline of 2042. SGMA gives local agencies authority to define and plan for achieving and maintaining sustainable groundwater management while avoiding specific undesirable results through the preparation and implementation of a Groundwater Sustainability Plan (GSP).

The Temescal Subbasin is designated as a medium-priority basin. The basin lies mostly within the boundaries of the cities of Corona and Norco, and Home Gardens, an unincorporated area of Riverside County within the City of Corona's sphere of influence. See Appendix A for the Temescal Subbasin map. The City of Corona Department of Water and Power, the City of Norco, and Home Gardens County Water District provide water service to most of the basin, but there are some small areas outside the agencies' combined jurisdictions. These areas are either managed by the U.S. Forest Service, or underlie Prado Reservoir, which is operated by the United States Army Corps of Engineers.

Public agencies with water or land use authority are eligible to sustainably manage groundwater resources locally through the formation of a Groundwater Sustainability Agency (GSA) and preparation of a GSP. The Temescal Subbasin GSA (hereafter GSA) was formed by a Memorandum of Understanding (MOU) among the City of Corona, the City of Norco, and the Home Gardens County Water District. The GSA is dedicated to participating in the collective goals of groundwater sustainability and good basin management through the development of a GSP for the Temescal Subbasin.

Sustainable management of the Temescal Subbasin is critical to local water supply reliability. The three local agencies have water supply portfolios that include imported water, groundwater from multiple local basins, and Corona and Norco use reclaimed water for landscape irrigation. Water conservation measures have also been implemented (as documented in the recent Corona and Norco Urban Water Management Plans) and provide an important tool for responding to water shortages.

The GSA members have long cooperated in water supply planning, monitoring, and management in the Temescal Subbasin. The City of Corona has had a lead role, including preparation in 2008 of a Groundwater Management Plan for the Temescal Subbasin in accordance with State Assembly Bill 3030. This cooperative management will continue for preparation of the Temescal Subbasin GSP (hereafter GSP). The GSP will be prepared and applied jointly among the three agencies. Under the MOU establishing the GSA, the City of

Corona accepted the lead role in developing a GSP for the Temescal Subbasin and submitting it to the California Department of Water Resources.

Purpose

The purpose of this Outreach and Stakeholder Involvement Communications Plan is to provide a framework for integrating public and stakeholder outreach and involvement into GSP preparation. The Outreach and Stakeholder Involvement Communications Plan clarifies objectives, outlines important categories of stakeholders and potential interests, determines methods and timing of outreach and involvement activities, and establishes a process for evaluation and adaptation should the plan need to be updated. Under the requirements of SGMA, GSAs must consider the interests of all beneficial uses and users of groundwater and provide opportunities for public engagement and active involvement of diverse social, cultural, and economic elements of the population.

Objectives

This plan will help ensure SGMA requirements are met for the unique needs of the communities and stakeholders connected to the groundwater of the Temescal Subbasin. The plan will also be guided by the additional stakeholder outreach and stakeholder involvement objectives determined by the GSA. These objectives are to:

- Inform all stakeholders of the GSP development process, including purpose, opportunities and issues, core recommendations, and timeline.
- Provide meaningful opportunities for stakeholders and the public to learn, ask questions, and provide input.
- Involve the many diverse communities and stakeholders of Corona, Norco, and Home Gardens, recognizing that different approaches may be needed to reach specific populations like Disadvantaged Communities, and flexibility and adaptation in approach may be required.
- Ensure a transparent process where stakeholders and the public can understand what important discussions are taking place, how they can participate in them, and how input is being used.

A Note on Covid-19

Given the current Covid-19 crisis, many activities that would usually take place in-person during a planning process, such as workshops and community events, may not be possible. With the uncertainty of when in-person activities will be allowed by local and state authorities or deemed safe by communities, other involvement tools like virtual public meetings and communication and calls with partners will be employed where appropriate to meet the involvement goals for the GSP. Furthermore, even when in-person gatherings are allowed by health authorities, there may be community members who are not able to attend due to individual risk factors. Weaving different virtual activities together with the GSP process will require flexibility as well as thoughtfulness in involving the public.

2. GSA Decision Making Process

As noted, the cities of Corona and Norco and the Home Gardens County Water District have developed and adopted an MOU forming the GSA for the Temescal Subbasin. The GSP will be prepared under the authority of the GSA, with the City of Corona serving as lead agency.

The City of Corona is a General Law City operating with a City Council/City Manager form of government. The City Council is composed of five Council Members including the Mayor and Vice Mayor. Corona's City Council Members are community leaders who listen to all citizens of the City, prioritize plans and projects, allocate funds, and make decisions essential to the future of Corona. The Corona City Council members are elected officers identified in Government Code Section 87200. The City Council meets the first and third Wednesday of each month at 6:30 PM at Corona City Hall, 400 South Vicentia Ave, Corona, California. Meetings are announced, and agenda are posted on the City of Corona website; the meetings are open to the public. The vote of a majority of City Council Members present at any meeting attended by a quorum is necessary to determine any proposition or resolution presented. The City Council is supported by City staff from multiple departments. The Department of Water and Power is leading the GSP work for the City and other members of the GSA.

The City of Norco is a Charter City operating with a City Council/City Manager form of government. The Norco City Council is the elected body of city government within the City of Norco. The Norco City Council consists of five members elected at large for four-year terms by the citizens of Norco. Annually, the Norco City Council appoints a Mayor and Mayor Pro-Tem from its own membership to serve a one-year term. The Norco City Council makes all policy decisions and adopts laws for the City of Norco. The Norco City Council members are elected officers identified in Government Code Section 87200. The City Council meets the first and third Wednesday of each month at 7:00 p.m. at Council Chambers located at 2820 Clark Avenue, Norco, California. Meetings are announced and open to the public. The vote of a majority of City Council Members present at any meeting attended by a quorum is necessary to determine any proposition or resolution presented. Norco City Council meeting agenda are posted on the City of Norco website.

The Home Gardens County Water District is a special district formed under State law to provide water supply within its service area. Home Gardens is governed by a 5-person Board of Directors that elects a president from its members and appoints a secretary. The Board meets every 3rd Thursday of every month at its office, located at 3832 Grant St, Corona, California. Meetings are announced, and agenda are posted at various public locations throughout Home Gardens; the meetings are open to the public. The board (except as otherwise specifically provided in the California Water Code) manages and conducts the business and affairs of the Home Gardens County Water District. The vote of a majority of directors present at any meeting attended by a quorum is necessary to determine any proposition or resolution presented.

3. Stakeholders and Potential Interests

List of Interested Parties

Formulating an effective GSP will rely in part on soliciting input from as many stakeholders as possible to ensure that the plan explores and addresses the topics of greatest interest. During formation, the GSA submitted an initial list of parties interested in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents (see Appendix B). This initial list was used to create a list of stakeholders that will be updated throughout the GSP preparation.

Stakeholder Categories

Community members and contacts from stakeholder organizations (such as local, state, and federal agencies; businesses; community organizations; and non-profits) will be sought and involved throughout GSP preparation. The following are key stakeholder categories:

- Agricultural Interests
- California Native American Tribes
- California Statewide Groundwater Elevation Monitoring Agencies
- Businesses and Development
- Disadvantaged Communities
- Domestic Well Owners
- Environmental and Conservation
- Extractive Industry
- Federal Government Agencies
- Groundwater Right Holders
- Industrial Well Operators
- Land Use Planning Agencies
- Local Water Districts
- Municipal Well Operators
- Private Water Users
- Regulatory Agencies
- Surface Water User

Disadvantaged and Severely Disadvantaged Communities

Disadvantaged Communities are characterized by an annual median household income less than 80% of the California statewide median household income and Severely Disadvantaged Communities are characterized by an annual median household income less than 60% of the California statewide median household income. In many instances, members of these communities have faced historical disinvestment, systemic racism, and environmental injustices among other systemic challenges. Focused attention is required to ensure that they are provided opportunities to be informed and involved in planning processes.

The map in Appendix C shows the Disadvantaged and Severely Disadvantaged Communities within the Temescal Subbasin, representing all the areas identified from census-designated places, tracts, and block groups. The map reveals broad disadvantaged areas across the communities of the City of Corona and Home Gardens, centered around the State Route 91 corridor stretching from both sides of its intersection with Interstate 15 to State Route 71, including areas near the Corona Municipal Airport. As noted in the One Water One Watershed Plan Update 2018 (the Integrated Regional Water Management Plan for the Santa Ana River Watershed), specific communities who meet the criteria for disadvantaged communities may need to be involved, but are not yet identifiable by currently available census information. These communities will be included in focused outreach as they are identified. Involving these communities is needed for the preparation and implementation of the GSP in a way that supports a long-term sustainable water supply while reducing cost burdens.

Several of the identified areas score in the 70th to 80th percentiles for linguistic isolation on CalEnviroScreen, indicating that many households have low levels of English proficiency. American Community Survey data indicates Spanish as the most commonly spoken language other than English in Corona, Home Gardens, and Norco. The communities near the center of the City of Corona contain many single-family residences near commercial areas. Away from the center of Corona, including Home Gardens, the neighborhoods contain higher density residential and more mixed use and industrial areas. These factors are important to consider while developing focused outreach and involvement. For example, outreach material language translation will likely be needed in areas with limited English proficiency. Multiple means of communication (e.g., flyers, posters) will be utilized, recognizing that some communication methods directed toward rate payers (e.g., water bill insert) might not reach community members in multi-unit buildings if water is included in their rent. See the "Focused Outreach" subsection in Section 4 for more details on strategy.

Potential Stakeholder Interests

When planning for public outreach and stakeholder involvement, it is important to consider the types of questions and concerns stakeholders and the public may have. To help guide involvement efforts, a list of potential stakeholders and example interests is presented below in Table 1.

Table 1 – Potential Stakeholder Interests

Category	**Example Interests**
Agriculture	• Crop prices • Groundwater production and use costs • Water supply availability • Water rights • Water quality • Land value
Business and Development	• Economic growth • Population growth

Table 1 – Potential Stakeholder Interests	
Category	**Example Interests**
	• Water rates • Water quality
Cultural Resources	• Community history • Cultural identity
Environment and Conservation	• Climate change • Groundwater dependent ecosystems • Habitat and species of concern • Managed/preserved land • Water quality
Equity and Environmental Justice	• Access to planning process • Benefits to disadvantaged communities • Greater exposure to air, land, and water contaminants • Water quality • Water rates
Water Suppliers	• Drought • Groundwater supply availability • Groundwater production and use costs • Potential future limits on groundwater pumping • Water quality

4. Steps for Preparation of the Groundwater Sustainability Plan

Activities for this Outreach and Stakeholder Involvement Communications Plan will take place during six steps of preparation for the GSP. The steps are outlined below with brief descriptions of the key activities in each step.

- **Step 1: Launch Project.** During project launch, the project team will organize itself for the GSP preparation and stakeholder outreach and involvement. Project planning and project management structures will be established.
- **Step 2: Conduct Baseline Studies**. In this step, describing the plan area and conducting baseline studies for the planning process will occur. This includes describing current and historical groundwater conditions and developing the hydrogeologic conceptual model, which describes the occurrence and movement of groundwater in the Temescal Subbasin.
- **Step 3: Build Water Budget and Numerical Model.** At this step, the water budget will be quantified, which describes the amount of water that flows in and out of the subbasin, estimates changes in the amount of stored groundwater, and discusses the annual sustainable yield of the subbasin. A numerical groundwater model of the subbasin will be built in this step to assist in groundwater budget quantification. The model will be used

to evaluate future sustainability in multiple scenarios (including projected growth and climate change) and to simulate potential projects and management actions.

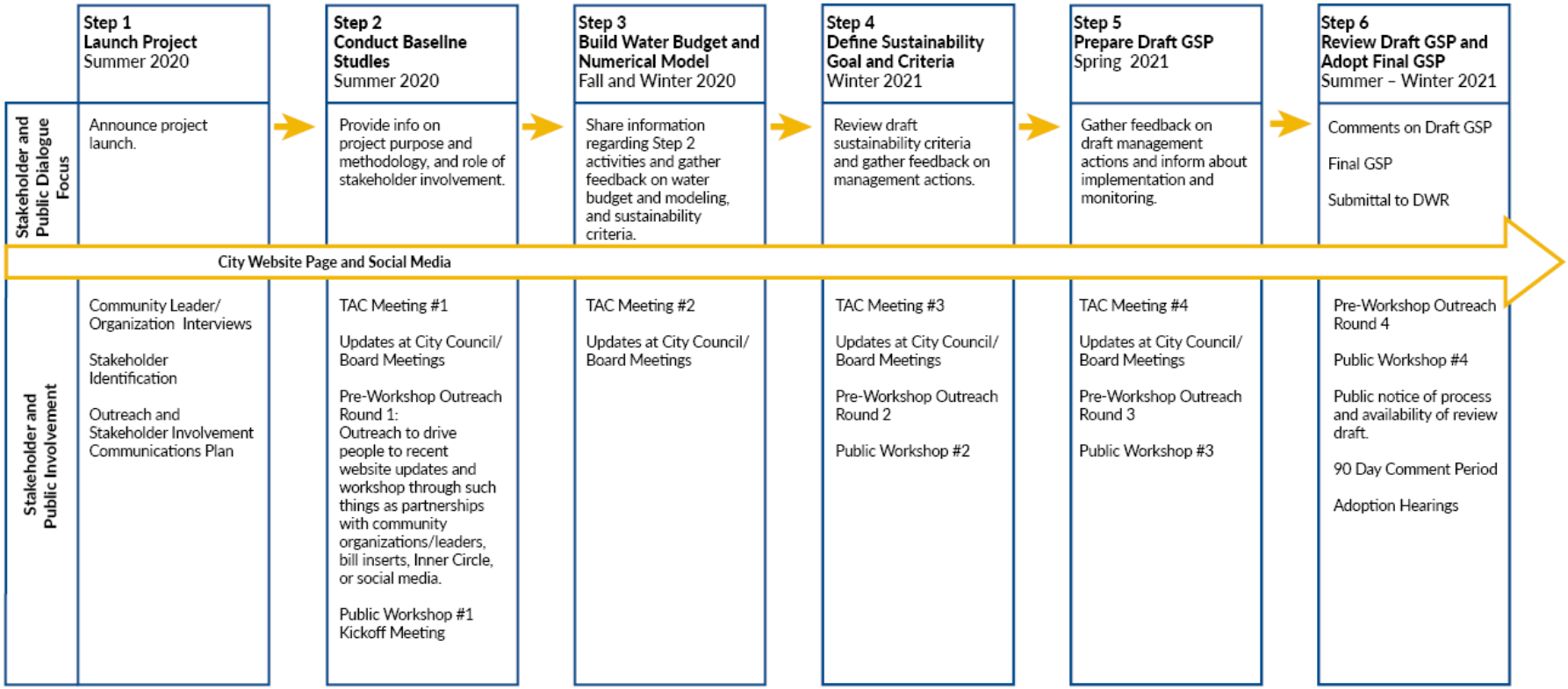
- **Step 4: Define Sustainability Goal and Criteria.** Building from the baseline studies, water budget, modeling, and input of stakeholders in the previous steps, the activities of this step will define the unique sustainability goal for the Temescal Subbasin. This goal and associated sustainable management criteria will define undesirable results and identify thresholds to avoid significant and unreasonable lowering of groundwater levels, reduction in storage, degraded water quality, land subsidence, and surface water depletion in the subbasin.
- **Step 5: Prepare Draft GSP.** This step will identify monitoring and management actions to fulfill the sustainability goal and sustainable management criteria and provide a plan for GSP implementation. The technical contents of the Draft GSP will then be completed.
- **Step 6: Review Draft GSP and Adopt Final GSP.** In the final step, the draft and final plan will be distributed for public review and comment.

See Section 4 for a process chart that aligns these planning steps with outreach and involvement activities.

5. Outreach and Involvement Process

The process chart on the next page provides an overview of how stakeholder and public outreach, and involvement activities align with the GSP preparation steps described in Section 3.

Temescal Subbasin GSP Outreach and Stakeholder Involvement Process



Outreach and Involvement Activities

Listed below are the anticipated stakeholder and public involvement activities that will occur during GSP preparation. They are listed in the order of appearance in the above process chart. The activities are designed to be flexible to meet evolving needs and issues during GSP preparation. Detailed logistics plans will be prepared prior to public workshops and technical advisory committee meetings, and will outline notification methods, formats, key messages, topics, and input and feedback opportunities.

Groundwater Sustainability Plan Webpage

Purpose: Host information about GSP preparation and related involvement activities.

Description: A webpage will be created on the City of Corona Department of Water and Power's website. It will host project information such as general SGMA/GSP information, project timeline, draft chapters, project updates, meeting materials and summaries, and FAQs. It will also allow visitors to sign up for the interested parties list.

Timing: All Steps.

Pre-Workshop Outreach

Purpose: Inform stakeholders about GSP preparation and drive attendance at public workshops.

Description: Pre-workshop outreach will use outreach materials and social media materials.

Outreach Materials

Potential outreach materials include one-page fact sheets (or similar materials such as project updates or notices) or bill insert announcements. The materials will be posted on the webpage, distributed to the interested parties list via email, and to the public using social media and community organizations. The timing of the creation and distribution of outreach materials will be tied to project milestones and public workshops.

Social Media, Websites, and Email

The GSA members will utilize their existing social media accounts to spread the word following completion of project milestones and in advance of public workshops. Posts on the City of Corona's Facebook, Twitter, Instagram, and/or Nextdoor pages will distribute information, outreach materials, and/or direct interested parties to the GSP webpage and public workshops. The City of Corona's Inner Circle email distribution list will likewise be used to disseminate information. The City of Norco will distribute information using its Facebook and Twitter accounts. Home Gardens County Water District has a webpage where workshop information will be posted. Stakeholder organizations will be encouraged to repost social media communications for wider distribution.

Timing: Step 2, Conduct Baseline Studies; Step 4, Define Sustainability Goal and Criteria; Step 5, Prepare Draft GSP; Step 6, Review Draft GSP and Adopt Draft GSP

Focused Outreach

Purpose: Involve Disadvantaged Communities and Severely Disadvantaged Communities.

Description: Throughout GSP preparation, opportunities will be for outreach to Disadvantaged and Severely Disadvantaged Communities. In Step 1, the foundation will be laid by reaching out to community leaders and organizations to begin to build relationships and learn what strategies have been successful for them, how to overcome any existing barriers, and best methods for engaging in culturally and linguistically appropriate ways. Using this information and the previously discussed demographic information, gaps in pre-workshop outreach methods will be identified and addressed. Spanish translation of materials and interpretation at events will also be woven into outreach and involvement. Examples of effective outreach that has already been identified include posts on community social media pages and receiving information in the mail. Potential outreach materials could include customized social media posts for community organizations to share.

In Step 2, focused outreach, such as virtual stakeholder meetings, social media livestreams, social media posts, or flyer distribution, will be conducted, possibly in partnership with community groups and leaders. The purpose is to inform community members of their groundwater resources, how they are managed, and who manages them so that they are more comfortable in engaging in discussions later in GSP preparation. Basic information about the role of the GSP in groundwater management and public involvement will also be introduced. Potential outreach materials could include stakeholder meeting presentations, social media posts, or informational flyers.

Steps 3-6 will include continuation of pre-workshop outreach methods. It is also possible that some community members in disadvantaged communities may not have easy access to internet or cell phone data, so in-person meetings may be considered, if allowed by health authorities and community members are not excluded from public gatherings due to vulnerability to infection.

Timing: All Steps.

Technical Advisory Committee Meetings

Purpose: The purpose of the Technical Advisory Committee (TAC) is to contribute community and stakeholder perspectives and interests in GSP planning and GSP and SGMA implementation in the Temescal Subbasin.

Description: TAC members will provide input and feedback on GSP development and implementation and GSA policies based on their expertise, knowledge, resources, and understanding of their communities, environment, commerce, and applicable regulations. The GSA and the project team will consider the TAC's input throughout GSP preparation, along with input from the broader community, other stakeholders, and other government agencies involved in groundwater management and associated regulatory requirements.

TAC members represent the diverse interests of GSA-eligible agencies and groundwater uses and users. The intent of the Technical Advisory Committee is to contribute community and stakeholder perspectives and interests in GSP planning and GSP and SGMA implementation in the Temescal Subbasin.

See Appendix D for the protocols and operating principals document.

Timing: Step 2, Conduct Baseline Studies; Step 3, Build Water Budget and Numerical Model; Step 4, Define Sustainability Goal and Criteria; Step 5, Prepare Draft GSP.

Public Workshops

Purpose: Create a forum to share project information with the public and stakeholders and provide input and feedback opportunities.

Description: Public workshops will allow stakeholders an opportunity to provide incremental input at meaningful points in GSP development. The workshop series will also help community members and other stakeholders understand the purpose, need, benefits, and issues associated with sustainable groundwater planning. The planned focus of these workshops is the following:

1. Kickoff (Step 2, Conduct Baseline Studies)
2. Criteria for sustainability (Step 4, Define Sustainability Goal and Criteria)
3. Preliminary evaluation of management actions (Step 5, Prepare Draft GSP)
4. Presentation of draft GSP (Step 6, Review Draft GSP and Adopt Draft GSP)

Public workshops could include elements such as a presentation, Q&A sessions, and various opportunities for attendees to provide input or feedback such as live polling, breakout groups, or comment cards. The first public workshop will likely take the form of a virtual meeting. The project team will assess the conditions for future workshops and weigh the risks and benefits of holding them in-person. Any in-person workshops will be held in a venue that maximizes accessibility and convenience for the communities of Corona, Home Gardens, and Norco.

Timing: Step 2, Conduct Baseline Studies; Step 3, Build Water Budget and Numerical Model; Step 4, Define Sustainability Goal and Criteria; Step 5, Prepare Draft GSP; Step 6, Review Draft GSP and Adopt Draft GSP

City Council and Board of Directors Meeting Presentations

Purpose: Update the city councils of the Cities of Corona and Norco, and the Board of Directors of Home Gardens, and their respective communities, on GSP development and hold the GSP adoption hearing.

Description: The public will be able to hear updates on GSP preparation as an agenda item and provide comment periodically throughout the planning process and at the final adoption hearing.

Timing: Step 2, Conduct Baseline Studies; Step 3, Step 4, Define Sustainability Goal and Criteria; Step 5, Prepare Draft GSP; Step 6, Review Draft GSP and Adopt Draft GSP

Public Comment Period

Purpose: Allow the public to comment on the GSP before adoption.

Description: According to SGMA, a GSA may adopt a GSP after a public hearing, held at least 90 days after providing public notice of a comment period. Draft GSP materials, including draft chapters and supporting documents will also be released for public review periodically throughout GSP preparation to facilitate additional public review.

Timing: Step 2, Conduct Baseline Studies; Step 3, Step 4, Define Sustainability Goal and Criteria; Step 5, Prepare Draft GSP; Step 6, Review Draft GSP and Adopt Draft GSP

Inter-basin Coordination

Purpose: SGMA requires coordination of specific GSP elements between connected basins and/or subbasins.

Description: The GSA and their technical consultants will communicate with the GSAs, agencies, and/or technical consultants in and for neighboring basins and subbasins to coordinate water budget and sustainability criteria. This will facilitate consistency in estimates of flow across basin boundaries and make sure that sustainable basin management does not adversely affect neighboring basins.

Timing: Step 2, Conduct Baseline Studies; Step 3, Step 4, Define Sustainability Goal and Criteria; Step 5, Prepare Draft GSP; Step 6, Review Draft GSP and Adopt Draft GSP

6. Evaluation and Adaptation

This is a working plan, recognizing that an outreach and involvement plan should allow for evaluation and adaptation. After each public workshop, a discussion and evaluation of outreach and involvement activities will occur at internal GSA workgroup meetings to determine what went well, what could be improved, and what the key lessons learned are.

To help answer those questions, the outreach and involvement plan objectives will be reviewed:

- Were all stakeholders informed of the GSP development process, including purpose, opportunities and issues, core recommendations, and timeline?
- Were stakeholders and the public provided meaningful opportunities to learn, ask questions, and provide input?
- Were the many diverse communities and stakeholders of Corona, Norco, and Home Gardens, involved? Were tailored approaches used to reach specific populations like Disadvantaged Communities?

- Was the process transparent such that stakeholders and the public can understand what important discussions are taking place, how they can participate in them, and how input is being used ensured?

The following information can also be collected and used as indicators:

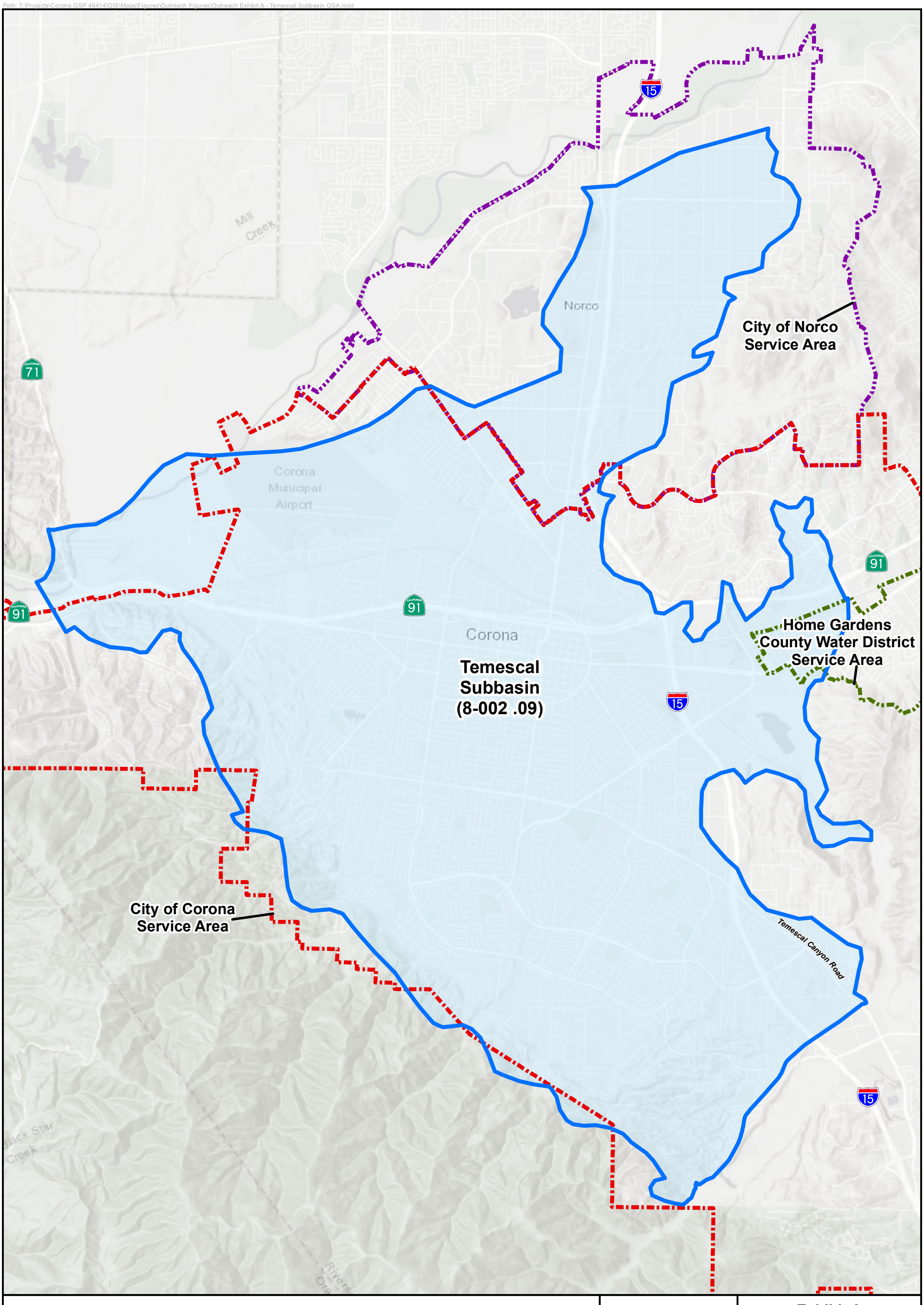
- **Interested Party List Additions:** Number of contacts added to the list since the last workshop.
- **Social Media Interactions:** Number of likes, comments, and shares.
- **Public Workshops Attendance:** Number of attendees and change over time.
- **Public Workshop Feedback:** Public workshops will end with a poll and/or short survey, asking attendees how they learned about the workshop, recommending means for getting the word out to other community members, what they liked about the format, and what they liked least**.**

The evaluation input will inform the adaptation of subsequent outreach and involvement activities.

Appendix A

Temescal Subbasin Map

Path: T:\Projects\Corona GSP 46414\GIS\Maps\Figures\Outreach Figures\Outreach Exhibit A - Temescal Subbasin GSA.mxd



Legend

- Temescal Subbasin Groundwater Sustainability Agency (GSA)
- City of Corona Service Area
- City of Norco Service Area
- Home Gardens County Water District Service Area
- Temescal Subbasin of the Upper Santa Ana Valley Groundwater Basin

N

0 0.5 1

Miles

Exhibit A
Temescal Subbasin Groundwater Sustainability Agency

TODD GROUNDWATER

Appendix B

List of Interested Parties

TEMESCAL VALLEY SUBBASIN
GROUNDWATER SUSTAINABILITY AGENCY
LIST OF PARTIES INTERESTED IN THE TEMESCAL SUBBASIN

The following list satisfies Water Code Section 10723.2, which states: a GSA shall consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing Groundwater Sustainability Plans (GSPs). The list of interested parties presented below has been developed for the GSA. Many of the agencies identified below have already been contacted by the parties to the MOU for the GSA. The interests of all the agencies, organizations, and individuals identified below shall be considered during the development of the GSP for the GSA.

1. Local Water Districts within or adjoining the GSA:
    a. Metropolitan Water District of Southern California
    b. City of Riverside
    c. The MOU/GSA member agencies
    d. Western Municipal Water District (adjacent to the subbasin/GSA)
    e. City of Eastvale (adjacent)
    f. City of Chino Hills (adjacent)
    g. Jurupa Community Services District (adjacent)
    h. Temescal Valley Water District (adjacent)
    i. Eagle Valley Water District (adjacent)
    j. Orange County Water District (adjacent)
    k. Orange County Water Public Works Department (adjacent)
    l. Inland Empire Utilities Agency (adjacent)
    m. Chino Basin Water Management District (adjacent)

2. Holders of Overlying Groundwater Rights:
    a. There are a limited number of known agricultural, industrial, and domestic well owners that account for a very small proportion of subbasin annual groundwater use. These existing pumpers include the Dairy Farmers of America and other small producers. Known pumping is tracked on behalf of the Santa Ana River Watermaster, and these producers interests will be considered during the development of the GSP for the subbasin.
    b. Municipal and Industrial Well Operators
        i. The MOU/GSA member agencies are the only municipal well operators within the Temescal Subbasin
        ii. All American Asphalt, Dart Container Corporation of California, and Minnesota Mining and Manufacturing Corporation operate industrial supply wells in the subbasin. Known pumping is tracked on behalf of the Santa Ana River Watermaster, and these producers interests will be considered during the development of the GSP for the subbasin.

3. Surface Water Users
    a. Santa Ana Watershed Protection Authority
    b. Santa Ana River Watermaster. The Santa Ana River overlies portions of the Basin. Surface flows in the Santa Ana River are monitored by the Santa Ana River Watermaster. The Santa Ana River is adjudicated and minimum flows are required to reach the Prado Basin on an annual basis.
    c. The MOU/GSA member agencies

4. Environmental Users of Groundwater
    a. Riverside County Flood Control and Water Conservation District
    b. Santa Ana River Watermaster
    c. California Regional Water Quality Control Board - Santa Ana Region (8)

5. Local Land Use Planning Agencies
    a. Riverside County, Planning Department
    b. City of Corona
    c. City of Norco

6. The Federal Government
    a. United States Army Corps of Engineers (Prado Dam Management Area)
    b. United States Forest Service

7. California Native American Tribes
    a. Not present within the Temescal Subbasin or proposed GSA area.

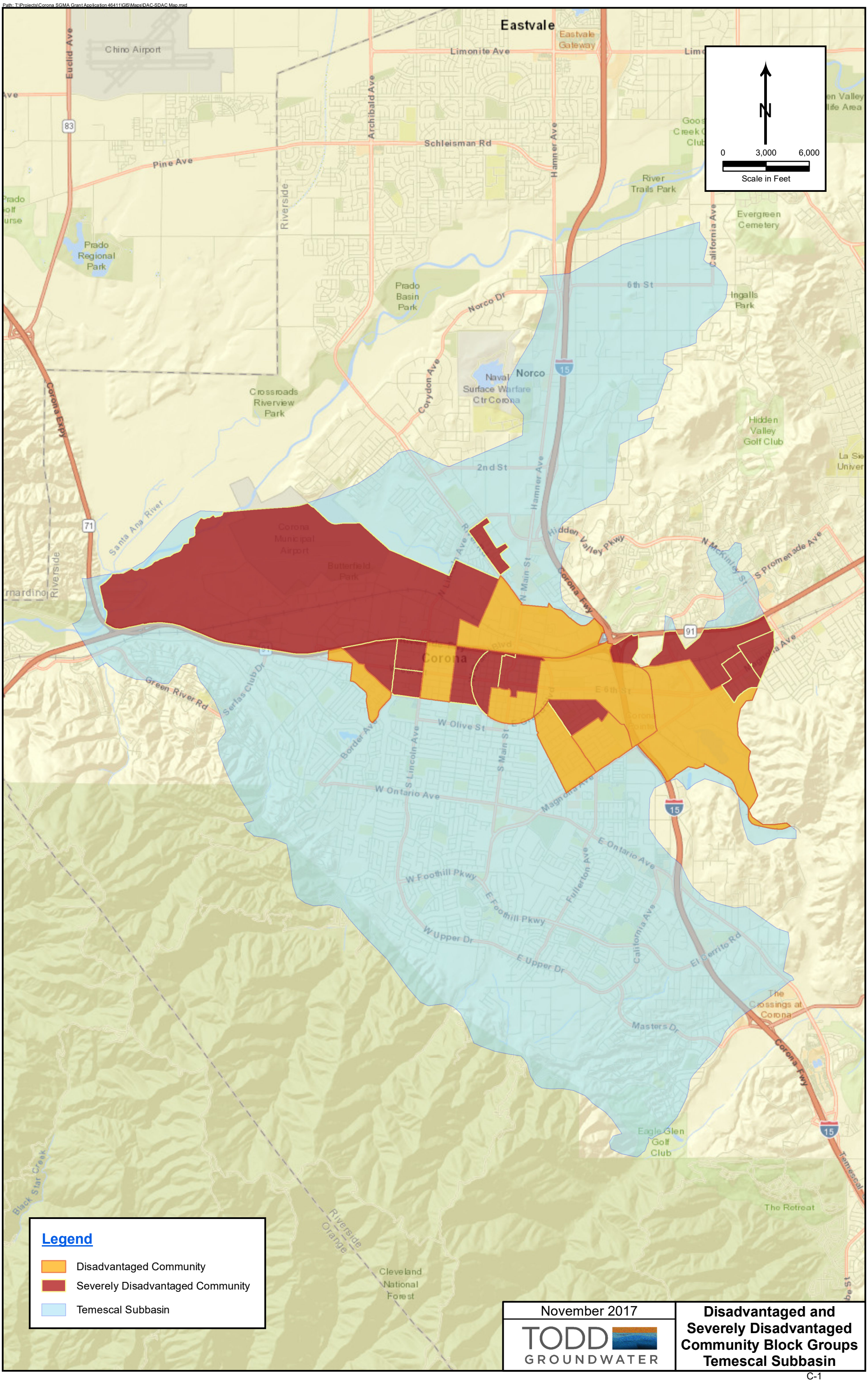
8. Disadvantaged Communities
    a. There are 21 Census block groups within the City of Corona where median income is below the threshold for disadvantaged communities, and 13 of these block groups are below the severely disadvantaged community income threshold.
    b. There are 4 Census block groups within the Home Gardens County Water District where median income is below the threshold for severely disadvantaged communities.

9. CASGEM Agencies
    a. Western Municipal Water District is the monitoring entity responsible for CASGEM program in the Temescal Subbasin

Appendix C

Disadvantaged and Severely Disadvantaged Communities Map

Path: T:\Projects\Corona SGMA Grant Application 46411\GIS\Maps\DAC-SDAC Map.mxd



Appendix D

Protocol and Operating Principles for Temescal GSA Technical Advisory Commitee

Protocols and Operating Principles for Temescal Subbasin Groundwater Sustainability Agency Technical Advisory Committee

August 7, 2020

1. INTRODUCTION

The State of California Sustainable Groundwater Management Act (SGMA), passed in 2014, calls for the development and implementation of groundwater sustainability plans for all basins determined high and medium priority by the California Department of Water Resources. Under SGMA, these basins should reach sustainability within 20 years of implementing their sustainability plans with a deadline of 2042. SGMA gives local agencies authority to define and plan for achieving and maintaining sustainable groundwater management while avoiding specific undesirable results through the preparation and implementation of a Groundwater Sustainability Plan (GSP).

The Temescal Subbasin, a medium-priority basin, lies mostly within the boundaries of the cities of Corona and Norco, and Home Gardens, an unincorporated area of Riverside County within the City of Corona's sphere of influence. The Temescal Subbasin GSA (GSA) was formed by a Memorandum of Understanding among the City of Corona, the City of Norco, and the Home Gardens County Water District. The GSA is dedicated to participating in the collective goals of groundwater sustainability and good basin management through the development of a GSP for the Temescal Subbasin.

GSAs must consider the interests of all beneficial uses and users of groundwater and provide opportunities for public engagement and the Temescal Subbasin GSA is seeking active involvement of diverse social, cultural, and economic elements of the population. In order to achieve those requirements and provide more opportunities for stakeholders to represent diverse interests and provide input to inform GSP preparation, the GSA chose to form a Technical Advisory Committee (TAC). This document establishes the protocols and operating principles and records the charge and role of the TAC in GSP preparation, collaborative principles, meeting logistics information, and additional considerations for productive meetings where all TAC members can participate equally and effectively.

2. CHARGE

The purpose of the TAC is to provide input and guidance to the staff and consultant team of the GSA who are preparing the GSP. At the request of the GSA, the TAC members will provide input and feedback on GSP development and implementation and GSA policies based on their expertise, knowledge, resources, and understanding of their communities, environment, commerce, and applicable regulations. The GSA and the project team will consider the TAC's input throughout GSP preparation, along with input from the broader community, other stakeholders, and other government agencies involved in groundwater management and associated regulatory requirements.

Additionally, Technical Advisory Committee members represent the diverse interests of GSA-eligible agencies and groundwater uses and users. The intent of the Technical Advisory Committee is to contribute community and stakeholder perspectives and interests in GSP planning and GSP and SGMA implementation in the Temescal Subbasin.

The Technical Advisory Committee will provide review and guidance to the GSA on groundwater-related issues during the development of the GSP that may include:

- Sustainability goals and objectives
- Monitoring programs
- Annual work plans and reports
- Modeling scenarios
- Inter-basin coordination activities
- Projects and management actions to achieve sustainability
- Community outreach, including engagement with disadvantaged communities
- Local regulations to implement SGMA
- General advice

3. ROLES AND RESPONSIBILITIES

To accomplish the above charge, Technical Advisory Committee members agree to the following:

- Contribute input towards long-term sustainable management of the Temescal Subbasin based on their knowledge and expertise in policy, technical, and community matters
- Communicate to other stakeholders and community members about the GSA, GSP process, and SGMA
- Work collaboratively with others on the Technical Advisory Committee
- Commit time needed to review material and participate in ongoing discussions
- Collectively reflect diversity of interests
- Represent constituents' perspectives, but also consider broader community input and input from other members during Technical Advisory Committee meeting discussions

- Participate in all Technical Advisory Committee meetings for the entire planning process
- Partner with the GSA and project team in publicizing public involvement activities

4. PARTICIPATION AND COLLABORATION PRINCIPLES

All Technical Advisory Committee members will work together to create a collaborative, problem-solving environment. The preferred deliberation process is a collaborative process whereby Technical Advisory Committee members choose to cooperate to achieve shared and/or overlapping objectives, in support of the GSA's direction for the creation of a GSP for the Temescal Subbasin.

By agreeing to serve on the Technical Advisory Committee, members commit to the following principles:

- Commit to a good faith effort.
- Use common conversational courtesy.
- All ideas and point of view have value. All ideas have value in this setting. We are looking for innovative ideas. The goal is to achieve understanding. Simply listen, you do not have to agree. If you hear something you do not agree with or you think is "silly" or "wrong," please remember that the purpose of the forum is to share ideas.
- Be honest, fair and as candid as possible. Help others understand you and work to understand others.
- Share relevant information.
- Avoid editorials. It will be tempting to analyze the motives of others or offer editorial comments. Please talk about *your own* ideas and thoughts. Avoid commenting on why you believe another participant thinks something.
- Honor time and be concise. People's time is precious; treat it with respect.
- Think innovatively and welcome new ideas. Creative thinking and problem solving are essential to success. Attempt to think about the problem in a new way.
- Seek solutions for all – help to integrate each other's interests into creative solutions that address diverse needs.
- Invite humor and good will.

Meetings will be conducted using a facilitator, who will:

- Maintain a neutral position during Technical Advisory Committee discussions.
- Work to ensure that all Technical Advisory Committee members have the opportunity to participate equally.
- Guide meeting discussions per the agenda and manage time.
- Provide dialogue activities as needed for productive outcomes.
- Enforce the Technical Advisory Committee collaboration principles stated above.
- Ask "why" to clarify interests.

- Track actions, next steps, and deadlines.
- Participate in agenda preparation as part of meeting the above responsibilities and integrating the Technical Advisory Committee in the planning process.

5. MEMBERSHIP

The intent of the Technical Advisory Committee is to provide broad participation and advice to the GSA. To facilitate effective meetings and manage group size, the Technical Advisory Committee will not exceed 18 members.

The GSA Staff (made up of City of Corona Department of Water and Power staff) will manage its membership and composition and the Staff may make appointments from time-to-time after receiving Technical Advisory Committee recommendations from interested parties to serve on Technical Advisory Committee. When an organization's representative is no longer able to serve, the organization will recommend a new representative to the Technical Advisory Committee. If the organization withdraws from the Technical Advisory Committee, the Technical Advisory Committee and Staff will identify another organization and corresponding representative to fill that seat and recommend the organization to the GSA for appointment.

The Technical Advisory Committee strives to include a range of interests in groundwater in the Temescal Subbasin as outlined in SGMA. Technical Advisory Committee members live in the Temescal Subbasin or represent organizations with a presence or agencies with jurisdiction in the Subbasin, including:

- All Groundwater Users
- Municipal Well Operators, Public Utilities Commission-Regulated Water Companies, and Private and Public Water Systems
- County and City Governments
- Planning Departments/Land Use
- Local Landowners
- Disadvantaged Communities
- Business and Agriculture
- Rural Residential Well Owners
- Environmental Users
- Water Supply and Management Surface Water Users (if connection between surface and ground water)

No Technical Advisory Committee member shall be compensated by the GSA for preparation for or attendance at meetings of the GSA or any committee created by the GSA. The fiscal responsibility of the Technical Advisory Committee falls under the oversight of the GSA.

6. REQUEST FOR NO USE OF ALTERNATES

The GSA requests that once each Technical Advisory Committee member identifies its representative, each representative will commit to attending all meetings in person for the duration of the study. The meetings will build on each other, where discussions in one meeting will shape and inform the discussions at the next meeting. Because continuity is only optimized by consistency in attendance and participation by the representatives, the GSA has established a "no alternate" policy.

7. TERM OF SERVICE

The Technical Advisory Committee is being formed with an understanding that it will serve through submittal of the GSP by January 31, 2022.

8. MEETING LOGISTIC AND COMMUNICATION

Project Duration

The final GSP will be submitted to the State of California Department of Water Resources by January 31, 2022.

Meeting Schedule and Length

There will be four Technical Advisory Committee meetings, currently scheduled for Summer 2020, Fall, 2020, Winter 2021, and Spring 2021. Meetings will last 2 to 4 hours.

Meeting Location

The first Technical Advisory Committee meeting will take place as a virtual meeting online, largely due to restrictions implemented in response to COVID-19. The GSA and project team will assess the latest State and local social distancing requirements and guidance to determine in-person and online venues for future meetings.

Agendas

Agendas will be distributed via email one week in advance of each meeting.

Meeting Summaries

Meeting summaries will be prepared and distributed.

9. COMMUNICATION & MEDIA

GSA Staff will serve as primary contacts for all communication, outreach and media. At the request of the GSA, or Staff, the Technical Advisory Committee may advise on outreach and community engagement.

Media Interaction

Technical Advisory Committee members reserve freedom to express their own opinions to media representatives, but not the opinions of others. The temptation to discuss someone else's statements or position should be avoided. Participants can refer media inquiries to Technical Advisory Committee members for individual comments.

If contacted by the press or an external party concerning discussions, participants are asked to:

- Point out that they are not speaking on behalf of the Technical Advisory Committee, unless specifically authorized by the Technical Advisory Committee to do so
- Present their views only and conscientiously refrain from expressing, characterizing or judging the view of others
- Avoid using the press as a vehicle for negotiation

Member-To-Member Communications

Technical Advisory Committee members may want to share information and documents with other members during the study process. To ensure that all members have the same information available to them, all documents are to be distributed through the established point of contact, who is listed at the end of this document.

The Technical Advisory Committee is intended to be a collaborative experience, in which members work through ideas, issues and solutions in person to gain mutual understanding. As such, Technical Advisory Committee members agree to avoid engaging in email "dialogue" with other members outside the meeting process, and instead commit to using the Technical Advisory Committee meetings for dialogue and discussion purposes.

10. OPEN MEETINGS

All Technical Advisory Committee meetings will be open to the public and announced in advance on the project website. Meeting materials and summaries for each meeting will be posted on the project website.

11. POINT OF CONTACT FOR TECHNICAL ADVISORY COMMITTEE MEMBERS

The established point of contact for Technical Advisory Committee members' questions, suggestions, and input is Melissa Estrada-Maravilla, who is reachable by email at Melissa.Estrada-Maravilla@CoronaCA.gov or phone at 951.736.2479.

APPENDIX E

List of Public Meetings During GSP Development and GSP Comments and Responses

Public Meetings Held During Development of the Temescal Basin Groundwater Sustainability Plan

August 19, 2020 – Temescal Basin Technical Advisory Committee Meeting 1

November 18, 2020 – Temescal Basin Technical Advisory Committee Meeting 2

February 17, 2021 – Temescal Basin Technical Advisory Committee Meeting 3

June 16, 2021 – Temescal Basin Technical Advisory Committee Meeting 4

September 29, 2020 – Public Workshop 1 for Temescal Basin Groundwater Sustainability Plan Development

March 2, 2021 – Public Workshop 2 for Temescal Basin Groundwater Sustainability Plan Development

July 8, 2021 – Public Workshop 3 for Temescal Basin Groundwater Sustainability Plan Development

APPENDIX F

Summaries of Technical Advisory Committee Meetings

Technical Advisory Committee Meeting #1

Meeting Summary

Wednesday, August 19, 2020
2:00 p.m. – 4:00 p.m.
Location: Zoom Virtual Meeting

Attendees

Technical Advisory Committee Members

- Ava Moussavi, Riverside County Flood Control and Water Conservation District
- Chad Blais, City of Norco Public Works Department
- David Vigil, Home Garden County Water District
- Eric Lindberg, California Regional Water Quality Control Board – Santa Ana Region
- Jacque Casillas, Vice Mayor, City of Corona
- Katie Hockett, City of Corona Department of Water and Power
- Roberta A. Reed, 3M Industrial Mineral Products Division
- Timothy Ballon, All American Asphalt
- Tom Moody, City of Corona Department of Water and Power
- Wes Speake, Councilmember, City of Corona

City of Corona Department of Water and Power Staff

- Kristian Alfelor
- Melissa Estrada-Maravilla

Consultant Team

- Chad Taylor, Todd Groundwater
- Phyllis Stanin, Todd Groundwater
- Alyson Scurlock, Kearns & West
- Jack Hughes, Kearns & West
- Joan Isaacson, Kearns & West

Summary

1. Welcome and Introductions

Tom Moody, General Manager at the City of Corona Department of Water and Power, welcomed all to the first meeting of the Temescal Groundwater Sustainability Agency Technical Advisory Committee (TAC). He introduced Todd Groundwater, Carollo Engineers, and Kearns & West as the consultants assisting the Temescal Groundwater Sustainability Agency (Temescal GSA) with preparation of the Temescal Groundwater Sustainability Plan (Temescal GSP) and meeting facilitation.

2. Overview of Meeting Agenda

Joan Isaacson serving as TAC meeting facilitator, Kearns & West, led roundtable introductions for all attending. Isaacson thanked all for attending since their expertise, track record of working collaboratively with other agencies and organizations, and relationships with communities and other stakeholders would be very valuable throughout preparation of the Temescal GSP. She then reviewed the meeting agenda (see Appendix A), noting that the meeting would focus on an introduction to the Sustainable Groundwater Management Act (SGMA), Temescal GSP workplan and schedule, Outreach and Stakeholder Involvement Communications Plan, and TAC members' roles.

3. Orientation to the Sustainable Groundwater Management Act

Chad Taylor, Senior Hydrogeologist at Todd Groundwater, presented the background and purpose of SGMA, an overview of the Temescal Basin and Temescal GSA, and the Temescal GSP development timeline. SGMA is California State legislation that establishes requirements and specifies deadlines for achieving and maintaining groundwater sustainability. These requirements include forming a GSA and preparing a GSP to facilitate local groundwater management informed by stakeholders. SGMA requires that groundwater basins designated as medium (such as the Temescal Basin) or high priority form GSAs and file GSPs by January 31, 2022 and subsequently demonstrate sustainable groundwater management by 2042. See page 10 in Appendix B for map of the Temescal Basin. Sustainability, as defined in SGMA, is the local management and use of groundwater in a way that can be maintained without experiencing undesirable results. SGMA requires evaluation of undesirable results in consideration of six sustainability indicators which are chronic lowering of groundwater levels; reduction of groundwater storage; degradation of water quality; depletion of interconnected surface water affecting beneficial uses; land subsidence affecting land uses; and seawater intrusion.

Taylor explained that the City of Corona, the City of Norco, and Home Gardens County Water District formed the Temescal GSA in 2017 through a memorandum of understanding. The Temescal GSA will work with the California Department of Water Resources (DWR), the TAC, consultants, residents, local public, and other agencies and stakeholder organizations during the Temescal GSP preparation. The Temescal GSA has begun the process of developing and implementing a GSP for the Temescal Basin, including data gathering and review, preparation of a Draft Plan Area Chapter, and preparation of an Outreach and Stakeholder Involvement Communications Plan. For more information on the Temescal GSA, see pages 11 through 12 in Appendix B.

Discussion/Q&A

The team opened the floor for questions and discussion. Taylor listed two discussion questions for consideration: 1) What have you heard about groundwater and/or SGMA and what do you think are some important groundwater management issues? 2) Are you aware of any data or studies we should review during GSP preparation? Discussions, comments, and questions are summarized below.

- The State of California requires local municipal organizations to serve as GSA partners, so private companies are not eligible, but they can participate in GSP preparation in other ways.
- The Temescal Basin has a current Groundwater Management Plan and the majority of water after a rainfall event goes to local recharge. This is interesting, and we should find a way to inform the public on how this happens in the Temescal Basin, so they can know about it and understand it.

- The fact sheet sent prior to this meeting was great. The public should know that the GSA agencies have been and are good stewards of our groundwater.
- Other GSPs have considered what it would mean to decrease water use in the future and that is a concern this TAC should think about.
- It is important that TAC members work with and train others in their agency or organization in consideration of the 2042 sustainability mark so that there is capacity for someone to provide input over 20 years.
- Let's not shy away from talking about Direct Potable Reuse and Indirect Potable Reuse projects as part of this process. They can be hard to talk about but should be talked about sooner rather than later as they are a big part of groundwater replenishment.

4. Summary of Groundwater Sustainability Plan Workplan and Schedule

Taylor provided a summary of the Temescal GSP workplan and schedule. The Temescal GSP will build from past and existing management activities, including the 2008 Groundwater Management Plan. Major Temescal GSP elements include data compilation; plan area; hydrogeologic conceptual model; groundwater model; sustainability goals and criteria; management actions, projects, and monitoring; and plan development. Data compilation and a Draft Plan Area Chapter are already complete. The next steps are to develop the hydrogeological conceptual model, assess current and historical groundwater conditions, and construct a numerical groundwater model. These will be used to calculate groundwater budgets and sustainable yield, so that it is known how much groundwater is available for use. After that comes the creation of sustainability goals and criteria, which define what sustainability means in the Temescal Basin. Next, management actions will be identified to meet sustainability goals and criteria and a monitoring program will be established.

Taylor reviewed the Temescal GSP preparation schedule noting that there will be four TAC meetings total and three public workshops and a presentation of the Draft GSP during the process. The Draft Temescal GSP will be made available for public review in Summer 2021. The final Temescal GSP will be completed by Fall 2021 prior to submittal to DWR. See pages 13 through 16 in Appendix B for more information on the Temescal GSP workplan and schedule.

Discussion/Q&A

There were no questions or comments from the TAC members for this agenda item.

5. Outreach and Involvement

Jack Hughes, Kearns & West, provided an overview of the purpose, objectives, and components of the Outreach and Stakeholder Involvement Communications Plan. The purpose is to provide a framework for integrating public and stakeholder outreach and involvement into the Temescal GSP preparation. The objectives include making sure all stakeholders are informed of the Temescal GSP process and how they can get involved; providing meaningful opportunities for stakeholders and the public to learn and provide input; involving the diverse communities and stakeholders of Corona, Norco, and Home Gardens; and ensuring a transparent process. An important component is involving communities and stakeholders with diverse groundwater interests.

Hughes reviewed the planned outreach and involvement activities included in the plan and how they would be aligned with the Temescal GSP planning steps. The public will have opportunities to get information and provide comment during the public workshops and/or during the presentation on Temescal GSP updates provided during the City Council or Board of Directors meetings of each

respective Temescal GSA member. There will also be three public workshops. Each workshop will be accompanied by several methods of pre-workshop outreach to boost attendance and circulate information such as emails, social media posts, and distributing fact sheets.

Hughes noted the importance of engaging underrepresented communities throughout the Temescal GSP process. He displayed areas in the Temescal Basin that DWR has identified as Disadvantaged Communities and Severely Disadvantaged Communities. The consultant team has talked with local community leaders to discuss strategies and best practices for conducting engagement with underrepresented communities and what community organizations will be important to partner with.

Hughes then overviewed the outreach materials being developed in preparation for the first public workshop. The Temescal GSA website (www.CoronaCA.gov/Groundwater) will serve as a hub for project information and updates. It will include a comment form for anyone to contribute input during the Temescal GSP process. The Temescal GSA fact sheet (see Appendix C) introduces broader groundwater concepts to bring public awareness to local groundwater resources in addition to information about SGMA and the Temescal GSP. The first public workshop is tentatively scheduled for September 29, 2020 and will be held virtually. See pages 17 through 24 in Appendix B for more information on outreach and involvement.

Discussion/Q&A

Hughes posed the following questions for discussion: 1) How can we reach more of your community members, constituents/other stakeholders, and the public in our pre-workshop outreach? 2) How might you be able to help us spread awareness of the first public workshop?

- The TAC discussed what stakeholders had already been identified. A working list has been developed that includes many agencies, businesses, private pumpers, and other stakeholders upstream and downstream, as well as those in neighboring basins. TAC members can suggest additional interested parties to add. The website, via the comment page, provides an additional option for anyone interested in signing up for updates.
- The TAC discussed if the project team had target numbers for engagement in underrepresented communities in mind. There are no target numbers for engagement.
- One question asked was, how many members of the public attended public meetings for other GSPs? A member of the consultant team stated that the public attendance at public meetings for other GSPs varies. Depending on the Basin, attendance has ranged from zero members of the public and several agency representatives to many members of the public and agency representatives.
- The idea of a focus group was also mentioned. One suggestion was to incentivize participation by offering gift cards or coupons. People in line at bi-weekly food drives at city hall could be engaged. Another idea was to encourage people to answer a one-question survey that drives them to the project website. TAC members discussed options for what that question could be.
- The TAC noted that the fact sheet was very good but might be a little too dense, and it could maybe be reduced to one-page with English on one side and Spanish on the other.

6. Role of the Technical Advisory Committee

Isaacson explained the role of the TAC and reviewed the TAC Protocols and Operating Principles document (see Appendix D), which was provided to TAC members before the meeting. The general purpose of the TAC is to provide input and guidance to the Temescal GSA and consultant team during

the development of the Temescal GSP. TAC members represent diverse groundwater interests and will work collaboratively to contribute input towards long-term sustainable management of the Temescal Basin, communicate with additional stakeholders and community members about the Temescal GSA, Temescal GSP process, and SGMA, review material and participate in ongoing discussions, and help to publicize public involvement activities. TAC members were asked to provide a general confirmation of the operating protocols and to reach out to the project team contact (Melissa Estrada-Maravilla) if they saw any red flags.

Discussion/Q&A

There were no questions or comments from the TAC members for this agenda item.

7. Public Comment

No members of the public provided comment.

8. Next Steps and Final Comments

Isaacson summarized next steps for the TAC members. Following this meeting, Estrada will send out the Draft Plan Area Chapter of the Temescal GSP for TAC members to review. The consultant team will continue preparing the technical analyses. Comments on the Draft Plan Area Chapter of the Temescal GSP are due to the GSA on September 4, 2020. Additional next steps are preparing for the upcoming public workshop tentatively scheduled for September 29, 2020 and the next TAC meeting on November 18, 2020.

Discussion/Q&A

- The time for the first public workshop was discussed. A start time before 6:00 p.m. would be good as it is difficult to conduct a virtual public workshop later in the evening. Also, the timing of future workshops could be alternated to see what works best.

Temescal Subbasin Groundwater Sustainability Agency

Technical Advisory Committee

August 19, 2020



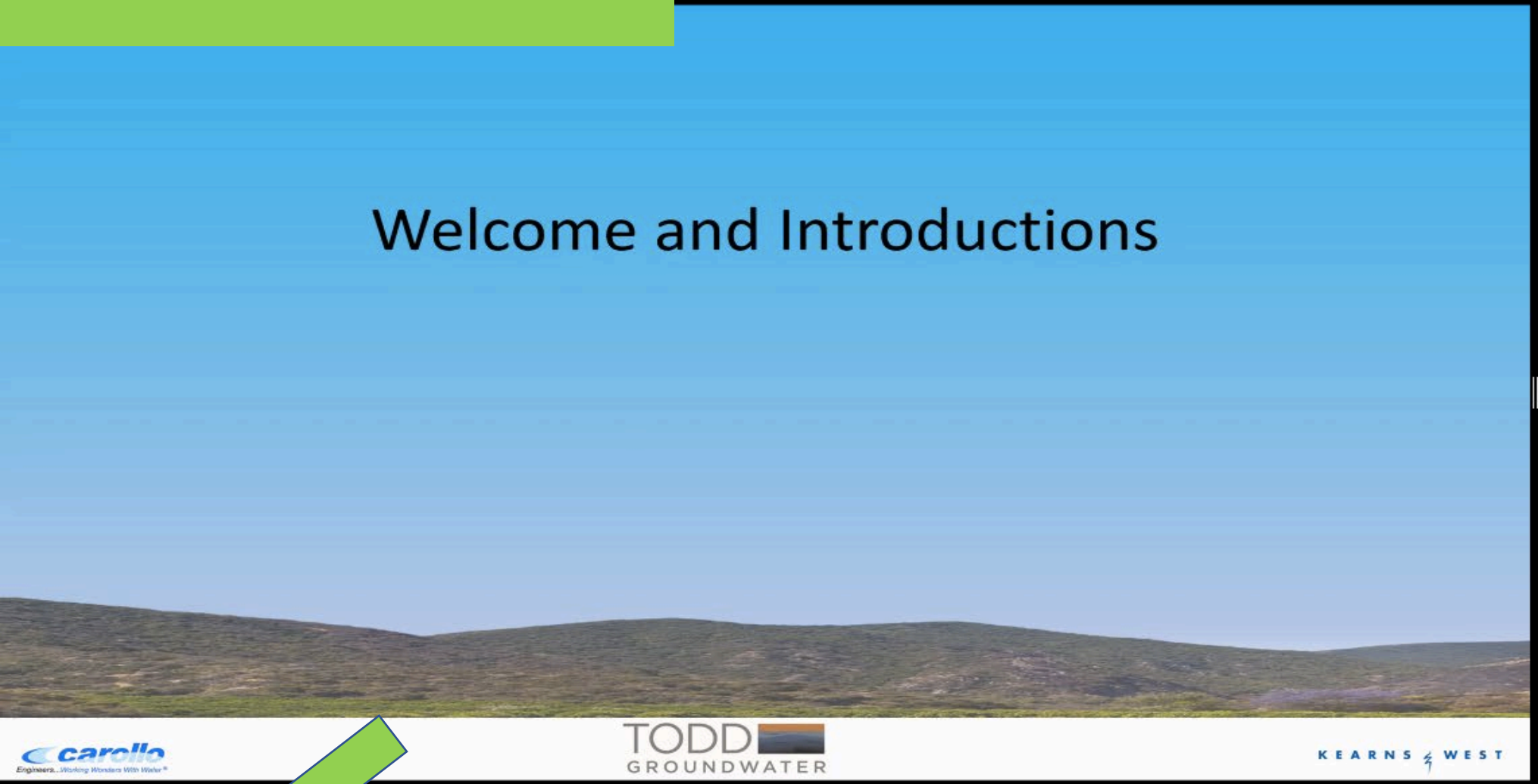
carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS WEST

You are viewing Jack Hughes's screen
View Options
Gallery View

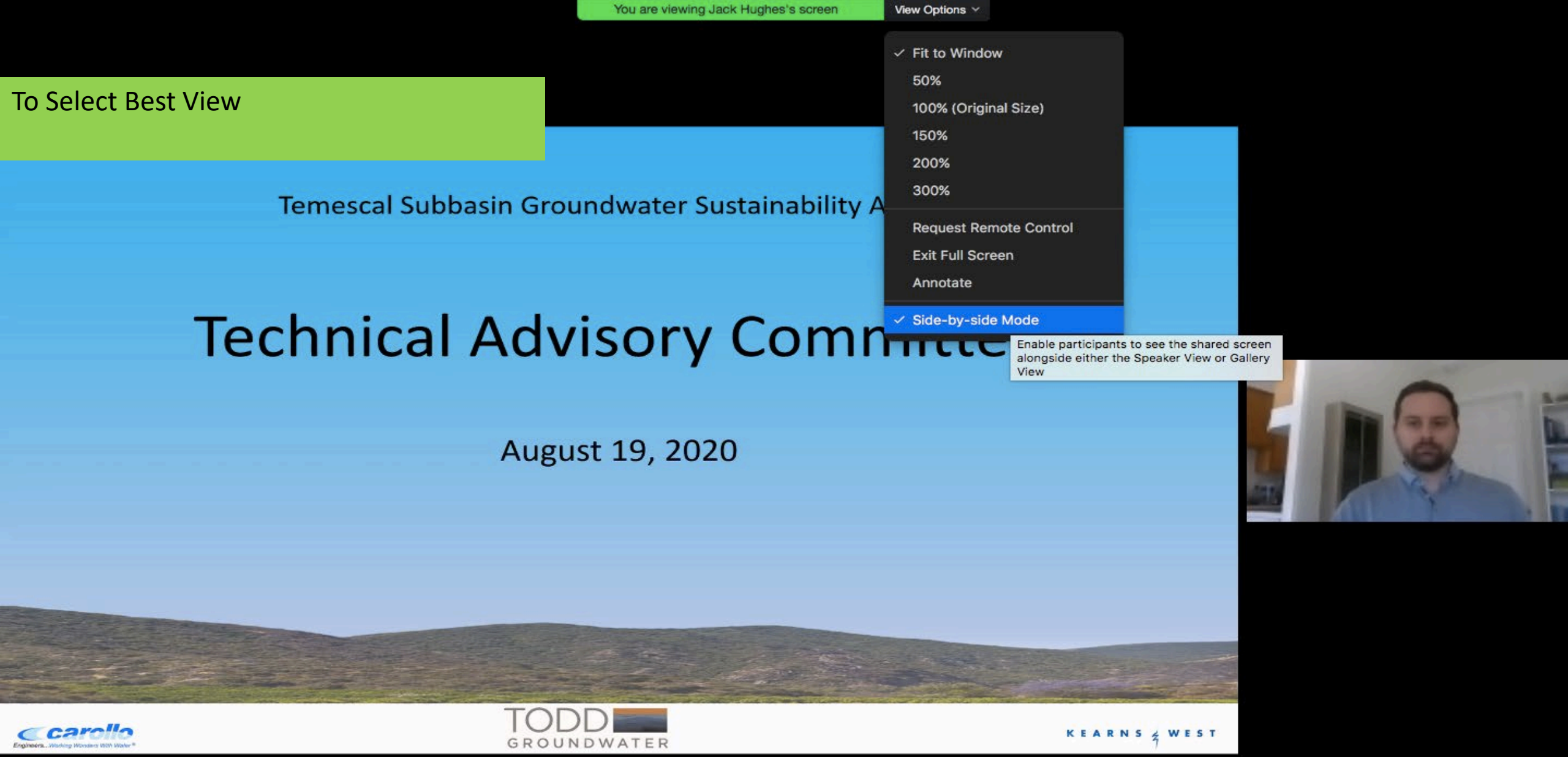
How to Mute and Start/Stop Video





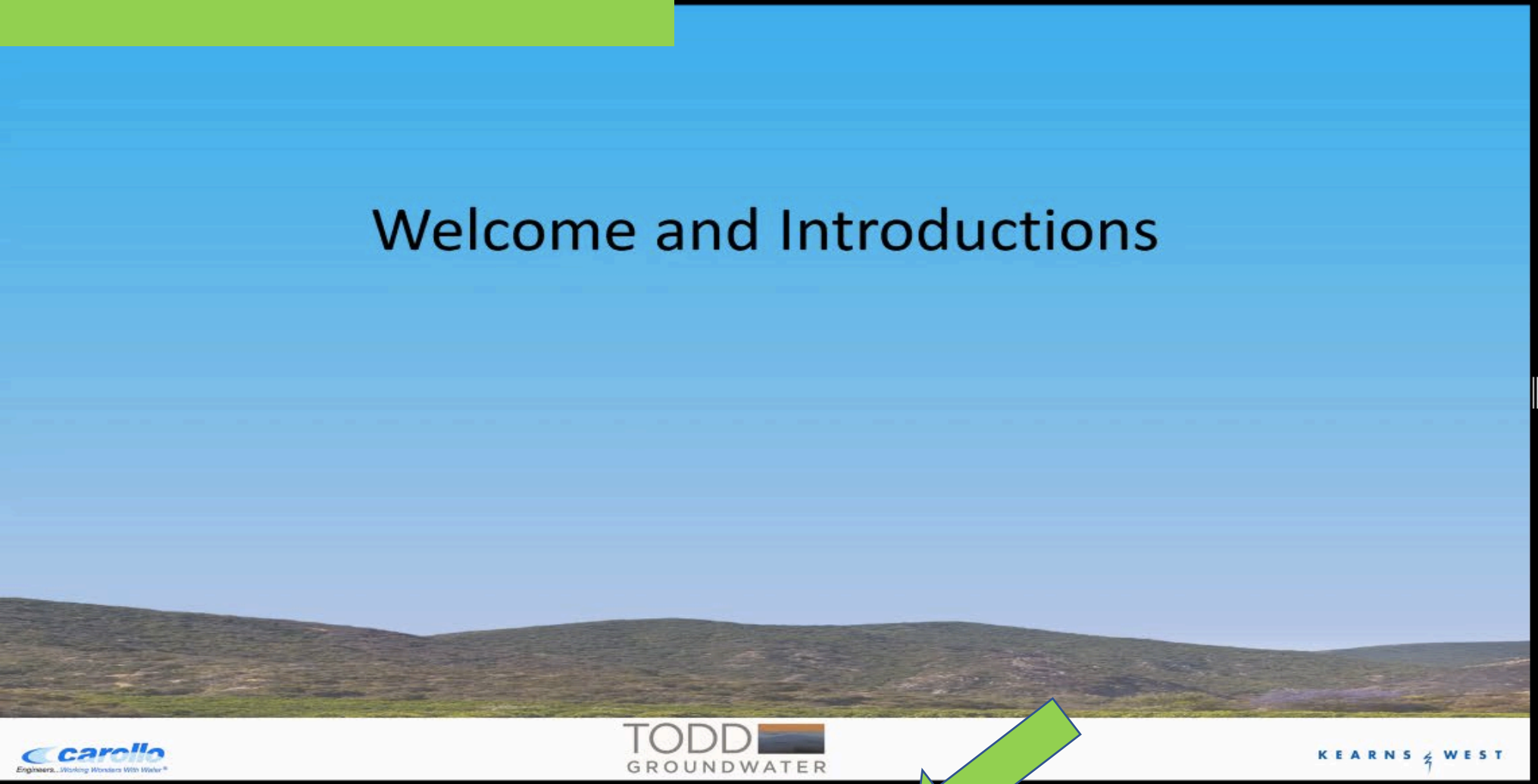
Unmute
Start Video
Participants
2
Chat
Share Screen
Record
Leave

To Select Best View



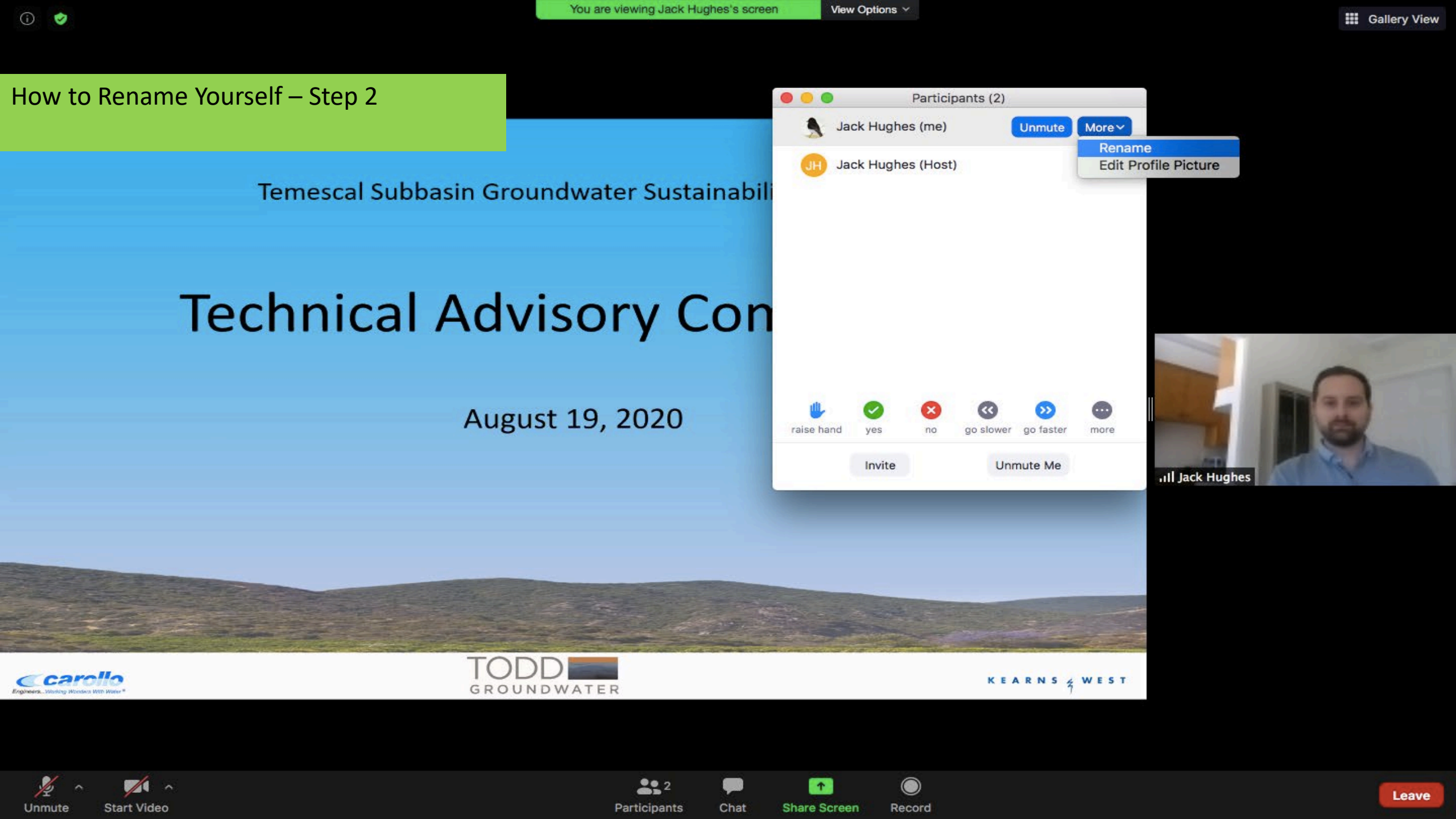
You are viewing Jack Hughes's screen
View Options
Gallery View

How to Rename Yourself – Step 1



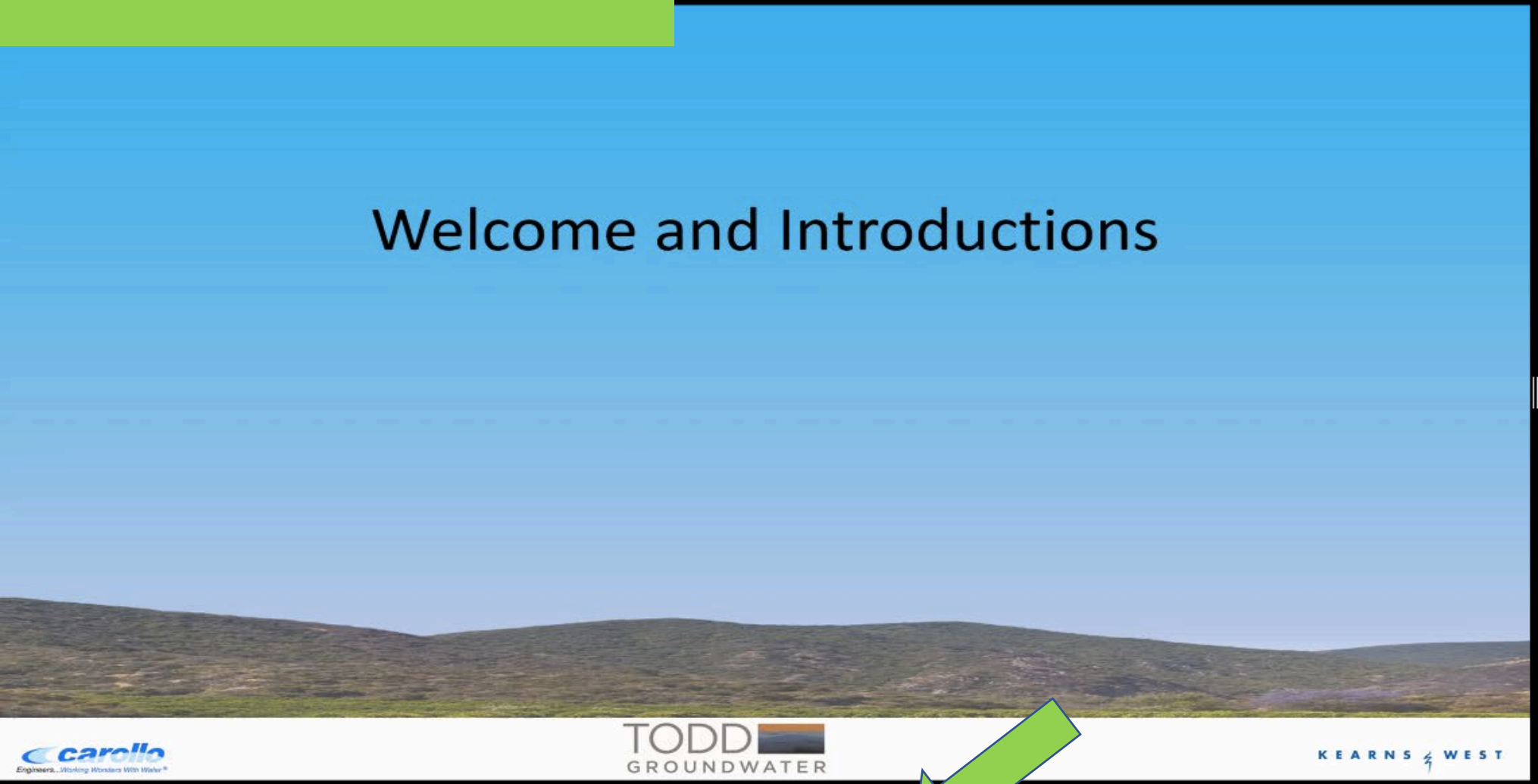


Unmute
Start Video
Participants
2
Chat
Share Screen
Record
Leave


You are viewing Jack Hughes's screen
View Options
Gallery View
How to Rename Yourself – Step 2
Temescal Subbasin Groundwater Sustainabili
Technical Advisory Con
August 19, 2020
Participants (2)
Jack Hughes (me)
Unmute
More
Rename
Edit Profile Picture
Jack Hughes (Host)
raise hand
yes
no
go slower
go faster
more
Invite
Unmute Me
Jack Hughes
carollo
TODD GROUNDWATER
KEARNS & WEST
Unmute
Start Video
Participants
2
Chat
Share Screen
Record
Leave

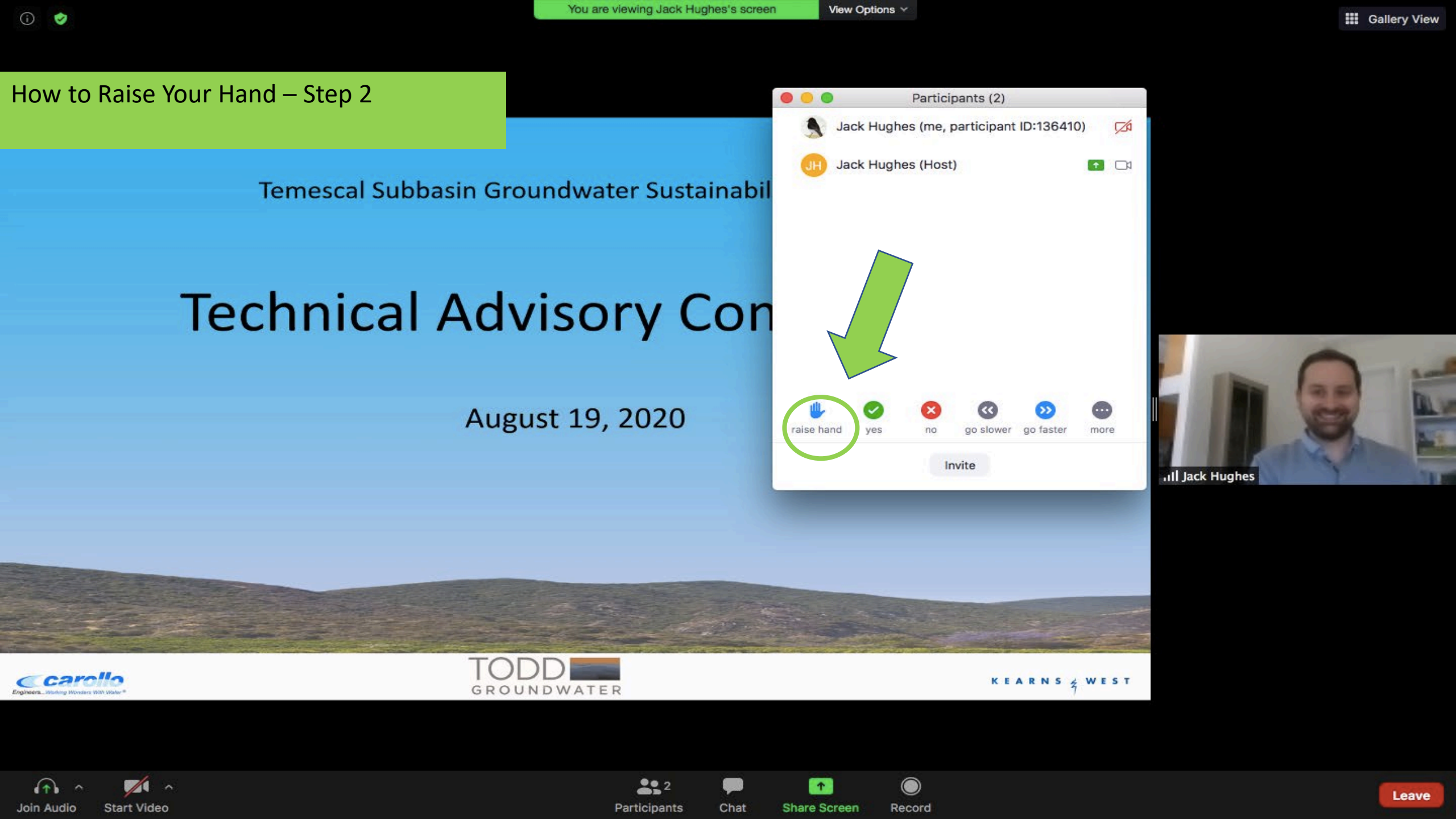
You are viewing Jack Hughes's screen
View Options
Gallery View

How to Raise Your Hand– Step 1





Unmute
Start Video
2
Participants
Chat
Share Screen
Record
Leave


You are viewing Jack Hughes's screen
View Options
Gallery View
How to Raise Your Hand – Step 2
Temescal Subbasin Groundwater Sustainabil
Technical Advisory Con
August 19, 2020
Participants (2)
Jack Hughes (me, participant ID:136410)
Jack Hughes (Host)
raise hand
yes
no
go slower
go faster
more
Invite
Jack Hughes
carollo
Engineers...Working Wonders With Water
TODD GROUNDWATER
KEARNS & WEST
Join Audio
Start Video
Participants
2
Chat
Share Screen
Record
Leave

Welcome and Introductions



Introductions

- Name
- Who you are representing
- What have you been pleasantly surprised by recently?



Why the Temescal Groundwater Sustainability Agency Needs You



carollo
Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS WEST

Tips for a Productive Discussion

- Let one person speak at a time
- Help make sure everyone gets equal time to give input
- Keep your input concise so others have time to participate
- Actively listen to others and seek to understand their perspectives
- Offer ideas to address questions and concerns raised by others



Overview of Meeting Agenda



Meeting Agenda

1. Welcome and Introductions
2. Overview of Meeting Agenda
3. Orientation to the Sustainable Groundwater Management Act
   - Sustainable Groundwater Management Act (SGMA) Overview
   - Temescal Subbasin GSA
   - Discussion/Q&A
4. Summary of GSP Workplan and Schedule
   - GSP Workplan and Schedule
   - Discussion/Q&A
5. Outreach and Involvement
   - Outreach and Stakeholder Involvement Plan
   - Focus on Disadvantaged Community Engagement
   - Website Overview
   - Fact Sheets
   - Public Workshop 1
   - Discussion/Q&A
6. Role of the Technical Advisory Committee
   - Technical Advisory Committee (TAC) formation and purpose
   - Draft TAC Protocols and Operating Principles and Confirmation
   - Discussion of TAC roles and responsibilities
7. Public Comment
8. Next Steps and Final Comments

Orientation to the Sustainable Groundwater Management Act



Sustainable Groundwater Management Act (SGMA)

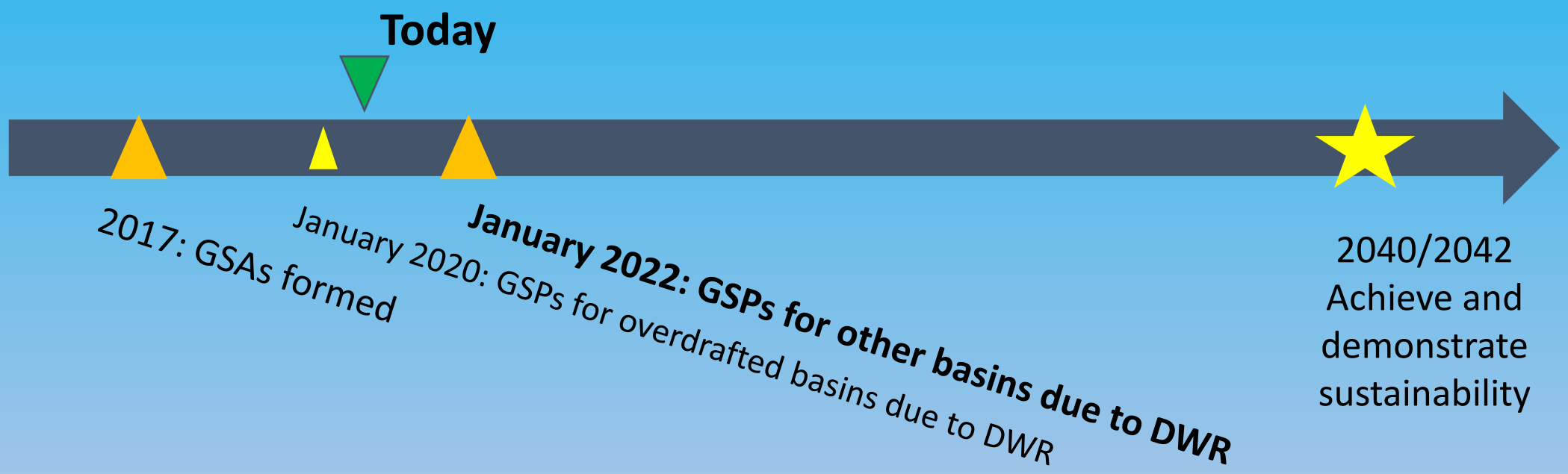
Landmark legislation signed into law in 2014

- Provides framework for sustainable groundwater management
- Purpose is to facilitate local management of groundwater
- State assistance, and intervention if necessary

Includes comprehensive requirements for:

- Forming groundwater sustainability agencies (GSA)
- Preparing groundwater sustainability plans (GSP)
- Meeting deadlines

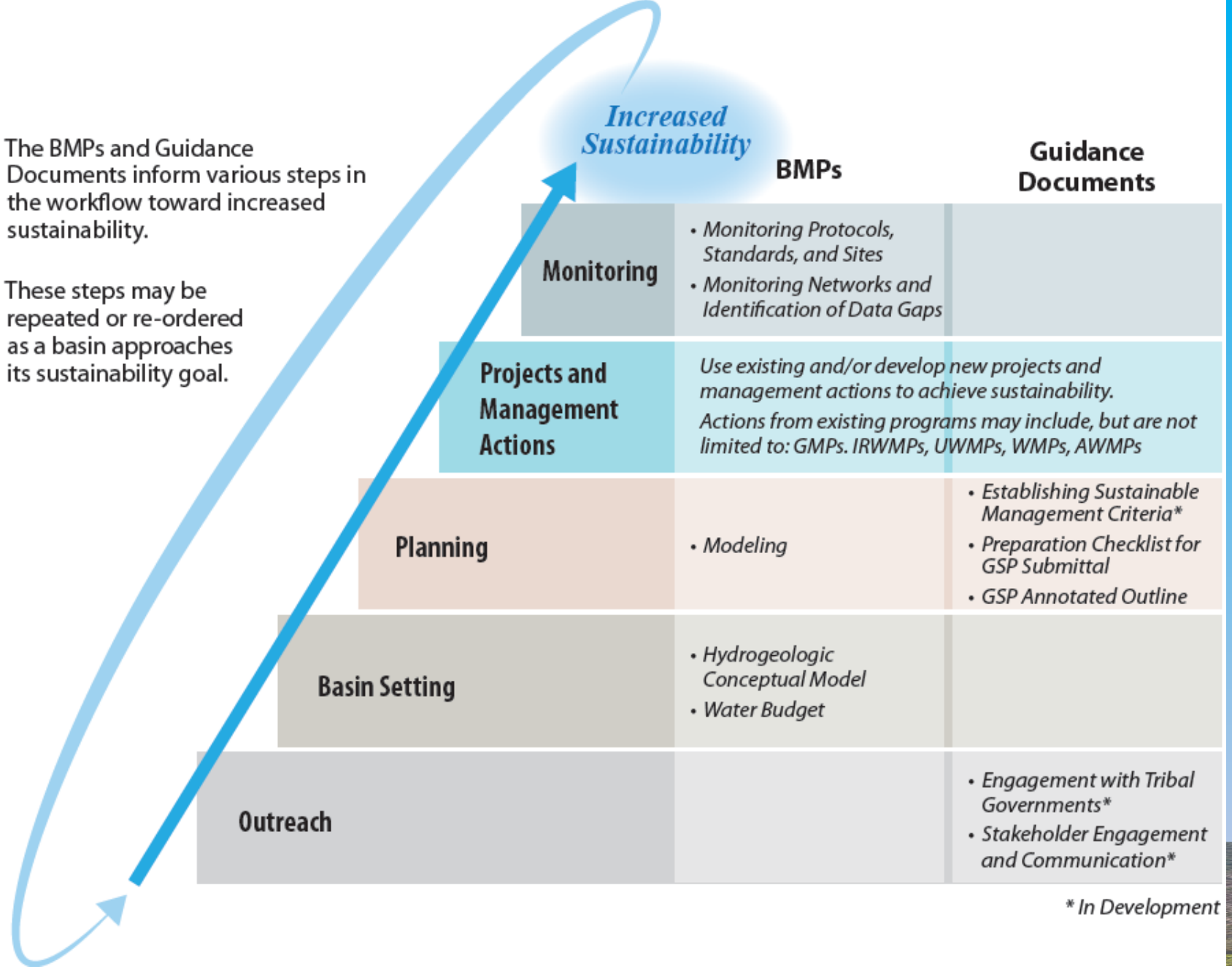
SGMA has a required timeline



Achieving sustainable groundwater management

The BMPs and Guidance Documents inform various steps in the workflow toward increased sustainability.

These steps may be repeated or re-ordered as a basin approaches its sustainability goal.



* In Development



carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS WEST

What is Sustainable Groundwater Management?

- The management and use of groundwater in a manner that can be maintained without causing undesirable results
- Evaluated with respect to specific Sustainability Indicators
- Locally defined



Sustainability Indicators



Chronic lowering of groundwater levels



Reduction of groundwater storage



Degradation of water quality



Depletions of interconnected surface water affecting beneficial uses



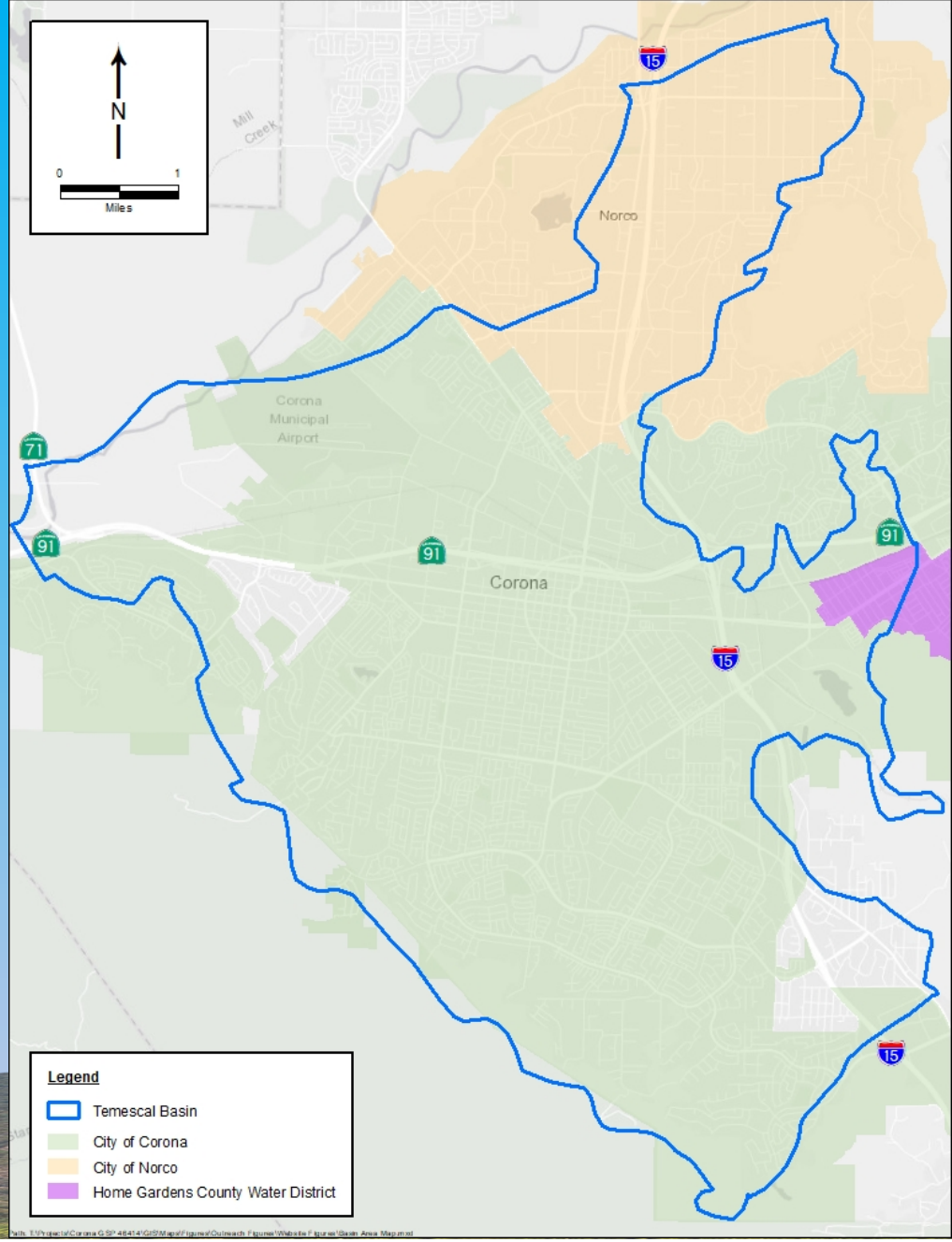
Land subsidence affecting land uses



Seawater intrusion (not applicable here)

The Temescal Basin

- DWR categorized as a Medium Priority Basin
- Contiguous and connected

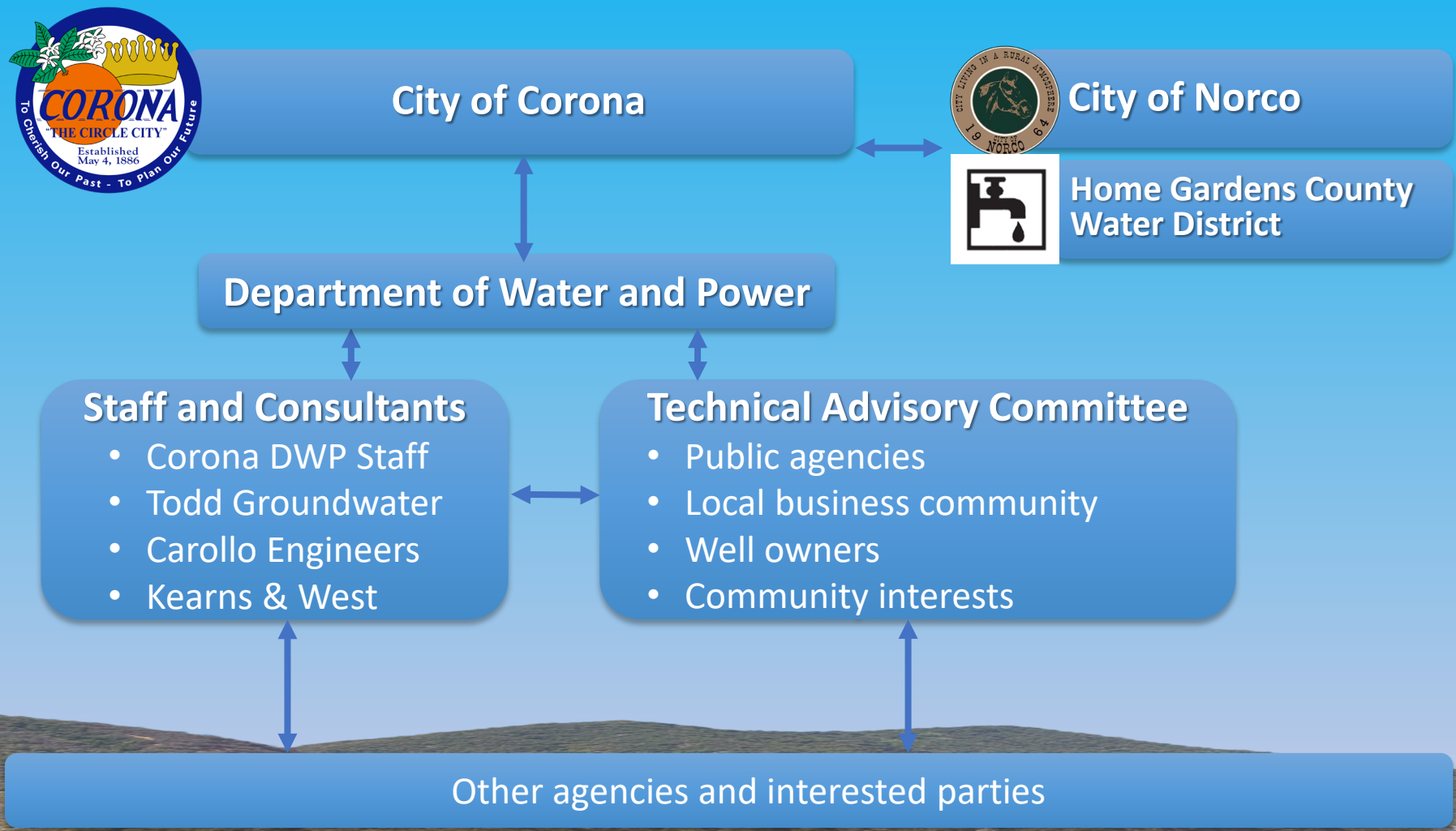


Groundwater Sustainability Agency for the Temescal Basin

- Managed together historically
- Corona, Norco, and Home Gardens County Water District formed GSA led by Corona
- Allows for preparation of one, unified GSP



GSA Organization



To Date, the Groundwater Sustainability Agency

- Awarded grant for GSP preparation
- Assembled GSP team
- Initiated technical work on GSP
- Created outreach plan
- Formed TAC
- Creating new SGMA section on DWP website



GRANT AGREEMENT BETWEEN THE STATE OF CALIFORNIA
(DEPARTMENT OF WATER RESOURCES) AND
CITY OF CORONA
AGREEMENT NUMBER 4600012652
2017 PROPOSITION 1 SUSTAINABLE GROUNDWATER PLANNING (SGWP) GRANT

THIS GRANT AGREEMENT is entered into by and between the Department of Water Resources of the State of California, herein referred to as the "State" or "DWR" and the City of Corona, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof, herein referred to as the "Grantee," which parties do hereby agree as follows:

1) PURPOSE. The State shall provide funding from the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1) to assist the Grantee in financing the planning and/or selected project activities (Project) that will improve sustainable groundwater management, pursuant to Water Code Section 79700 et seq. The provision of State funds pursuant to this Agreement shall not be construed or interpreted to mean that the Groundwater Sustainability Plan (GSP), or any components of the GSP, implemented in accordance with the Work Plan as set forth in Exhibit A, will be: adopted by the applicable Groundwater Sustainability Agency (GSA); obtain the necessary desirable results of Sustainable Management Criteria; or, meet all of the evaluation and assessment criteria when submitted to the Department of Water Resources as required by the Sustainable Groundwater Management Act and implementing regulations.
2) TERM OF GRANT AGREEMENT. The term of this Grant Agreement begins on the date this Grant Agreement is executed by the State, through final payment plus three (3) years unless otherwise terminated or amended as provided in this Grant Agreement. However, all work shall be completed in accordance with the Schedule as set forth in Exhibit C.
3) GRANT AMOUNT. The maximum amount payable by the State under this Grant Agreement shall not exceed $732,338.
4) GRANTEE COST SHARE. The Grantee is required to provide a Local Cost Share (non-State funds) of not less than 50 percent of the Total Project Cost. The cost share requirement for projects benefiting a Severely Disadvantaged Community (SDAC), Disadvantaged Community (DAC), or an Economically Distressed Areas (EDA) may be waived or reduced. The Grantee agrees to provide a Local Cost Share (non-State funds) for the amount as documented in Exhibit B (Budget). Local Cost Share may include Eligible Project Costs directly related to Exhibit A incurred after January 1, 2015.
5) BASIC CONDITIONS. The State shall have no obligation to disburse money for a project under this Grant Agreement until the Grantee has satisfied the following conditions (if applicable):
    1. Prior to execution of this Grant Agreement, selected applicants (Groundwater Sustainability Agency) for GSP Development projects must submit evidence of a notification to the public and DWR prior to initiating development of a GSP in compliance with California Code of Regulations, title 23, Section 350 et seq. (GSP Regulations) and Water Code Section 10727.8.
    2. The Grantee must demonstrate compliance with all relevant eligibility criteria as set forth on pages 7 and 8 of the 2015 Grant Program Guidelines for the SGWP Grant Program.
    3. For the term of this Grant Agreement, the Grantee submits timely reports and all other deliverables as required by Paragraph 16, "Submission of Reports" and Exhibit A.
6) DISBURSEMENT OF FUNDS. The State will disburse to the Grantee the amount approved, subject to the availability of funds through normal State processes. Notwithstanding any other provision of this Grant Agreement, no disbursement shall be required at any time or in any manner which is in violation of, or in conflict with, federal or state laws, rules, or regulations, or which may require any rebates to the federal government, or any loss of tax-free status on state bonds, pursuant to any federal statute or regulation. Any and all money disbursed to the Grantee under this Grant Agreement shall be deposited in a non-interest bearing account and shall be used solely to pay Eligible Project Costs.

Discussion / Q&A

- What have you heard about groundwater and/or SGMA and what do you think are some important groundwater management issues?
- Are you aware of any data or studies we should review during GSP preparation?

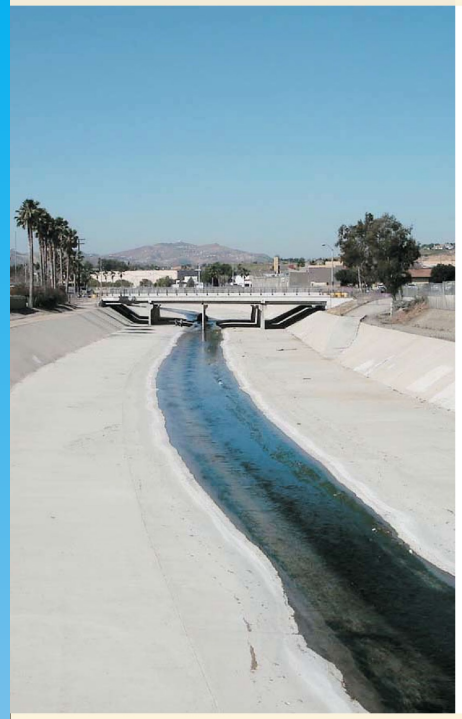


Summary of GSP Workplan and Schedule



The GSP will Build on Existing Management

- Local groundwater
- Imported water
- Water recycling and water conservation
- Monitoring
- Collaboration with other local agencies
- Transition to SGMA requirements



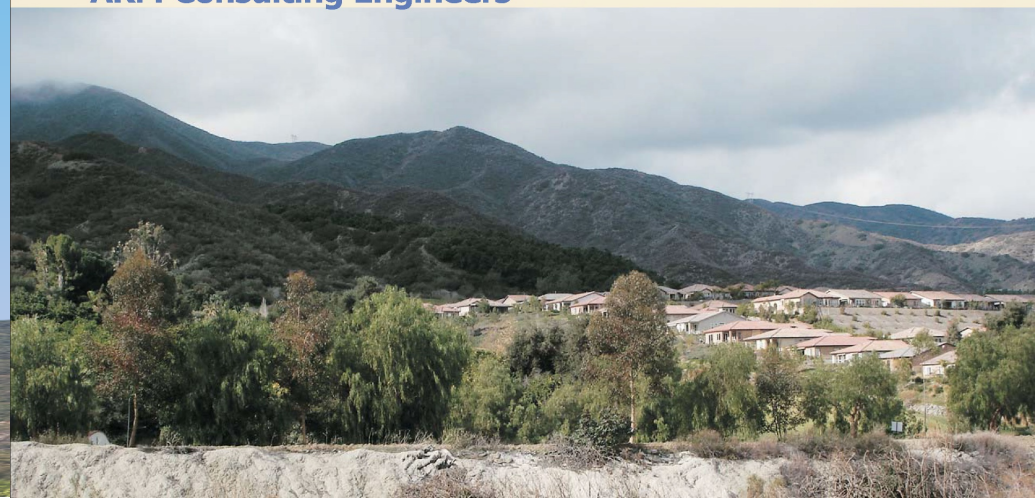
AB3030

Groundwater Management Plan

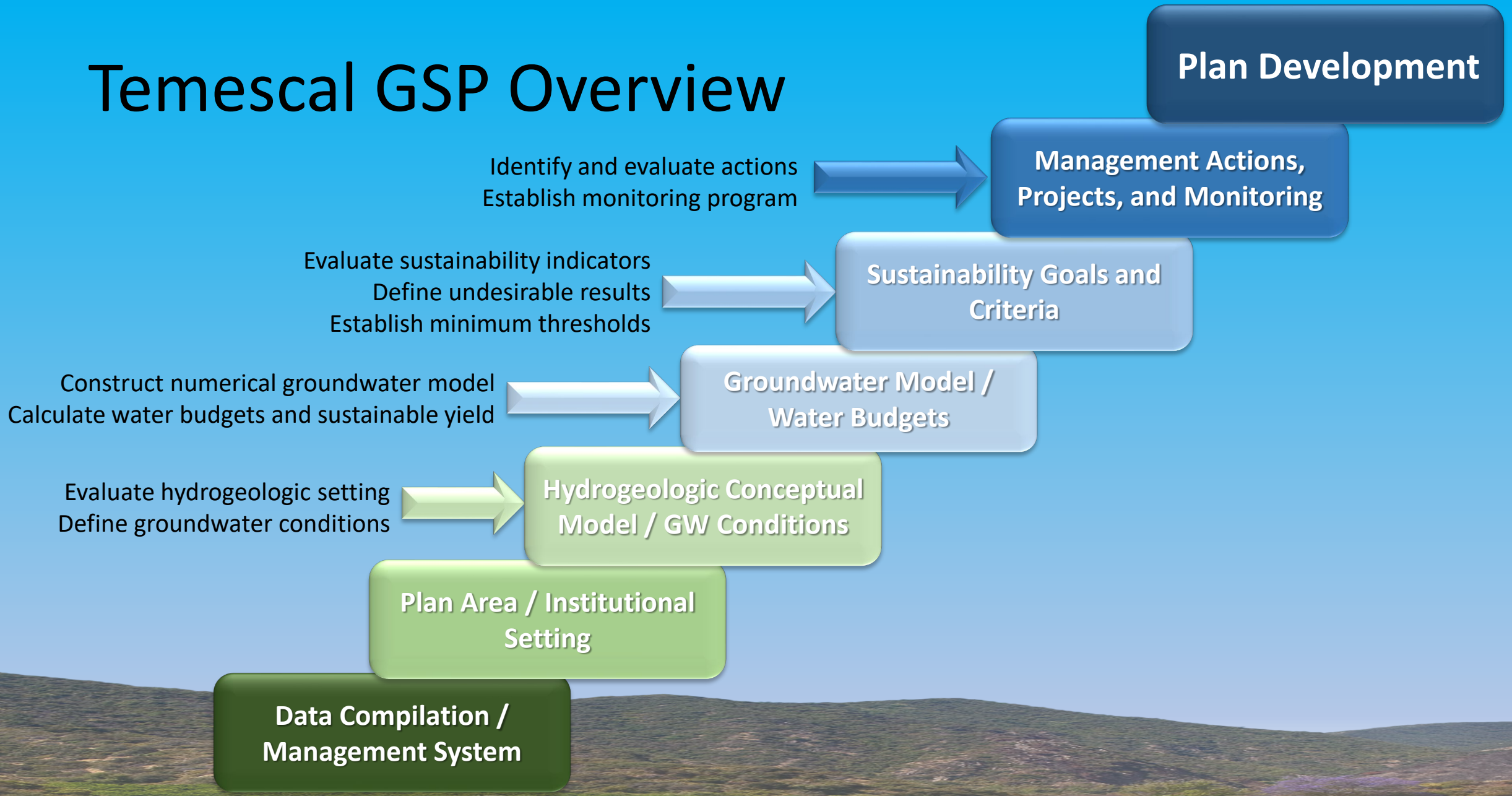
Prepared for
City of Corona

June 2008

Todd Engineers
AKM Consulting Engineers



Temescal GSP Overview



Sustainability Indicator Requirements



- Groundwater elevation decline based on historical trends, water year type, and projected water use in the basin



- Sustainable yield, calculated based on historical trends, water year type, and projected water use in the basin



- Number of supply wells, volume of water, or location of an isocontour exceeding constituents of concern, considering state and federal standards



- Depletion that has adverse impacts on beneficial use of surface water supported by the location, quantity, and timing of depletions; assumes use of a numerical model.



- Rate and extent of subsidence that interferes with surface land use supported by identification of land/property interests affected or likely to be affected.

Considerations for Temescal



- Historic low levels? Consider beneficial uses of wells; problems during the recent drought? **– Must be water levels in representative wells.**



- Use Water Level criteria? Develop operational range of storage with an emergency supply? **– Related to water levels.**



- Title 22, basin plan objectives, GAMA, GeoTracker, SNMP?

– Should coordinate with existing regional programs.



- Interconnected Surface Water and Groundwater Dependent Ecosystems (GDEs), Prado area? **– Modeling to identify potential undesirable results.**



- Subsidence does not currently interfere with land uses

– Can take advantage of statewide satellite estimates.

GSP Schedule



2021

2020

TAC Meetings and Workshops

TAC Meeting 4 – May 19, 2021

Draft GSP Presentation (Q3 2021)

TAC Meeting 3 – February 17, 2021

Public Workshop 3 Management Actions (Q2 2021)

Public Workshop 2 Sustainability Criteria (Q1 2021)

TAC Meeting 2 – November 18, 2020

Public Workshop 1 Kickoff and Introduction to SGMA (Q3 2020)

TAC Meeting 1 – August 19, 2020



GSP Workplan and Schedule Discussion/Q&A

Questions?

Comments?



Outreach and Stakeholder Involvement



Outreach and Stakeholder Involvement Plan Purpose

- Provide a framework for integrating public and stakeholder outreach and involvement into GSP preparation.
- Meet SGMA requirements
  - GSAs must consider the interests of all beneficial uses and users of groundwater and provide opportunities for public engagement and active involvement of diverse social, cultural, and economic elements of the population.

Outreach and Stakeholder Involvement Plan Objectives

- ***Inform*** all stakeholders of the GSP development process, including purpose, opportunities and issues, core recommendations, and timeline.
- Provide ***meaningful opportunities*** for stakeholders and the public to learn, ask questions, and provide input.
- Involve the many ***diverse communities and stakeholders*** of Corona, Norco, and Home Gardens, recognizing that different approaches may be needed to reach specific populations like Disadvantaged Communities, and flexibility and adaptation in approach may be required.
- Ensure a ***transparent process*** where stakeholders and the public can understand what important discussions are taking place, how they can participate in them, and how input is being used.

Outreach and Stakeholder Involvement Plan

Stakeholder Categories

- Agriculture
- California Statewide Groundwater Elevation Monitoring Agencies
- Businesses and Development
- Disadvantaged Communities
- Domestic Well Owners
- Environmental and Conservation
- Extractive Industry
- Federal Government Agencies
- Groundwater Right Holders
- Industrial Well Operators
- Land Use Planning Agencies
- Local Water Districts
- Municipal Well Operators
- Private Water Users
- Regulatory Agencies
- Surface Water Users

Outreach and Stakeholder Involvement Plan

Temescal Subbasin GSP Outreach and Stakeholder Involvement Process

	Step 1 **Launch Project** Summer 2020	Step 2 **Conduct Baseline Studies** Summer and Fall 2020	Step 3 **Build Water Budget and Numerical Model** Fall and Winter 2020	Step 4 **Define Sustainability Goal and Criteria** Winter 2021	Step 5 **Prepare Draft GSP** Spring 2021	Step 6 **Review Draft GSP and Adopt Final GSP** Summer – Winter 2021
Stakeholder and Public Dialogue Focus	Announce project launch.	Provide info on project purpose and methodology, and role of stakeholder involvement.	Share information regarding Step 2 activities and gather feedback on water budget and modeling, and sustainability criteria.	Review draft sustainability criteria and gather feedback on management actions.	Gather feedback on draft management actions and inform about implementation and monitoring.	Comments on Draft GSP Final GSP Submittal to DWR



Outreach and Stakeholder Involvement Plan Activities

- Pre-Workshop Outreach
- Public Workshops
- Technical Advisory Committee Meetings
- City Council and Board of Directors Meeting Presentations
- Public Comment Period



Temescal Subbasin GSP Outreach and Stakeholder Involvement Process

	Step 1 **Launch Project** Summer 2020	Step 2 **Conduct Baseline Studies** Summer and Fall 2020	Step 3 **Build Water Budget and Numerical Model** Fall and Winter 2020	Step 4 **Define Sustainability Goal and Criteria** Winter 2021	Step 5 **Prepare Draft GSP** Spring 2021	Step 6 **Review Draft GSP and Adopt Final GSP** Summer – Winter 2021
Stakeholder and Public Dialogue Focus	Announce project launch.	Provide info on project purpose and methodology, and role of stakeholder involvement.	Share information regarding Step 2 activities and gather feedback on water budget and modeling, and sustainability criteria.	Review draft sustainability criteria and gather feedback on management actions.	Gather feedback on draft management actions and inform about implementation and monitoring.	Comments on Draft GSP Final GSP Submittal to DWR
Stakeholder and Public Involvement	Community Leader/ Organization Interviews Stakeholder Identification Outreach and Stakeholder Involvement Communications Plan	TAC Meeting #1 Updates at City Council/Board Meetings Pre-Workshop Outreach Round 1 Public Workshop #1 Kickoff Meeting	TAC Meeting #2 Updates at City Council/Board Meetings	TAC Meeting #3 Updates at City Council/Board Meetings Pre-Workshop Outreach Round 2 Public Workshop #2	TAC Meeting #4 Updates at City Council/Board Meetings Pre-Workshop Outreach Round 3 Public Workshop #3	Pre-Workshop Outreach Round Public Workshop #4 Public notice of process and availability of review draft. 90 Day Comment Period & Adoption

City Website Page and Social Media

carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST

Focus on Underrepresented Community Engagement



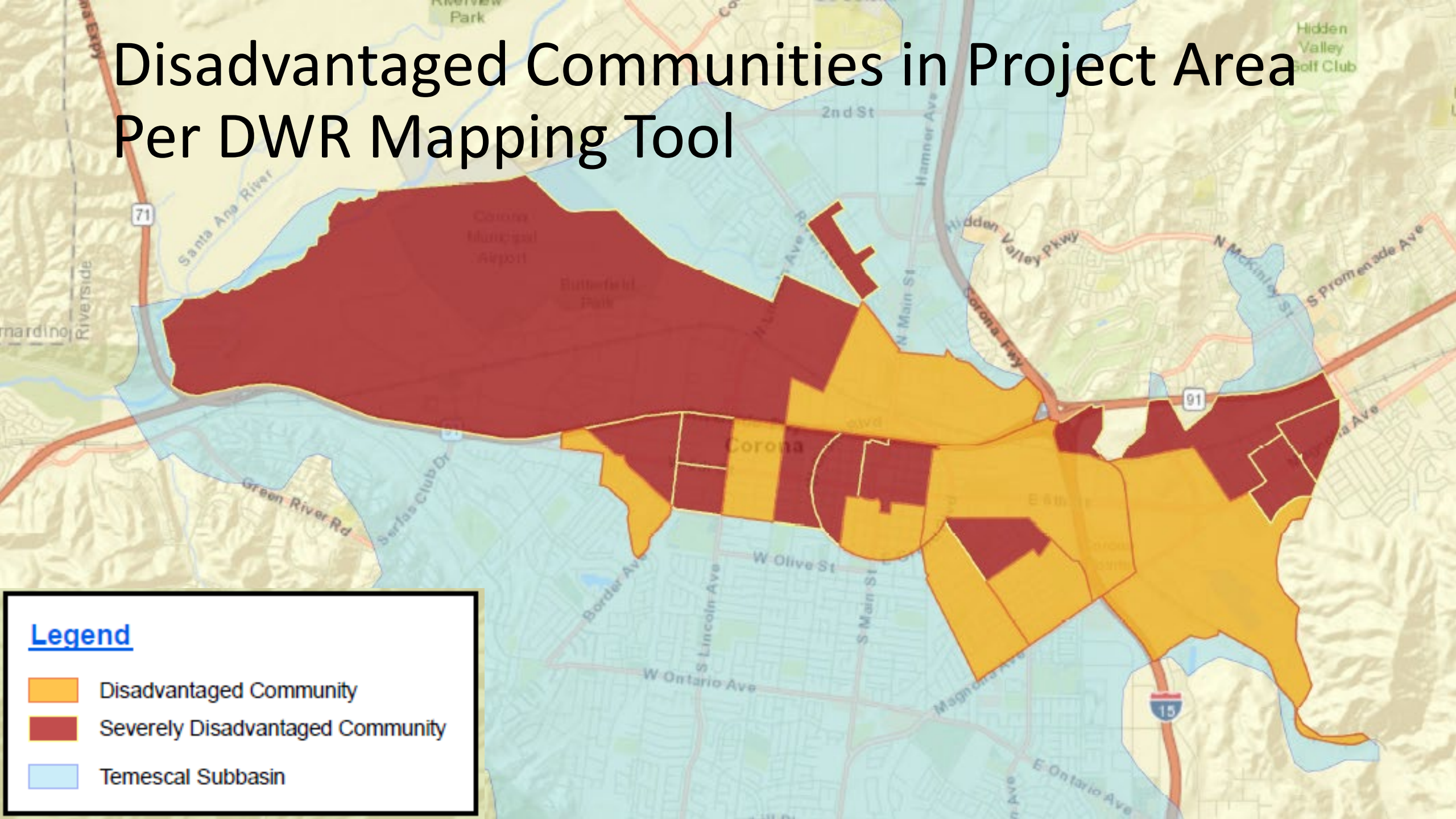
Underrepresented Community Engagement Definition

Underrepresented Communities are:

- Disadvantaged Communities characterized by an annual median household income less than 80% of the California statewide median household income.
- Severely Disadvantaged Communities are characterized by an annual median household income less than 60% of the California statewide median household income.



Disadvantaged Communities in Project Area Per DWR Mapping Tool



Temescal Subbasin GSP Outreach and Stakeholder Involvement Process

	Step 1 **Launch Project** Summer 2020	Step 2 **Conduct Baseline Studies** Summer and Fall 2020	Step 3 **Build Water Budget and Numerical Model** Fall and Winter 2020	Step 4 **Define Sustainability Goal and Criteria** Winter 2021	Step 5 **Prepare Draft GSP** Spring 2021	Step 6 **Review Draft GSP and Adopt Final GSP** Summer – Winter 2021
Stakeholder and Public Dialogue Focus	Announce project launch.	Provide info on project purpose and methodology, and role of stakeholder involvement.	Share information regarding Step 2 activities and gather feedback on water budget and modeling, and sustainability criteria.	Review draft sustainability criteria and gather feedback on management actions.	Gather feedback on draft management actions and inform about implementation and monitoring.	Comments on Draft GSP Final GSP Submittal to DWR
Stakeholder and Public Involvement	Community Leader/ Organization Interviews Stakeholder Identification Outreach and Stakeholder Involvement Communications Plan	TAC Meeting #1 Updates at City Council/Board Meetings Pre-Workshop Outreach Round 1 Public Workshop #1 Kickoff Meeting	TAC Meeting #2 Updates at City Council/Board Meetings	TAC Meeting #3 Updates at City Council/Board Meetings Pre-Workshop Outreach Round 2 Public Workshop #2	TAC Meeting #4 Updates at City Council/Board Meetings Pre-Workshop Outreach Round 3 Public Workshop #3	Pre-Workshop Outreach Round Public Workshop #4 Public notice of process and availability of review draft. 90 Day Comment Period & Adoption

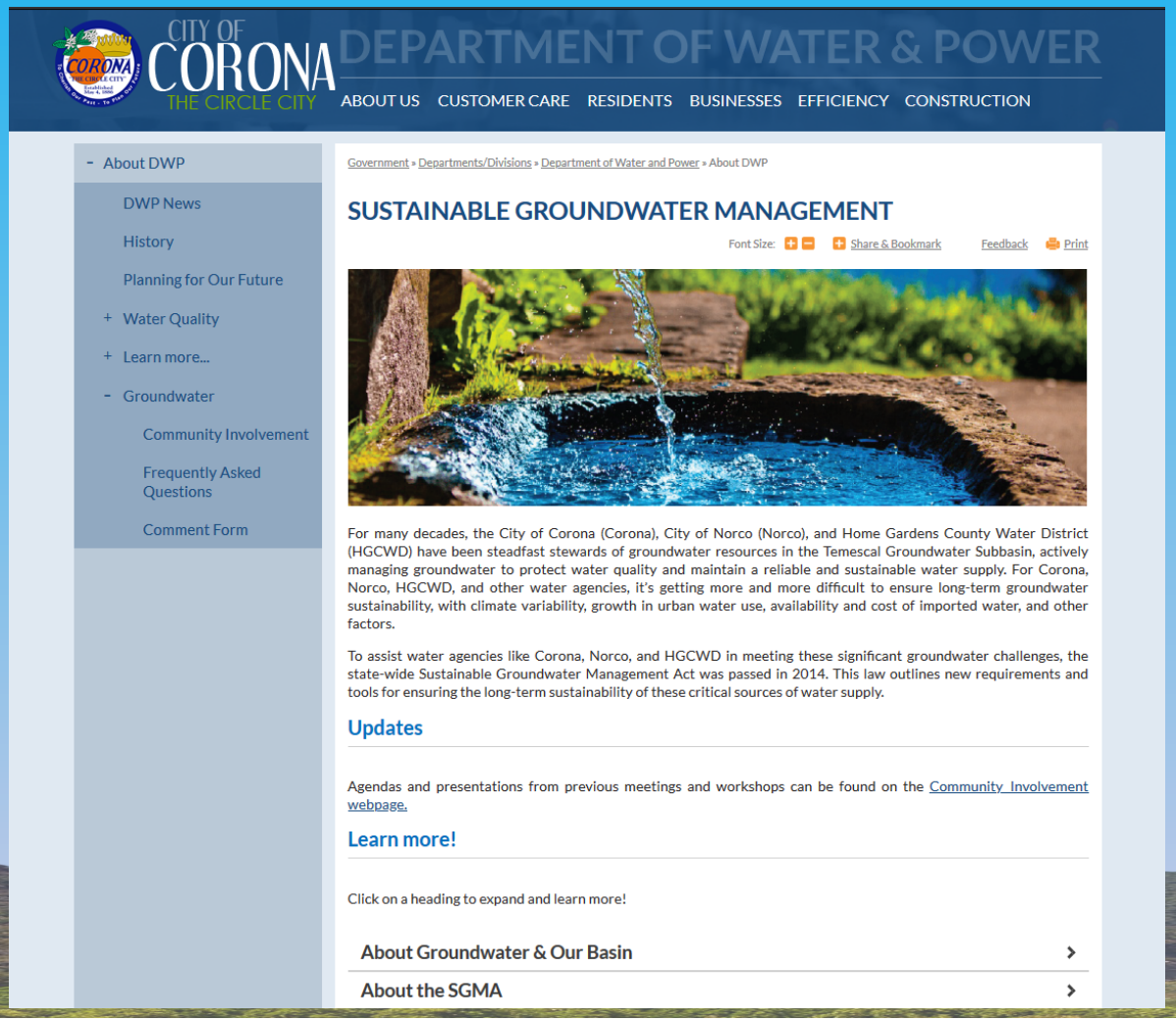
City Website Page and Social Media

carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST

Website



CITY OF CORONA
THE CIRCLE CITY
DEPARTMENT OF WATER & POWER

ABOUT US | CUSTOMER CARE | RESIDENTS | BUSINESSES | EFFICIENCY | CONSTRUCTION

- About DWP
  - DWP News
  - History
  - Planning for Our Future
  - + Water Quality
  - + Learn more...
  - - Groundwater
    - Community Involvement
    - Frequently Asked Questions
    - Comment Form

Government » Departments/Divisions » Department of Water and Power » About DWP

SUSTAINABLE GROUNDWATER MANAGEMENT

Font Size: Share & Bookmark Feedback Print

For many decades, the City of Corona (Corona), City of Norco (Norco), and Home Gardens County Water District (HGCWD) have been steadfast stewards of groundwater resources in the Temescal Groundwater Subbasin, actively managing groundwater to protect water quality and maintain a reliable and sustainable water supply. For Corona, Norco, HGCWD, and other water agencies, it's getting more and more difficult to ensure long-term groundwater sustainability, with climate variability, growth in urban water use, availability and cost of imported water, and other factors.

To assist water agencies like Corona, Norco, and HGCWD in meeting these significant groundwater challenges, the state-wide Sustainable Groundwater Management Act was passed in 2014. This law outlines new requirements and tools for ensuring the long-term sustainability of these critical sources of water supply.

Updates

Agendas and presentations from previous meetings and workshops can be found on the Community Involvement webpage.

Learn more!

Click on a heading to expand and learn more!

- About Groundwater & Our Basin
- About the SGMA

Fact Sheet

TEMESCAL GSA

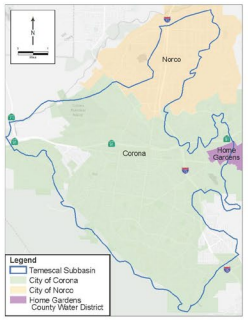
GROUNDWATER FOR PEOPLE, THE ENVIRONMENT, AND THE FUTURE

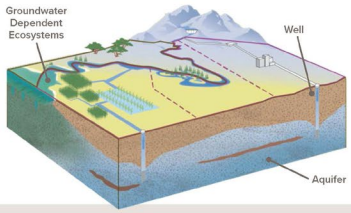
GET INVOLVED! Community input is needed! We want your help to create an effective plan for the future of our groundwater. Visit **CoronaCA.gov/Groundwater** or send an email to **Groundwater@CoronaCA.gov** to attend a workshop or learn more!

THE WATER BENEATH YOUR FEET AND IN YOUR FAUCET

You may not know it, but if you live in Corona, Norco, or Home Gardens, you are likely using groundwater that comes from the **Temescal Basin**. Groundwater from the Temescal Basin and other local groundwater basins, along with water purchased from other areas, is treated and blended together. It then arrives as tap water at your home or business.

The groundwater beneath your feet is an important local resource that will be even more important in the future. On the other side of this factsheet, you can learn more about who manages groundwater in the Temescal Basin and how you can get involved in protecting local groundwater for your community and all who depend on it.





WHAT IS GROUNDWATER?

Groundwater is an important source of water stored in the earth beneath our feet, in spaces between sand, soils, and fractured rock known as an **aquifer**. The areas of the most productive aquifers in California have been defined as **groundwater basins**, which can extend for many miles. The Temescal Basin covers nearly 66 square miles.

WHO USES GROUNDWATER?

Groundwater from aquifers is drawn out by pumps. Cities and water districts pump groundwater from **wells** to supply to businesses and homes. People in rural areas may have their own wells for personal use and/or to water crops. Groundwater also has many uses in manufacturing and industry. It can be used to process, wash, cool, or transport a product.

Groundwater is important to the environment, it flows to and from wetlands, springs, creeks, lakes, and other bodies of water. The plants and animals that live near or in these bodies of water sometimes depend on it for their survival. These areas are called **Groundwater Dependent Ecosystems**.

TEMESCAL GSA

GROUNDWATER FOR PEOPLE, THE ENVIRONMENT, AND THE FUTURE



GROUNDWATER MANAGEMENT

For many decades, the City of Corona, City of Norco, and Home Gardens County Water District have carefully managed groundwater in the Temescal Basin. They have made sure that there is enough clean and drinkable water for the communities that need it. This has become more of a challenge due to changes in climate, the cost of importing water, and the fact that more water is needed because communities are growing. To help all stewards of groundwater plan for these changes, the state-wide **Sustainable Groundwater Management Act** was passed in 2014.

The Sustainable Groundwater Management Act or "SGMA" is a California law that gives local agencies new tools for managing groundwater and planning for the future. The City of Corona, City of Norco, and Home Gardens County Water District have formed the Temescal Subbasin Groundwater Sustainability Agency (Temescal GSA) in order to make a **Groundwater Sustainability Plan** for the Temescal Basin. Since groundwater is such an important resource for everyone, we need your help!

GROUNDWATER FOR THE FUTURE



Important factors for groundwater basin management can be seen on the right. By creating a Groundwater Sustainability Plan, we will better manage the groundwater in the Temescal Basin and ensure we have enough for current and future generations. We will seek understanding of past groundwater use and plan for the sustainable use of future groundwater. Whether you own your own well, use water from the tap, irrigate your crops, or pump groundwater for your business, **everyone can participate in making this plan a success!** We want to hear your questions, ideas, and concerns about protecting our groundwater supply and quality in the Temescal Basin. To find out how, please visit the website at CoronaCA.gov/Groundwater.

To learn more about the TEMESCAL GROUNDWATER SUSTAINABILITY PLAN, including dates of public workshops and other ways to get involved:

- Please visit **CoronaCA.gov/Groundwater**
- Send an email to **Groundwater@CoronaCA.gov**

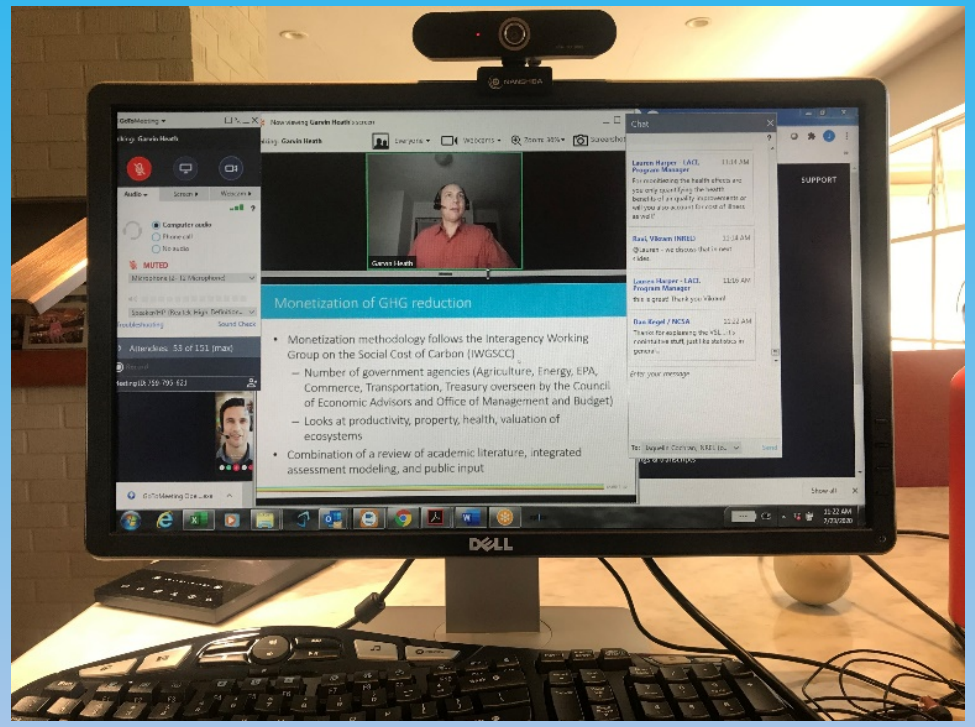
Home Gardens County Water District 3602 N. Grant St., Corona, Calif. 92879 (951) 737-4741
TEMESCAL GROUNDWATER SUSTAINABILITY PLAN

Public Workshop 1

- The first Public Workshop is tentatively scheduled for September 29th
- Focus
  - Introduction to SGMA and GSPs, the Temescal Basin, planning process, and resources



Public Workshop 1 . . . Virtual + Inclusive



Creative and innovative tools will be employed to accomplish workshop objectives

Discussion / Q&A

- How can we reach more of your community or constituents/other stakeholders and the public in our pre-workshop outreach?
- How might you be able to help us spread awareness of the first public meeting?



Role of the Technical Advisory Committee



TAC Protocols and Operating Principles

- Introduction
- Charge
- Roles and Responsibilities
- Participation and Collaboration Principles
- Membership
- Request for No Use of Alternatives
- Term of Service
- Meeting Logistics and Communication
- Communication and Media
- Open Meetings
- Point of Contact

TAC Protocols and Operating Principles

Introduction

Charge

Roles and Responsibilities

Participation and Collaboration Principles

Membership

Request for No Use of Alternatives

Term of Service

Meeting Logistics and Communication

Communication and Media

Open Meetings

Point of Contact

TAC Protocols and Operating Principles

Introduction

Charge

Roles and Responsibilities

Participation and Collaboration Principles

Membership

Request for No Use of Alternatives

Term of Service

Meeting Logistics and Communication

Communication and Media

Open Meetings

Point of Contact

TAC Protocols and Operating Principles

Introduction

Charge

Roles and Responsibilities

Participation and Collaboration Principles

Membership

Request for No Use of Alternatives

Term of Service

Meeting Logistics and Communication

Communication and Media

Open Meetings

Point of Contact

TAC Protocols and Operating Principles

Introduction

Charge

Roles and Responsibilities

Participation and Collaboration Principles

Membership

Request for No Use of Alternatives

Term of Service

Meeting Logistics and Communication

Communication and Media

Open Meetings

Point of Contact

TAC Protocols and Operating Principles

Introduction

Charge

Roles and Responsibilities

Participation and Collaboration Principles

Membership

Request for No Use of Alternatives

Term of Service

Meeting Logistics and Communication

Communication and Media

Open Meetings

Point of Contact

TAC Protocols and Operating Principles

Introduction

Charge

Roles and Responsibilities

Participation and Collaboration Principles

Membership

Request for No Use of Alternatives

Term of Service

Meeting Logistics and Communication

Communication and Media

Open Meetings

Point of Contact

TAC Protocols and Operating Principles

Introduction

Charge

Roles and Responsibilities

Participation and Collaboration Principles

Membership

Request for No Use of Alternatives

Term of Service

Meeting Logistics and Communication

Communication and Media

Open Meetings

Point of Contact

TAC Protocols and Operating Principles

Introduction

Charge

Roles and Responsibilities

Participation and Collaboration Principles

Membership

Request for No Use of Alternatives

Term of Service

Meeting Logistics and Communication

Communication and Media

Open Meetings

Point of Contact

TAC Protocols and Operating Principles

Introduction

Charge

Roles and Responsibilities

Participation and Collaboration Principles

Membership

Request for No Use of Alternatives

Term of Service

Meeting Logistics and Communication

Communication and Media

Open Meetings

Point of Contact

TAC Protocols and Operating Principles

Introduction

Charge

Roles and Responsibilities

Participation and Collaboration Principles

Membership

Request for No Use of Alternatives

Term of Service

Meeting Logistics and Communication

Communication and Media

Open Meetings

Point of Contact

TAC Protocols and Operating Principles

- Introduction
- Charge
- Roles and Responsibilities
- Participation and Collaboration Principles
- Membership
- Request for No Use of Alternatives
- Term of Service
- Meeting Logistics and Communication
- Communication and Media
- Open Meetings
- **Point of Contact**

Technical Advisory Committee Contact

Melissa Estrada-Maravilla

Email: Melissa.Estrada-Maravilla@CoronaCA.gov

Phone: 951.736.2479



Discussion of TAC Roles and Responsibilities and Confirmation

Questions?

Comments?

Protocols and Operating Principles Confirmation



Public Comment



Next Steps and Final Comments



Next Steps

- Continue Technical Analyses
  - Prepare internal draft Hydrogeologic Conceptual Model and Groundwater Conditions chapters of the GSP
  - Continue numerical model and water budget analysis
- Provide Administrative Draft Plan Area chapter of the GSP to TAC today, with all ***comments back by September 4th***.
- Prepare for and hold Public Workshop 1 (September 29th)
- Next TAC meeting November 18, 2020
  - Update on technical analyses
  - Conceptual sustainability criteria discussion

Thank You!



Technical Advisory Committee Meeting 2

Meeting Summary

Wednesday, November 18, 2020
1:00 p.m. – 3:00 p.m.
Location: Zoom Virtual Meeting

Attendees

Technical Advisory Committee Members

- Ava Moussavi, Riverside County Flood Control and Water Conservation District
- Chad Blais, City of Norco Public Works Department
- Eric Lindberg, California Regional Water Quality Control Board – Santa Ana Region
- Jacque Casillas, Vice Mayor, City of Corona
- Katie Hockett, City of Corona Department of Water and Power
- Timothy Ballon, All American Asphalt
- Tom Moody, City of Corona Department of Water and Power
- Wes Speake, Councilmember, City of Corona

City of Corona Department of Water and Power Staff

- Kristian Alfelor
- Melissa Estrada-Maravilla

Consultant Team

- Chad Taylor, Todd Groundwater
- Maureen Reilly, Todd Groundwater
- Alyson Scurlock, Kearns & West
- Jack Hughes, Kearns & West
- Joan Isaacson, Kearns & West

Summary

1. Welcome and Introductions

Joan Isaacson, meeting facilitator from Kearns & West, welcomed all to the second Technical Advisory Committee (TAC) meeting for the Temescal Basin Groundwater Sustainability Plan (Temescal GSP). The meeting took place online, via ZOOM, hosted by the Temescal Basin Groundwater Sustainability Agency (Temescal GSA). Isaacson led roundtable introductions for TAC members and the consultants assisting the Temescal GSA with meeting facilitation and preparation of the Temescal GSP.

2. Overview of Meeting Agenda

Isaacson reviewed the meeting agenda (see Appendix A). The focus of the meeting was on providing an overview of Public Workshop 1, reviewing Draft Temescal GSP chapters, and then reviewing and

getting input from the TAC on beneficial uses, the Draft Temescal GSP Sustainability Goal, and Conceptual Sustainability Criteria.

3. Public Workshop 1

Jack Hughes, Kearns & West, recapped the attendance and engagement from the first public workshop on September 29, 2020 held from 4:00 to 5:30 p.m. The workshop was held virtually via the Zoom platform, individuals also had the option to view and participate from the City of Corona Council Chambers. The workshop was streamed on the City of Corona's website, Facebook, and YouTube channels and on Corona TV, viewable on Channel 29 on Time Warner Spectrum and Channel 99 on AT&T. There were 13 participants on Zoom representing water districts, non-profits, and residents of the City of Norco and Riverside County. There were 452 Facebook engagements, which includes comments, likes, clicks, and shares, and 23 YouTube views as of November 6, 2020.

Hughes then described the input and feedback that was heard during and after the first public workshop. Participants asked questions about water quality early in the workshop when the project team was discussing water supply and groundwater basics. Later comments focused on coordination with stakeholders in neighboring basins when the project team was discussing the Temescal Basin and GSP development. Hughes noted that meetings with representatives from each neighboring basin are currently being set up to establish this coordination. Additional feedback was received in two post-workshop feedback forms regarding outreach and involvement. One participant suggested sending out questions or topics for discussion ahead of the workshops and another participant volunteered to make workshop announcements at pertinent Santa Ana Watershed Project Authority meetings. The next public workshop will take place in Spring 2021 and will focus on sustainability criteria. For more information, see Appendix B.

Discussion/Q&A

There were no questions or comments from the TAC members for this agenda item.

4. Draft Groundwater Sustainability Plan Chapters

Chad Taylor, Senior Hydrogeologist at Todd Groundwater, presented on the Draft Hydrogeologic Conceptual Model and Groundwater Conditions Chapters that were distributed to TAC members on November 17, 2020. Taylor provided an overview of the Temescal Basin, noting that it is a contiguous and connected basin that is categorized as medium-priority by the Department of Water Resources. The Draft Hydrogeologic Conceptual Model Chapter establishes the physical framework of the basin while the Draft Groundwater Conditions Chapter documents the historical and current status of the basin. Future analyses will include the water budget, which will quantify inflows, outflows, and storage change in the Temescal Basin, and the numerical model, which will evaluate sustainability criteria, monitoring, and project and management actions.

Taylor reviewed highlights of the Draft Hydrogeologic Conceptual Model Chapter. The Temescal Basin is primarily comprised of young unconsolidated deposits and is surrounded by older bedrock on most of the western and eastern boundaries. In addition, faulting affects groundwater in much of the Temescal Basin, especially on the western side. Taylor displayed three cross section orientations that help illustrate subsurface conditions in the Temescal Basin, noting that only one cross section would be the focus in the presentation. Taylor showed Cross Section A to A' and described the aquifers in the Basin. The Channel Aquifer has been identified as the principal aquifer used for groundwater production in the Temescal Basin. There are also two secondary aquifers in the Basin; they have historically been

less productive alluvial and sandstone aquifers. Taylor noted that the most productive wells in the Temescal Basin, measured by hydraulic conductivity, are in the Channel Aquifer. The basin thickness, or depth to the bottom of the basin, varies and is deepest in the southwest portion of the Channel Aquifer.

Taylor next reviewed highlights of the Draft Groundwater Conditions Chapter. Groundwater flows consistently towards the northwestern portion of the Temescal Basin and towards the western portion in the Prado area. The Draft Groundwater Conditions Chapter also includes historical groundwater elevation conditions and trends. Taylor showed an example of a hydrograph and described basin-wide trends seen in wells. The highest water levels in most wells were measured in the early 1980s and the lowest water levels are generally present in periods of dry conditions and increased pumping. Taylor noted that current water levels are near record lows.

For water quality, the primary constituents of concern in the Temescal Basin are total dissolved solids and nitrate. Total dissolved solids were found to be highest in the productive portion of the Temescal Basin and nitrate was also found to be high in some areas, both of which will be considered for future management. The Temescal Basin has areas of interconnected surface water in addition to areas where groundwater dependent ecosystems will need to be addressed. Taylor described subsidence as vertical displacement of ground surface, which has been estimated from satellite measurements and noted that there is no evidence of subsidence in the Temescal Basin. Taylor also noted that monitoring of subsidence will continue to ensure there are no changes in the future. For more information on the Draft Hydrogeologic Conceptual Model and Groundwater Conditions Chapters, see Appendix B.

Discussion/Q&A

The team opened the floor for questions and discussion. Discussions, comments, and questions are summarized below.

- Can you provide more detail on the depth of bedrock estimates, how many wells there are, and what interpolation method was used?
- The water quality map shows wells with differing water quality clustered together. What would drive the difference in water quality in the same aquifer? It would be helpful to state that the wells are at different depths.

5. Input on Beneficial Uses

Taylor presented the preliminary list below of known beneficial uses in the Temescal Basin and asked for TAC members' input on additional beneficial uses to include in the Temescal GSP.

- Municipal water supply
- Industrial water supply
- Rural residential water supply
- Small community water system supply
- Small commercial water supply
- Groundwater dependent ecosystems in Temescal Wash and Prado

Discussion and feedback from TAC members on beneficial uses included these comments:

- Cemetery landscaping uses groundwater.
- Industrial water supply includes mining as wash water is used for operations.

- Mining operations use water for processing and dust control in the area.
- It is important to understand the balance between local and imported resources in municipal water supply.
- Scattered residents have their own wells.
- Dust control for development could be included in municipal water supply and rural residential water supply.
- It would be interesting to find out if there are agricultural users in the Temescal Basin.
- There are recreational water uses where groundwater and surface water interface. One known recreational use is a ski club in the Temescal Canyon Lake.

6. Draft Sustainability Goal and Conceptual Sustainability Criteria

Taylor presented the Draft Sustainability Goal for TAC members' feedback. The goal is tailored to the local meaning of sustainability and is the starting point for defining sustainability in the Temescal GSP. The following Draft Sustainability Goal was presented:

To sustain groundwater resources for the current and future beneficial uses of the Temescal Basin in a manner that is adaptive and responsive to the following objectives:

- Provide a long-term, reliable, and efficient groundwater supply for municipal, industrial, and other uses;
- Provide reliable storage for water supply resilience during droughts and shortages;
- Protect groundwater quality;
- Support beneficial uses of interconnected surface waters; and
- Support integrated and cooperative water resource management.

Taylor explained the sustainability criteria required for evaluation according to the Sustainable Groundwater Management Act. The six sustainability indicators include chronic lowering of groundwater levels, reduction of groundwater storage, degradation of water quality, depletions of interconnected surface water affecting beneficial uses, land subsidence affecting land uses, and seawater intrusion (not applicable in the Temescal Basin). Taylor explained undesirable results, minimum thresholds, and measurable objectives. Undesirable results are significant and unreasonable conditions for any of the six sustainability indicators whereas minimum thresholds are numeric values used to define undesirable results. Measurable objectives are specific, quantifiable goals used to track the performance of sustainable management.

Taylor reviewed the six sustainability indicators and gave examples of undesirable results for each of them. He noted that subsidence, or the lowering of the ground surface due to the collapse of subsurface materials, is not a known issue in the Temescal Basin. Potential for undesirable results include reductions in drainage capacity, impacts on the grade of facilities, subsidence around a wellhead, and non-recoverable loss of storage capacity in the aquifers. The interconnected surface water indicator analyzes the relationship between water levels in a stream and groundwater for stream flow. When groundwater is higher, interconnected surface water flows from the groundwater to the stream.

The next indicator, groundwater storage, is directly connected to water levels, therefore this indicator can use water levels to establish minimum thresholds and measurable objectives to ensure that there is enough water to meet the needs of beneficial uses and users. The groundwater levels indicator will consider what undesirable effects should be avoided in the Temescal Basin, such as impacts to shallow

wells and maintenance of municipal and industrial water supply. Lastly, the water quality indicator will establish a numeric value to define significant and unreasonable degraded water quality throughout the Temescal Basin. Taylor noted that local, state, and federal water quality standards should be considered. See Appendix B for more information on the Draft Sustainability Goal and sustainability criteria.

Discussion/Input

The team asked for feedback on the Draft Sustainability Goal.

- The Draft Sustainability Goal and criteria look good.
- Groundwater recharge should be factored into redevelopment. New development should have landscapes that collect water to help create sustainable water storage. Basins should have their supply refreshed by rain and runoff. This can be accomplished in part by incorporating new parking lot designs and directing runoff differently to a landscaped area that can naturally filter water and allow it to percolate into the ground. There should be a target for quantifying recharge. Some of these stormwater capture elements are included in the City of Corona's General Plan Update.

The team posed the following questions for discussion: 1) Are you aware of undesirable results that have occurred in the past? 2) Are there specific undesirable results you are concerned about?

- Nitrate levels in basin groundwater have been rising recently and total dissolved solid levels might be dropping.
- Trichloropropane (TCP) and Per- and polyfluoroalkyl substances (PFAS) are contaminants of concern that have had undesirable results for the Temescal Basin. TCP and PFAS, along with total dissolved solids and nitrate, could potentially impact groundwater use.
- The more refined analytical technologies become, the more contaminants are found at smaller concentrations. There are contaminants that may exist in the water that are not currently known, and they may create future issues that we are not yet aware of. There should be some acknowledgement that unregulated contaminants today may be regulated in the future. The allowable limit for PFAS has changed drastically since it first started being regulated.
- PFAS and other contaminants are concerning for future groundwater uses. Groundwater will not be a sustainable water source if contaminants make it unusable.
- There has been pressure at the state level for regulating PFAS and it would be proactive to get ahead of the issue.

7. Public Comment

No members of the public provided comment.

8. Next Steps and Wrap Up

Isaacson summarized next steps for the consultant team and TAC members. The consultant team will prepare an internal draft of the Water Budget Chapter and continue conducting the numerical model analysis and developing the sustainability criteria. The consultant team distributed the Draft Hydrogeologic Conceptual Model and Groundwater Conditions Chapters to the TAC on November 17, 2020 and asked members to provide comments by December 4, 2020. Additional next steps are preparing for the upcoming public workshop, which will be held in Spring 2021 and the next TAC meeting on February 17, 2021.

Discussion/Q&A

There were no questions or comments from the TAC members for this agenda item.

Appendix A

Meeting Agenda

Temescal GSP

Technical Advisory Committee Meeting 2

November 18, 2020

1:00 – 3:00 p.m.
Zoom Meeting: https://zoom.us/j/97160500385

Agenda

1) Welcome and Introductions

2) Overview of Meeting Agenda

3) Public Workshop 1
   - Attendance and Engagement
   - Input and Feedback
   - Timeline and Focus for Public Workshop 2
   - Discussion/Q&A

4) Draft GSP Chapters
   - Hydrogeologic Conceptual Model
   - Groundwater Conditions
   - Discussion/Q&A

5) Input on Beneficial Uses

6) Draft Sustainability Goal and Conceptual Sustainability Criteria
   - Purpose of Sustainability Goal
   - Draft Goal, Presentation
   - Definition of Undesirable Results, Minimum Thresholds, and Measurable Objectives
   - Discussion of Draft Goal and Conceptual Undesirable Results for Consideration for Sustainability Indicators

7) Public Comment

8) Next Steps and Wrap Up

Appendix B

Presentation Slides

Temescal Groundwater Sustainability Agency

Technical Advisory Committee

November 18, 2020



carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST

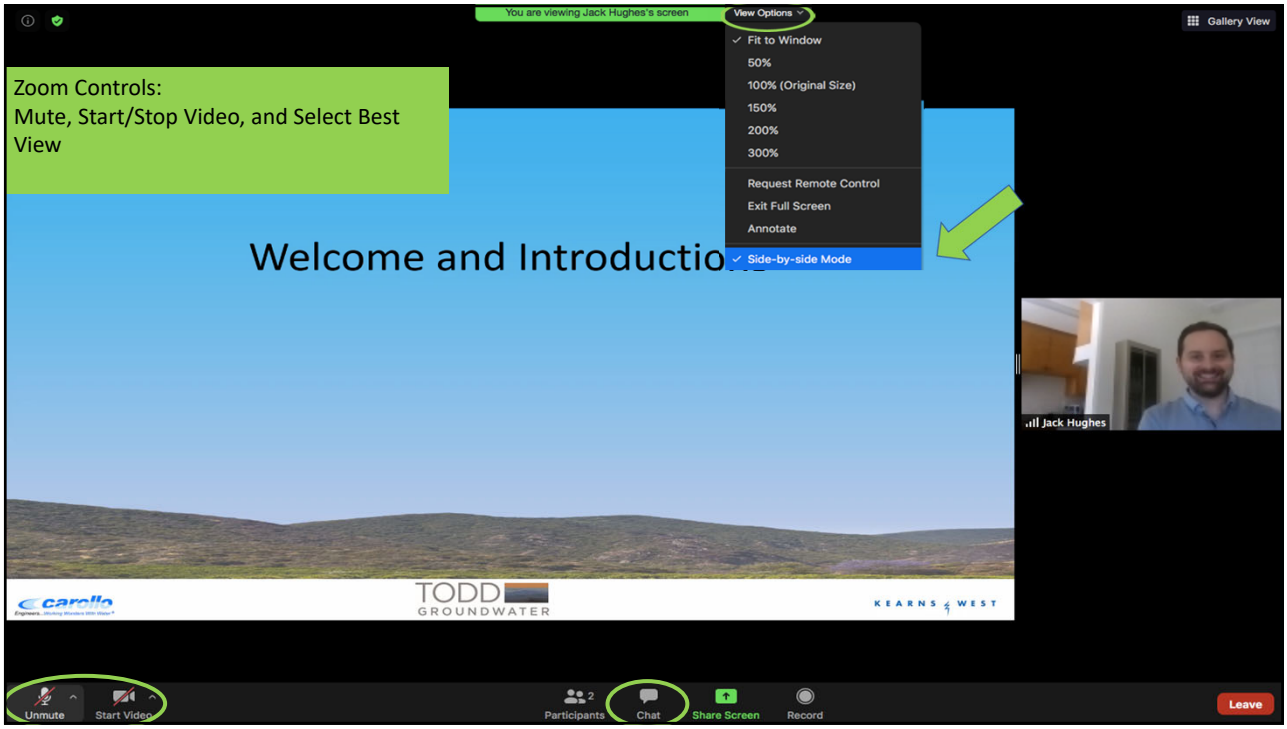
Welcome and Introductions



carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST



Tips for a Productive Discussion

- Let one person speak at a time
- Help make sure everyone gets equal time to give input
- Keep your input concise so others have time to participate
- Actively listen to others and seek to understand their perspectives
- Offer ideas to address questions and concerns raised by others

Overview of Meeting Agenda



Carollo Engineers...Working Wonders With Water® | TODD GROUNDWATER | KEARNS & WEST

Meeting Agenda

1. Welcome and Introductions
2. Overview of Meeting Agenda
3. Public Workshop 1
4. Draft GSP Chapters
5. Input on Beneficial Uses
6. Draft Sustainability Goal and Conceptual Sustainability Criteria
7. Public Comment
8. Next Steps and Final Comments



Carollo Engineers...Working Wonders With Water® | TODD GROUNDWATER | KEARNS & WEST

Public Workshop 1



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Public Workshop 1
Attendance and Engagement

- 13 Participants on Zoom
- 452 Facebook Engagements
- 23 YouTube Views (as of 11/6)



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Public Workshop 1 - Input and Feedback

Questions:

- Why might water taste bad?
- How is water cleaned?
- Why does water taste different in different areas?

Comments:

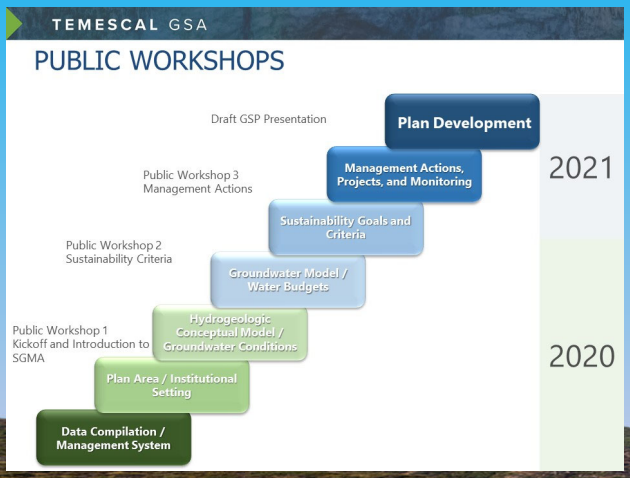
- Coordination with Chino, Riverside-Arlington, and Orange County Water District important
- Wetland behind Prado Dam has interconnected surface water and groundwater dependent ecosystems

Feedback on outreach and involvement:

- Send out questions or topics for discussion ahead of the workshops
- Make announcements at pertinent Santa Ana Watershed Project Authority task forces
- Good use of background slides, good presenters, and keeping things concise

carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Public Workshop 2



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Discussion / Q&A



Carollo Engineers...Working Wonders With Water® | TODD GROUNDWATER | KEARNS & WEST

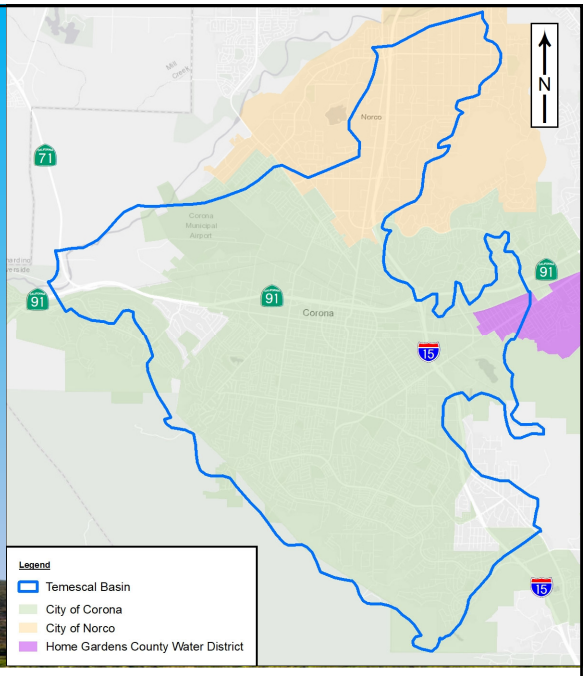
Draft GSP Chapters:
Hydrogeologic Conceptual Model
and
Groundwater Conditions



Carollo Engineers...Working Wonders With Water® | TODD GROUNDWATER | KEARNS & WEST

The Temescal Basin

- DWR categorized as a Medium Priority Basin
- Contiguous and connected



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Where are we now in GSP process?

- HCM establishes physical framework of the groundwater basin
- GW Conditions chapter documents historical and current status
- Water Budget will quantify inflows, outflows and storage change
- Numerical Model will support understanding of how the groundwater system works and provide the key analytical tool to evaluate:
  - Sustainability Criteria
  - Monitoring
  - Projects and management actions

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

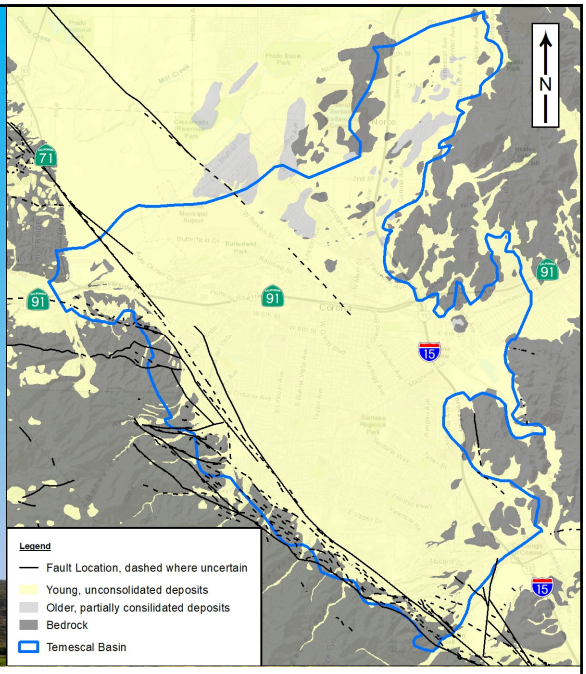
Hydrogeologic Conceptual Model Highlights



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Surficial Geology

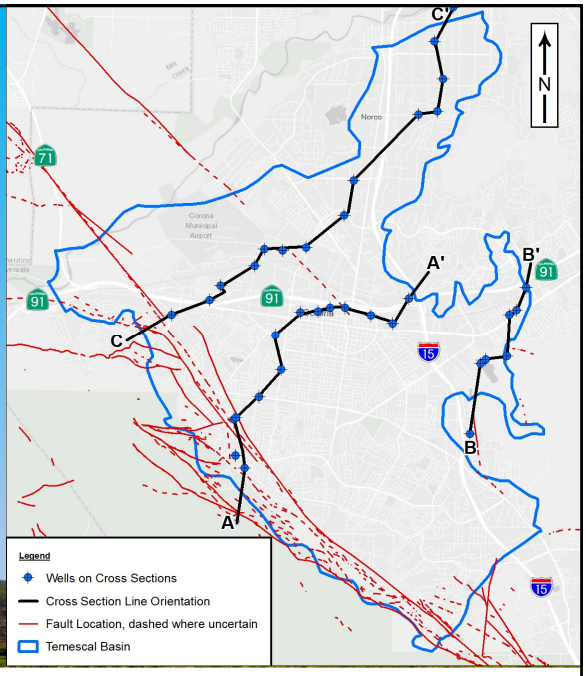
- Temescal Basin is primarily young unconsolidated deposits
- Older bedrock surrounds the Basin on the west and much of the east
- Faulting affects groundwater in much of the Basin



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Cross Sections

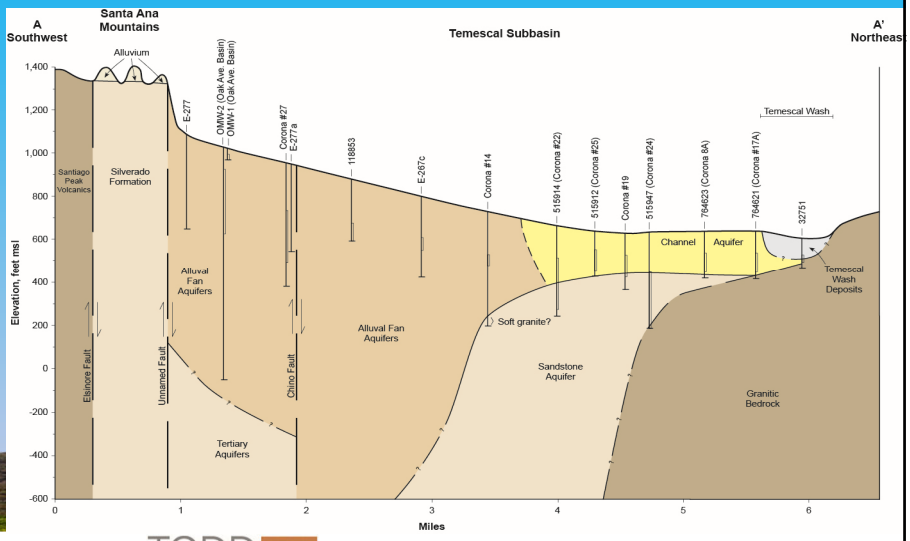
- Three cross sections
- Illustrate subsurface conditions
- Relationship between aquifers in the Temescal Basin



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Cross Section A

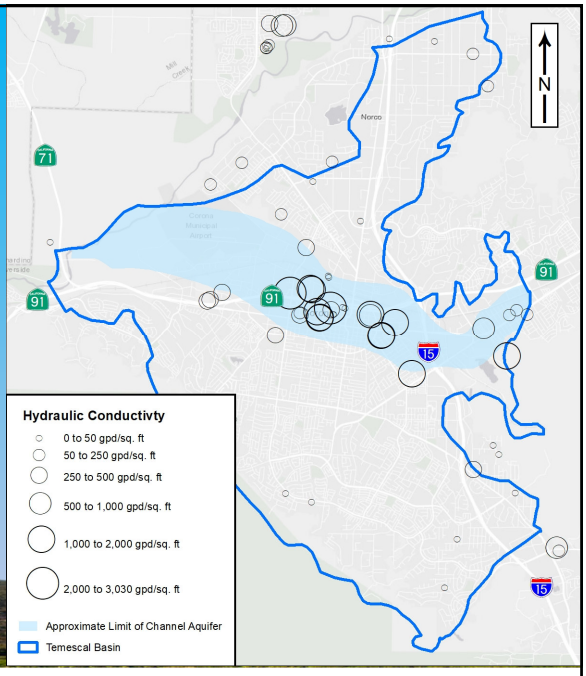
- Channel Aquifer is the principal aquifer
- Alluvial and Sandstone aquifers secondary



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Channel Aquifer

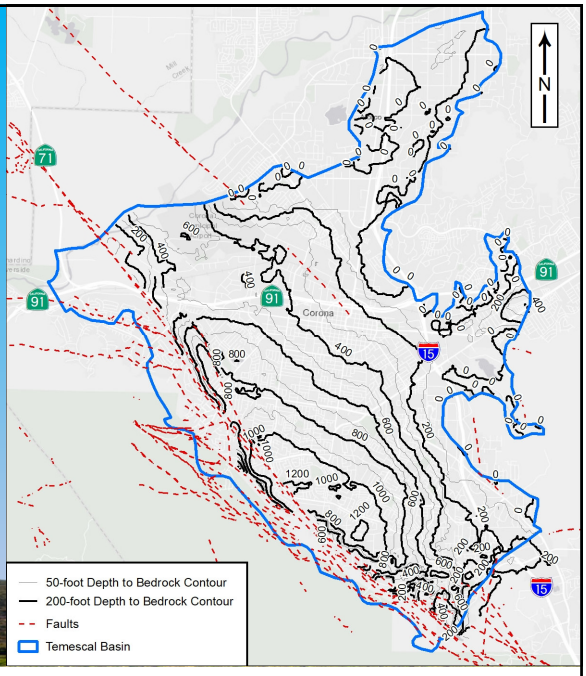
- Channel Aquifer not present everywhere
- The most productive wells (highest hydraulic conductivity) in the Temescal Basin are in the Channel Aquifer



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Temescal Basin Thickness

- Deepest in the southwest
- Shallower in the area of the Channel Aquifer
- Deepens near the Arlington Gap



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Groundwater Conditions Highlights



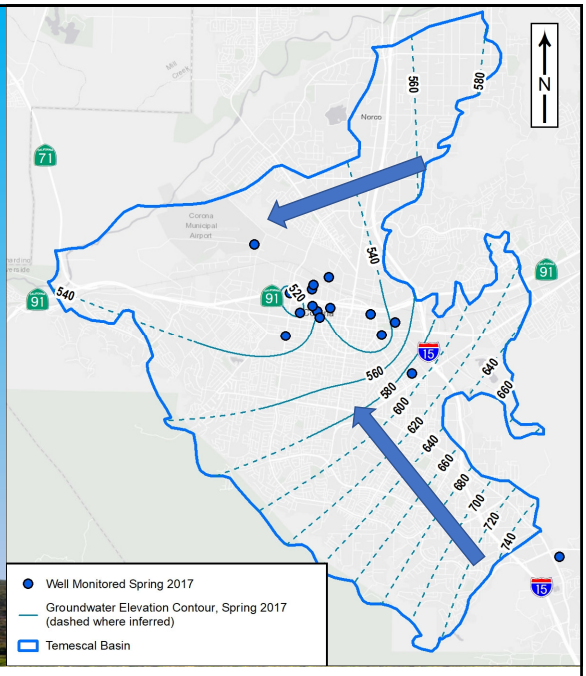
carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST

Groundwater Elevation Contours

- Flow in the Temescal Basin is towards the northwest, turning to the west in Prado
- Groundwater flow direction generally consistent



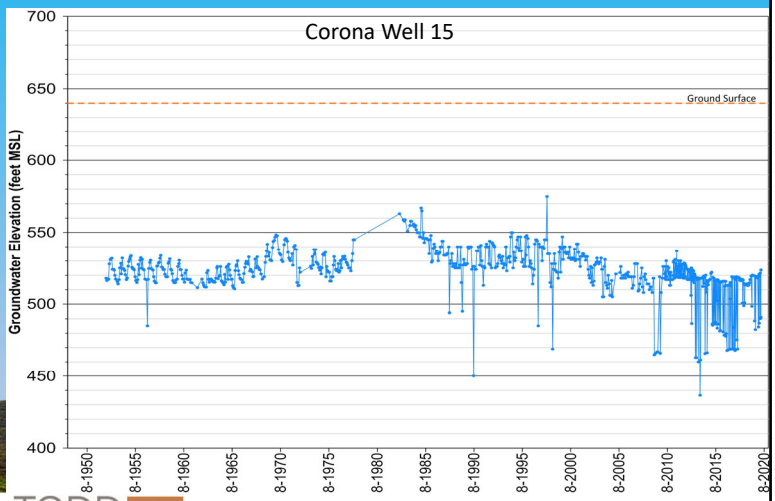
carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST

Historical Groundwater Elevations

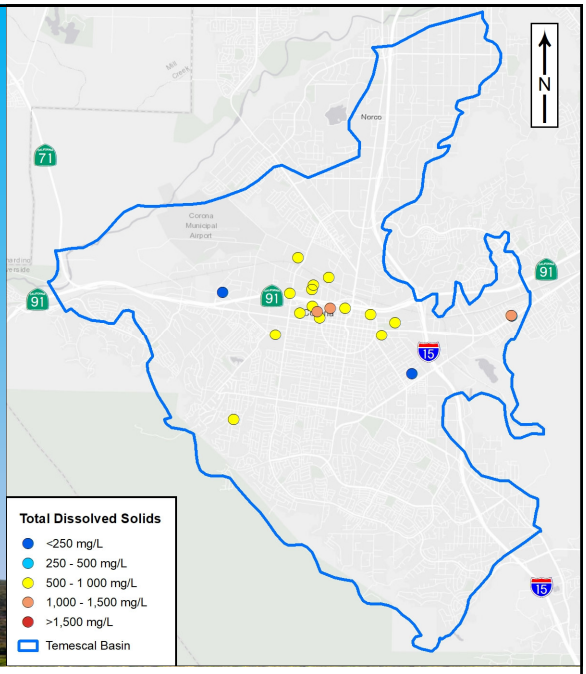
- Highest water levels in most wells measured in early 1980s
- Lowest levels generally in periods of dry conditions and increased pumping
- Most hydrographs show low water levels during 2000 to 2004, from increased pumping
- Current levels are near record lows



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Water Quality

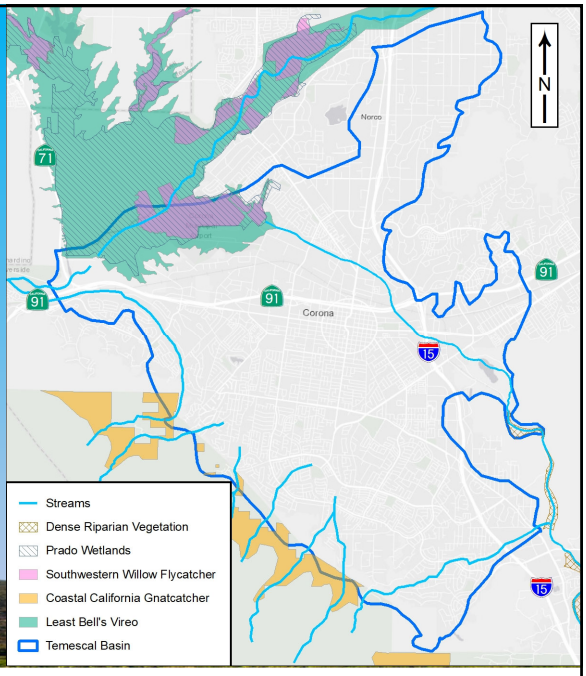
- Available groundwater quality data reviewed
- Primary constituents of concern in the Temescal Basin are total dissolved solids and nitrate
- Total dissolved solids (TDS) elevated in the productive portion of the Basin
- Nitrate also high in some areas



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Interconnected Surface Water

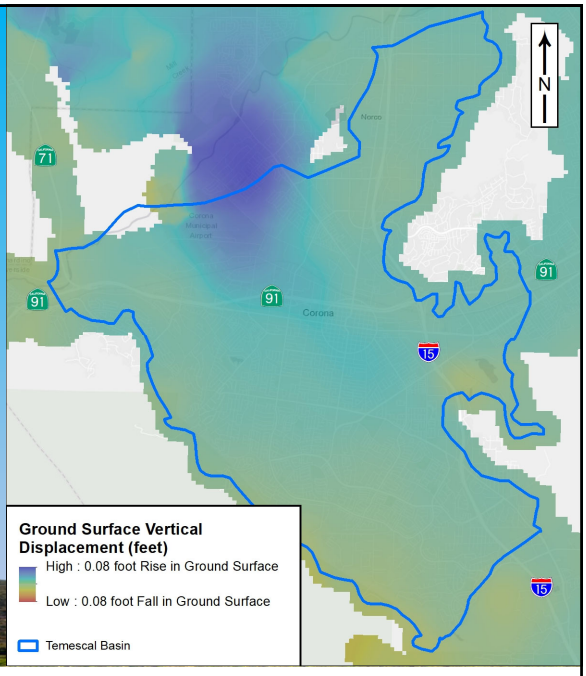
- First phase of surface water groundwater evaluation
- Combined review of depth to water, aerial imagery, conceptual model, and mapped features
- There are areas of interconnected surface water in the Basin
- Also areas where there are groundwater dependent ecosystems (GDEs) that will need to be addressed



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Subsidence

- Basin-wide vertical displacement estimates from satellite measurements
- No evidence of ground surface change in these measurements



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Discussion / Q&A



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Input on Beneficial Uses



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Known Beneficial Uses

- Municipal water supply
- Industrial water supply
- Rural residential water supply
- Small community water system water supply
- Small commercial water supply
- Groundwater dependent ecosystems in Temescal Wash and Prado



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Sustainability Goal and Criteria



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Draft Sustainability Goal

To sustain groundwater resources for the current and future beneficial uses of the Temescal Basin in a manner that is adaptive and responsive to the following objectives:

- Provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses
- Provide reliable storage for water supply resilience during droughts and shortages
- Protect groundwater quality
- Support beneficial uses of interconnected surface waters, and
- Support integrated and cooperative water resource management.



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Sustainability Indicators

- Chronic lowering of groundwater levels
- Reduction of groundwater storage
- Degradation of water quality
- Depletions of interconnected surface water affecting beneficial uses
- Land subsidence affecting land uses
- Seawater intrusion (not applicable here)



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Undesirable Results, Minimum Thresholds, and Measurable Objectives

Undesirable Result – significant and unreasonable conditions for any of the six sustainability indicators

Minimum Threshold (MT) – numeric value used to define undesirable results for each sustainability indicator

Measurable Objective (MO) – specific, quantifiable goal to track the performance of sustainable management



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Sustainability Criteria Considerations for Temescal Basin



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

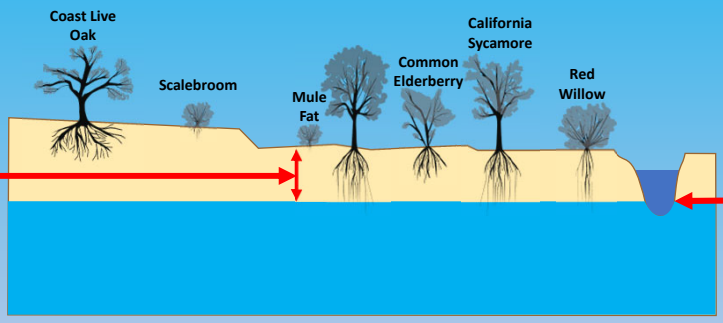
Subsidence

- Subsidence is lowered ground surface resulting from collapse of subsurface materials, commonly related to pumping and dewatering fine grained units
- Not a known issue and undesirable results not reported
- But potential exists for undesirable results
  - Reduction in drainage capacity; drainage problems
  - Impacts on grade of facilities, e.g. pipelines, roads, runways
  - Subsidence around a wellhead, e.g., casing collapse
  - Non-recoverable loss of storage capacity in the aquifers

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Interconnected Surface Water

For Riparian Vegetation: About 20 to 30 feet



For Stream Flow Depletion: Stream Bed Elevation

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Reduction of Groundwater Storage

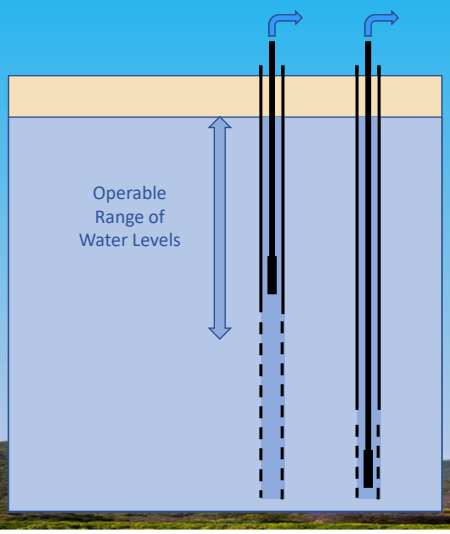
- Storage is connected to water levels and the intent is to make sure there is enough water to meet the needs of the beneficial uses and users
- GSP regulations allow use of groundwater level MTs and MOs as a proxy, provided that the GSP demonstrate a correlation between groundwater levels and storage

carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Groundwater Levels

What undesirable effects do we want to avoid?

- Impacts to shallow wells?
- Maintenance of municipal and industrial water supply?
- Other?



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Water Quality

- Numeric value used to define significant and unreasonable degraded water quality throughout the basin
- In setting MTs for degraded water quality, GSAs shall consider local, state, and federal water quality standards applicable to the basin
- Basin Plan and Maximum Concentration Limits
  - 10 mg/L Nitrate as N (both)
  - 770 mg/L TDS (basin plan) and 500 mg/L (MCL)



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Discussion / Q&A

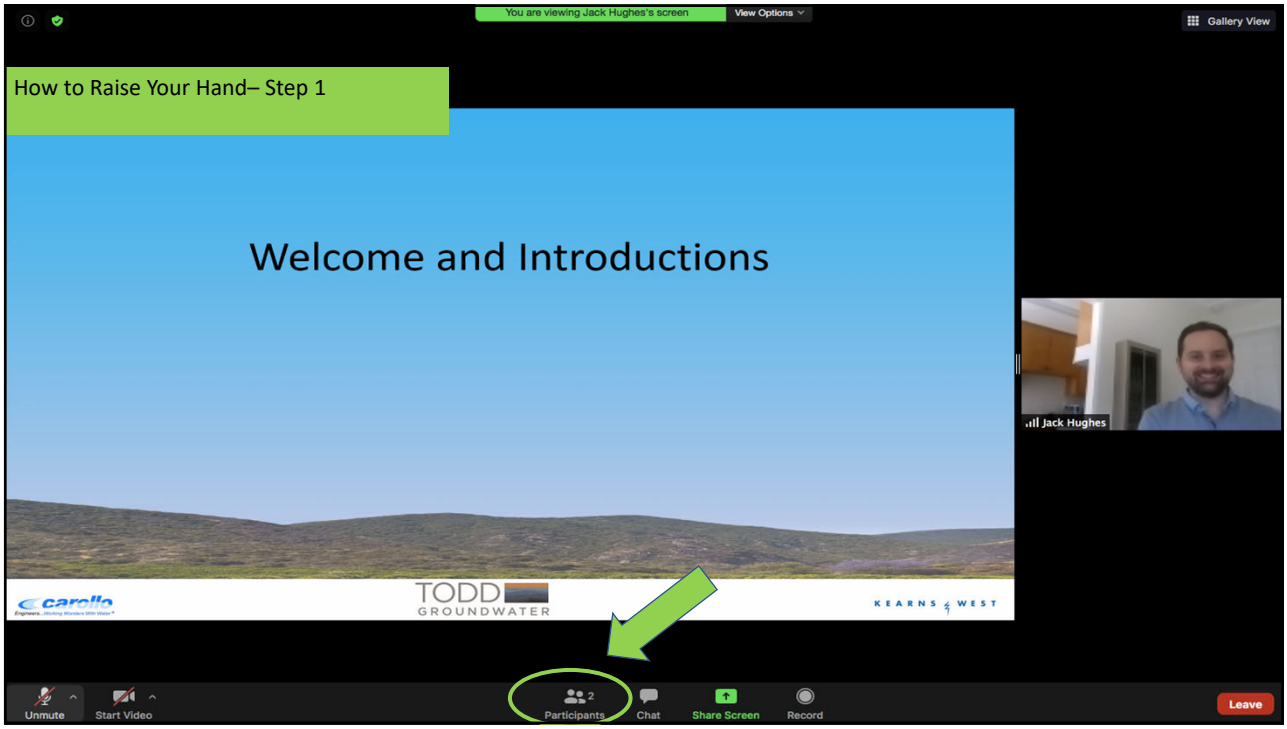
- Are you aware of undesirable results that have occurred in the past?
- Are there specific undesirable results you are concerned about?
- Comments on the Sustainability Goal:

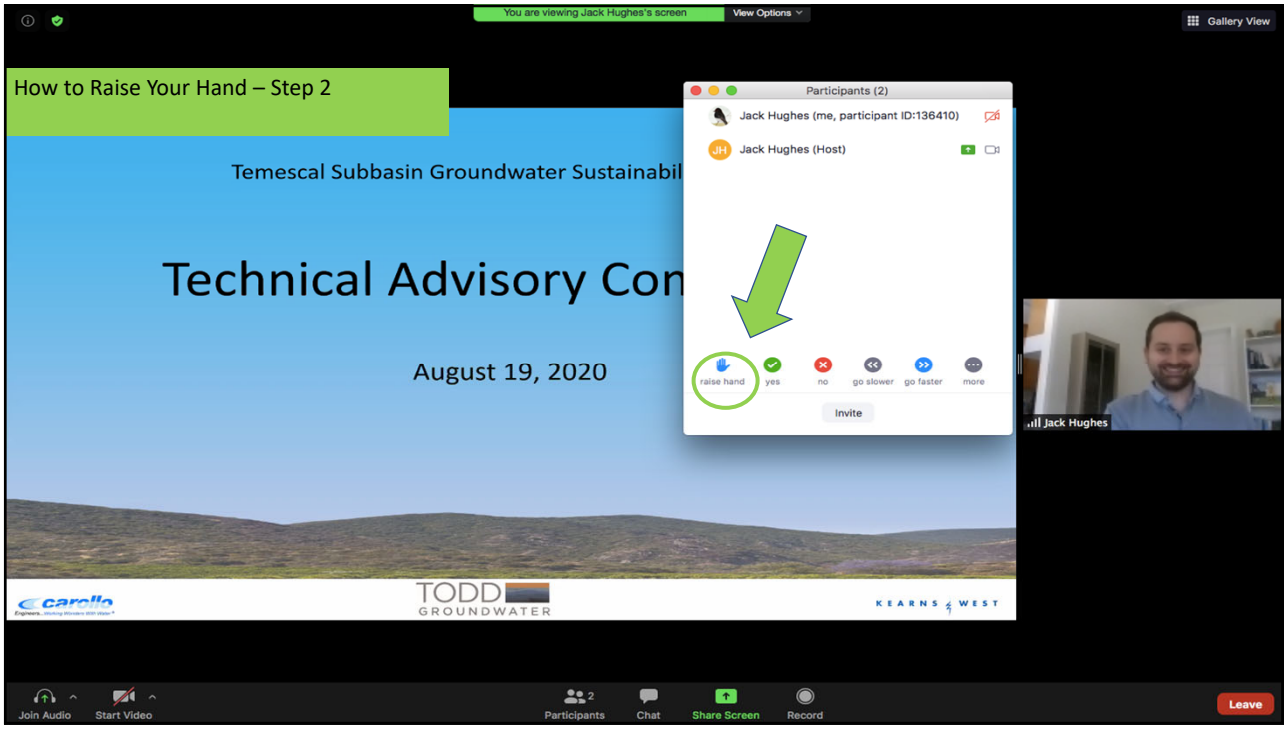
  To sustain groundwater resources for the current and future beneficial uses of the Temescal Basin in a manner that is adaptive and responsive to the following objectives:
  - Provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses
  - Provide reliable storage for water supply resilience during droughts and shortages
  - Protect groundwater quality
  - Support beneficial uses of interconnected surface waters, and
  - Support integrated and cooperative water resource management.

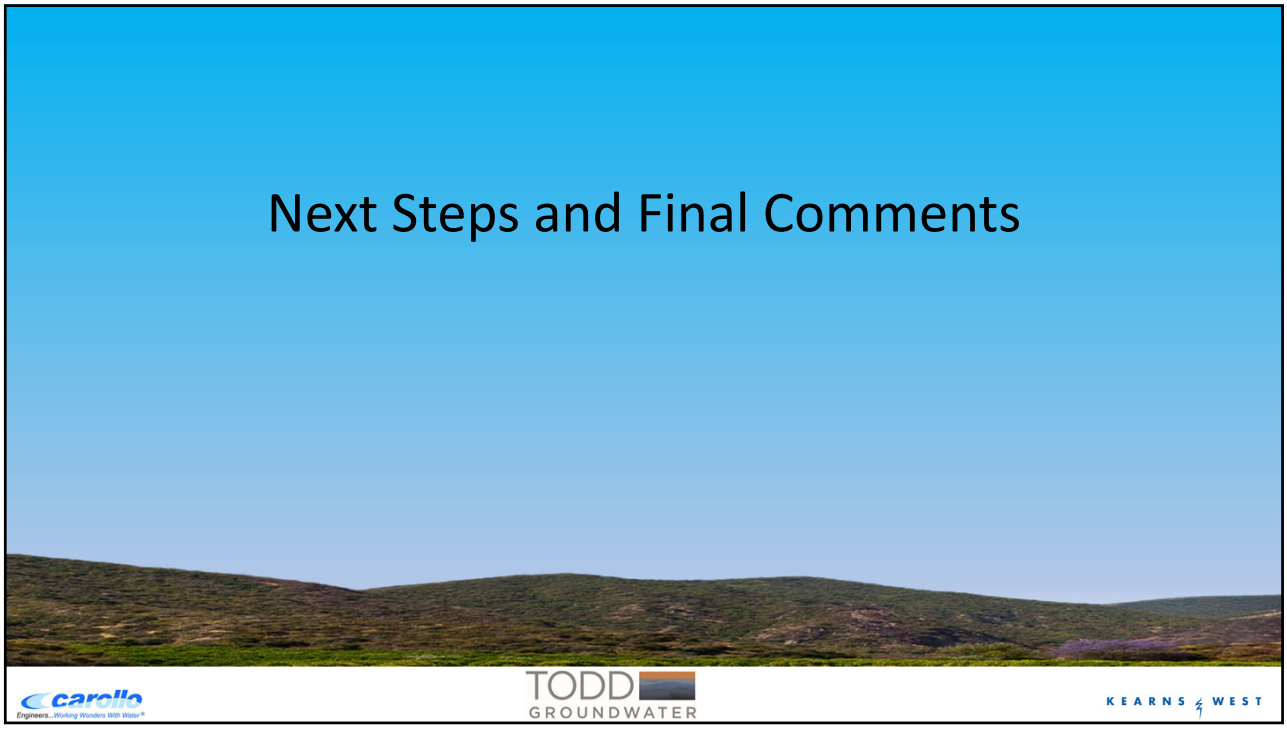


carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST


Public Comment
carollo
Engineers...Working Wonders With Water®
TODD
GROUNDWATER
KEARNS WEST


You are viewing Jack Hughes's screen
View Options
Gallery View
How to Raise Your Hand– Step 1
Welcome and Introductions
Jack Hughes
carollo
TODD
GROUNDWATER
KEARNS WEST
Unmute
Start Video
Participants
2
Chat
Share Screen
Record
Leave


How to Raise Your Hand – Step 2
You are viewing Jack Hughes's screen
View Options
Gallery View
Participants (2)
Jack Hughes (me, participant ID:136410)
Jack Hughes (Host)
raise hand
yes
no
go slower
go faster
more
Invite
Temescal Subbasin Groundwater Sustainabil
Technical Advisory Con
August 19, 2020
Jack Hughes
TODD GROUNDWATER
KEARNS & WEST
Join Audio
Start Video
Participants
Chat
Share Screen
Record
Leave


Next Steps and Final Comments
TODD GROUNDWATER
KEARNS & WEST

Next Steps

- Continue Technical Analyses
  - Prepare internal draft Water Budget chapter of the GSP
  - Continue numerical model analysis
  - Continue sustainability criteria development
- Administrative Draft HCM and GW Conditions chapters of the GSP provided to TAC November 17th, all ***comments back by December 4th***.
- Prepare for and hold Public Workshop 2 (date TBD)
- Next TAC meeting February 17, 2021
  - Update on technical analyses
  - Present sustainability criteria



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Thank You!



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Technical Advisory Committee Meeting 3

Meeting Summary

Wednesday, February 17, 2020
1:00 p.m. – 3:00 p.m.
Location: Zoom Virtual Meeting

Attendees

Technical Advisory Committee Members

- Ava Moussavi, Riverside County Flood Control and Water Conservation District
- Chad Blais, City of Norco Public Works Department
- Eric Lindberg, California Regional Water Quality Control Board – Santa Ana Region
- Jacque Casillas, Mayor, City of Corona
- Katie Hockett, City of Corona Department of Water and Power
- Roberta Reed, 3M Industrial Mineral Products Division
- Timothy Ballon, All American Asphalt
- Tom Moody, City of Corona Department of Water and Power
- Wes Speake, Vice Mayor, City of Corona

Additional City of Corona Department of Water and Power Staff

- Kristian Alfelor
- Melissa Estrada-Maravilla

Consultant Team

- Chad Taylor, Todd Groundwater
- Gus Yates, Todd Groundwater
- Maureen Reilly, Todd Groundwater
- Alyson Scurlock, Kearns & West
- Jack Hughes, Kearns & West
- Joan Isaacson, Kearns & West

Summary

1. Welcome and Introductions

Joan Isaacson, facilitator from Kearns & West, welcomed all to the third meeting of the Temescal Groundwater Sustainability Agency (Temescal GSA) Technical Advisory Committee (TAC). She led roundtable introductions for TAC members and the consultants assisting the Temescal GSA with meeting facilitation and preparation of the Temescal Groundwater Sustainability Plan (Temescal GSP).

2. Overview of Meeting Agenda

Isaacson reviewed the meeting agenda (see Appendix A). The focus was providing an update on the status of the Temescal GSP, presenting the draft sustainability criteria and getting input from TAC members, and providing an overview of Public Workshop 2.

3. Temescal GSP Status

Chad Taylor, Principal Hydrogeologist at Todd Groundwater, provided a status update on the Temescal GSP. The Hydrogeologic Conceptual Model and Groundwater Conditions chapters are now complete and posted to the Temescal GSA website for the public to access. The Numerical Model, which is used to calculate the water budget, and the Water Budget chapter, are underway and will include forecast modeling for growth and climate change.

Taylor described coordination meetings that have taken place with GSA representatives of neighboring basins, including the Orange County Water District, Chino Basin Watermaster, and Western Municipal Water District. All are willing to share information and data and are interested in reviewing documents as they become available. Todd Groundwater will continue to coordinate with stakeholders in neighboring basins, especially with the Western Municipal Water District and Chino Basin Watermaster to ensure the water budget for the Temescal Basin is similar to the ones they have prepared. For more information on the Temescal GSP Status, see pages 4 through 5 in Appendix B.

Discussion/Q&A

There were no questions or comments from the TAC members for this agenda item.

4. Draft Sustainability Criteria Presentation and Discussion

Before presenting the draft sustainability criteria for the Temescal Basin, Taylor reviewed the following sustainability goal that was presented at the last TAC meeting on November 18, 2020:

To sustain groundwater resources for the current and future beneficial uses of the Temescal Basin in a manner that is adaptive and responsive to the following objectives:

- Provide a long-term, reliable, and efficient groundwater supply for municipal, industrial, and other uses;
- Provide reliable storage for water supply resilience during droughts and shortages;
- Protect groundwater quality;
- Support beneficial uses of interconnected surface waters; and
- Support integrated and cooperative water resource management.

Taylor explained that according to the Sustainable Groundwater Management Act, there are six sustainability indicators for which they must develop criteria. The six indicators include chronic lowering of groundwater levels, reduction of groundwater storage, degradation of water quality, land subsidence affecting land uses, depletions of interconnected surface water affecting beneficial uses, and seawater intrusion. Seawater intrusion is not applicable in the inland Temescal Basin. The five applicable indicators will be evaluated for the Temescal Basin.

Next, Taylor explained the factors relating to and defining sustainability that will be developed for each sustainability indicator. These include undesirable results, minimum thresholds, and measurable objectives. Undesirable results are significant and unreasonable conditions for any of the six sustainability indicators. Minimum thresholds are numeric values used to define undesirable results.

Measurable objectives are specific, quantifiable goals used to track the performance of sustainable management. Lastly, he recapped the known beneficial uses in the Temescal Basin that were discussed by TAC members at the previous meeting. See pages 6 through 23 in Appendix B for more information on the draft sustainability criteria.

Chronic Lowering of Groundwater Levels

Taylor presented the sustainability criteria for chronic lowering of groundwater levels. Undesirable results for this indicator can occur progressively as water levels fall. These results can include increased pumping costs/decreased pump output, entrained air and/or broken suction on pumps, exposed screens, cascading water in the well, increased clogging of screens and/or accelerated corrosion, reduced saturated aquifer thickness, and reduced aquifer capacity. Taylor explained that the minimum threshold for defining undesirable results relative to chronic lowering of groundwater levels is defined at each key well by the historic minimum static groundwater elevation (or maximum historical depth to groundwater). Undesirable results are indicated when exceedances occur in measurements from two consecutive quarters in each of two consecutive years, in two-thirds or more of the key wells.

Taylor displayed the table of key wells, which are a subset of the current water level monitoring wells with representative records that continue to be monitored. The key wells table includes wells in the principal channel aquifer and secondary aquifers and wells that have been monitored a long time. Most wells have had historic maximum depths to groundwater within the last 10 years and the pump intake depth for most wells is below the historic depth to water. Taylor reviewed the measurable objective to maintain groundwater levels above the historic maximum depth to water, which maintains groundwater levels within the historical operating range. In summary, the water level conditions are currently sustainable and historic static lows will be used as the minimum threshold; the objective is to be above historical static lows.

Discussion/Q&A

The team opened the floor for questions and discussion. Discussion, comments, and questions are summarized below.

- Having visuals to accompany the data would be helpful.
- Seeing how long the wells have been operational is good, but it would be nice to know how the differences between relate to the location of the wells. It seems shallower wells are closer to the river and deeper wells are farther away.

Reduction of Groundwater Storage

Taylor presented the sustainability criteria for reduction of groundwater storage, noting that storage is connected to water levels. He explained that GSP regulations allow the use of groundwater level minimum thresholds and measurable objectives as a proxy, and that the historic minimum-based water level threshold is well-suited for use as a proxy for groundwater storage. Undesirable results are defined as insufficient supply to support beneficial uses during droughts. Since groundwater storage is related to water levels, undesirable results are also associated with groundwater level declines.

Taylor explained the minimum threshold for groundwater storage, which is the same for groundwater levels. Using the historical minimum maintains the historical operational storage range in the principal channel aquifer and protects the most productive wells. The measurable objective for storage is also

fulfilled by the measurable objective for groundwater levels, which maintains groundwater levels within the historical operating range. In summary, there is currently sufficient storage in the Temescal Basin and water level sustainability criteria will be used as a proxy for storage.

Discussion/Q&A

There were no questions or comments from the TAC members for this sustainability criteria.

Degradation of Water Quality

Maureen Reilly, Senior Engineer at Todd Groundwater, presented the sustainability criteria for degradation of water quality. She explained that the Temescal GSA is not responsible for local problems or degradation caused by others and that groundwater quality is under regulatory oversight by state agencies. However, the Temescal GSA is responsible for increased concentrations of water quality constituents due to groundwater management, such as through recharge and changes in pumping patterns relating to groundwater management. Undesirable results for this indicator will focus on total dissolved solids and nitrate, with other constituents being tracked as well. Total dissolved solids are both naturally occurring and anthropogenic. High nitrate concentrations in the Temescal Basin may be a result of previous agricultural or wastewater disposal. Because high concentrations of total dissolved solids and nitrate can limit beneficial uses, the main users of water either treat or blend groundwater.

To help inform measurable objectives, Reilly reviewed what other agencies in the basin are already doing. Water quality objectives have been defined in the Regional Water Quality Control Board Santa Ana Basin Plan and by the State of California in drinking water maximum contaminant levels. Nitrate levels have been set at 45 milligrams per liter (mg/L) and total dissolved solids levels have been set at 770 mg/L in the Regional Water Quality Control Board Santa Ana Basin Plan. She noted that total dissolved solids have a secondary maximum contaminant level for aesthetics which is 1,000 mg/L. Todd Groundwater looked at average concentrations in wells in the Temescal Basin before water entered the treatment process in the last 5 years. This showed 58 percent of wells exceeding the nitrate maximum contaminant levels and 33 percent exceeding the total dissolved solids secondary maximum contaminant level. Reilly explained that while concentrations at some wells exceed the maximum contaminant levels, all water delivered to end users meets all local, state, and federal standards.

Reilly described the minimum threshold for water quality as a statistically significant increase in the percentage of wells with 5-year averages exceeding the maximum contaminant level for total dissolved solids and/or nitrate, relative to current conditions. Statistically significant is defined as more than a 10 percent increase in the number of wells in a 5-year period. The measurable objective for total dissolved solids and nitrate is to maintain or reduce the percentage of wells with average concentrations exceeding the threshold based on conditions assessed in each 5-year Temescal GSP update. In summary, total dissolved solids and nitrate concentrations are elevated in some Temescal Basin wells, but all water delivered meets local, state, and federal drinking water standards through the use of treatment and blending facilities. The threshold is based on the number of currently affected wells.

Discussion/Q&A

The team opened the floor for questions and discussion. Discussion, comments, and questions are summarized below.

- The first question asked for confirmation of the water quality threshold being a change from the present, even though some wells currently exhibit issues. A consultant team member

stated that current water quality constituents already exist, and the threshold is set to avoid any future degradation to water quality.

- Another question asked was whether the statistically significant change identified as 10 percent was based on any standards. A consultant team member explained that 10 percent is what other GSAs are using because anything less than 10 percent is typically within the natural variability of the data.
- TAC members discussed if maintaining current nitrate levels would be achievable without making any other changes in runoff and discharge from the surrounding areas. A consultant team member said that maintaining current levels could be compromised by legacy nitrate loading from historic agricultural uses. The nitrates flow slowly through the system and may not have reached groundwater or monitored wells yet. This will be important to monitor and report on in the 5-year Temescal GSP updates. A TAC member added that Corona has a desalination facility that assists in nitrate removal. The facility will help to improve water quality in the future, but it takes time. Nitrates are still being applied as part of fertilizers, but the nitrate fertilizer was more common when most of the basin's agricultural activity was made up of orange groves. The small size and relatively shallow groundwater conditions in the Temescal Basin reduces the potential for legacy loading compared to other basins.

Land Subsidence Affecting Land Uses

Reilly presented the sustainability criteria for land subsidence affecting land uses and explained that when water is removed from the aquifer, fine-grain materials can compact and the ground surface can decline. Undesirable results for subsidence include damage to drainage channels; reduction in flood management capacity; damage to facilities; impacts on the grade of infrastructure such as pipelines, roads, and highways; damage to wellheads; casing failures; and non-recoverable loss of groundwater storage as fine-grained layers collapse. Subsidence in the Temescal Basin has been estimated by satellite via remote sensing using InSAR data provide by DWR going back to 2015. This method has a margin of error of approximately 0.1 feet. InSAR datasets estimate ground surface change in the Temescal Basin ranging between a rise of 0.08 feet to a fall of 0.08 which is very small and within the margin of error. She noted that none of these undesirable results have been observed in the Temescal Basin but that they will continue to be monitored over time.

Reilly presented the minimum threshold for subsidence, defined as a rate of decline equal to or greater than 0.2 feet in any 5-year period. This has been considered in terms of a cumulative decline equal to or greater than one foot of decline since 2015, which represents current conditions and aligns with the Sustainable Groundwater Management Act start date. The measurable objective is conceptually zero subsidence, while acknowledging measurement error and other uncertainties. In summary, there is no known current or historical subsidence in the Temescal Basin. The threshold is based on potential impacts to infrastructure using remotely sensed ground surface changes.

Discussion/Q&A

There were no questions or comments from the TAC members for this sustainability criteria.

Depletions of Interconnected Surface Water Affecting Beneficial Uses

Gus Yates, Senior Hydrogeologist at Todd Groundwater, presented the sustainability criteria for depletions of interconnected surface water affecting beneficial uses. He explained that groundwater

close to the surface can interact with vegetation or stream flows. Vegetation that relies on groundwater is referred to as phreatophytes and ecosystems that rely on groundwater are referred to as groundwater dependent ecosystems. Yates displayed a map showing the potential groundwater dependent ecosystems in the Temescal Basin and focused on the Prado Basin area. Depths in all wells around the Prado Basin and trends for groundwater levels, groundwater pumping, river flow, and rainfall were analyzed to determine if the Prado wetlands were supported by groundwater. The conclusion is that the Prado wetlands are more dependent on surface flows. Changes in surface inflows have much more influence than changes in groundwater pumping or levels to the north or south. More monitoring is needed in the southern Prado Basin and between Prado and central Temescal Basin pumping.

Yates explained the undesirable results for interconnected surface water. Declining groundwater levels in areas with riparian vegetation can reduce water availability to phreatophytic plant species, which are ones that extend roots to the water table and extract groundwater during the dry season when soil moisture is depleted. Another undesirable result is die-back, or mortality of Prado Basin vegetation. The minimum threshold for depletion of interconnected surface water is historical minimum water levels (maximum depth to water) in shallow monitoring wells in the southern Prado area, correlated with Temescal Basin pumping or water levels. The measurable objective for interconnected surface water is an amount of depletion that is less than the amount specified as the minimum threshold. Given that the objective is based on historical conditions, no specific rise in shallow groundwater levels or increase in stream flow is identified as providing a preferred set of groundwater dependent ecosystem conditions. In summary, changes in surface inflows have much more influence than changes in groundwater pumping or levels to the north or south; additional monitoring in the southern Prado Basin is needed.

Discussion/Q&A

The team opened the floor for questions and discussion. Discussion, comments, and questions are summarized below.

- TAC members said the presentation of the sustainability criteria was great.
- TAC members discussed the interplay of groundwater and surface water with the Prado wetlands. It was suggested that other stakeholders have interests in the health of the Prado wetlands and the surrounding water quality concerns. TAC members thought there was a lot of value in adding monitoring near the Prado wetlands to better understand the nearby groundwater practices.

5. Public Workshop 2

Jack Hughes, Kearns & West, provided an overview of the second public workshop on March 2, 2021 from 4:00-6:00 p.m. The public workshop will be held virtually on the Zoom platform and will be streamed on the City of Corona Facebook page, website, and on Corona TV. Spanish interpretation will be available for those in the Zoom meeting. The second public workshop will focus on the Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget. Additionally, the project team is currently finalizing the second fact sheet. The second fact sheet will accompany the emails sent to interested parties and will be posted to the Temescal GSA website to provide the public an opportunity to learn about the topics prior to the workshop. Hughes invited TAC members to attend the second public workshop and to help spread the word to others who might be interested. See page 24 in Appendix B for more information.

Discussion/Q&A

The team opened the floor for questions and discussion. Discussion, comments, and questions are summarized below.

- TAC members discussed the attendance at the first public workshop and ways to publicize the second workshop. About 13 people attended the first public workshop and additional participants connected via live streaming. The consultant team is finalizing the invitation materials for the second public workshop and will send them to TAC members for assistance with distribution.

6. Public Comment

No members of the public provided comment.

7. Next Steps and Wrap Up

Isaacson summarized next steps for the consultant team and TAC members. The consultant team will continue conducting the technical analyses, including the Water Budget calculations and Numerical Model analysis. The consultant team will also continue preparing the Sustainability Criteria Temescal GSP chapter and begin drafting the Monitoring Program Temescal GSP chapter. Additional next steps include the upcoming second public workshop, to be held on March 2, 2021, and the final TAC meeting on May 19, 2021. The final TAC meeting will focus on the Water Budget and Groundwater Model and include discussion of projects and management actions.

Discussion/Q&A

The team opened the floor for questions and discussion. Discussion, comments, and questions are summarized below.

- Review times for the Draft Sustainability Criteria Temescal GSP and Monitoring Program Temescal GSP chapters were discussed. TAC members should expect to receive the chapters to review in March.

Appendix A

Meeting Agenda

Temescal GSP

Technical Advisory Committee Meeting 3

February 17, 2020

1:00 – 3:00 p.m.
Zoom Meeting: https://zoom.us/j/96317714187

DRAFT Agenda

1) Welcome and Introductions

2) Overview of Meeting Agenda

3) Temescal GSP Status
   - Hydrogeologic Conceptual Model and Groundwater Conditions Chapters
   - Coordination with Neighboring Basins
   - Discussion/Q&A

4) Draft Sustainability Criteria Presentation and Q&A/Discussion
   - Sustainability Goal
   - Beneficial Uses Recap
   - Draft Sustainability Criteria
     - Chronic Lowering of Groundwater Levels
     - Reduction of Groundwater Storage
     - Degradation of Water Quality
     - Land Subsidence
     - Depletions of Interconnected Surface Water
     - Seawater Intrusion – Not applicable

5) Public Workshop 2
   - Virtual Workshop, March 2, 2021, 4-6 p.m.
   - Focused on Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget
   - Discussion/Q&A

6) Public Comment

7) Next Steps and Wrap Up

Appendix B

Presentation Slides

Temescal Groundwater Sustainability Agency

Technical Advisory Committee

February 17, 2021

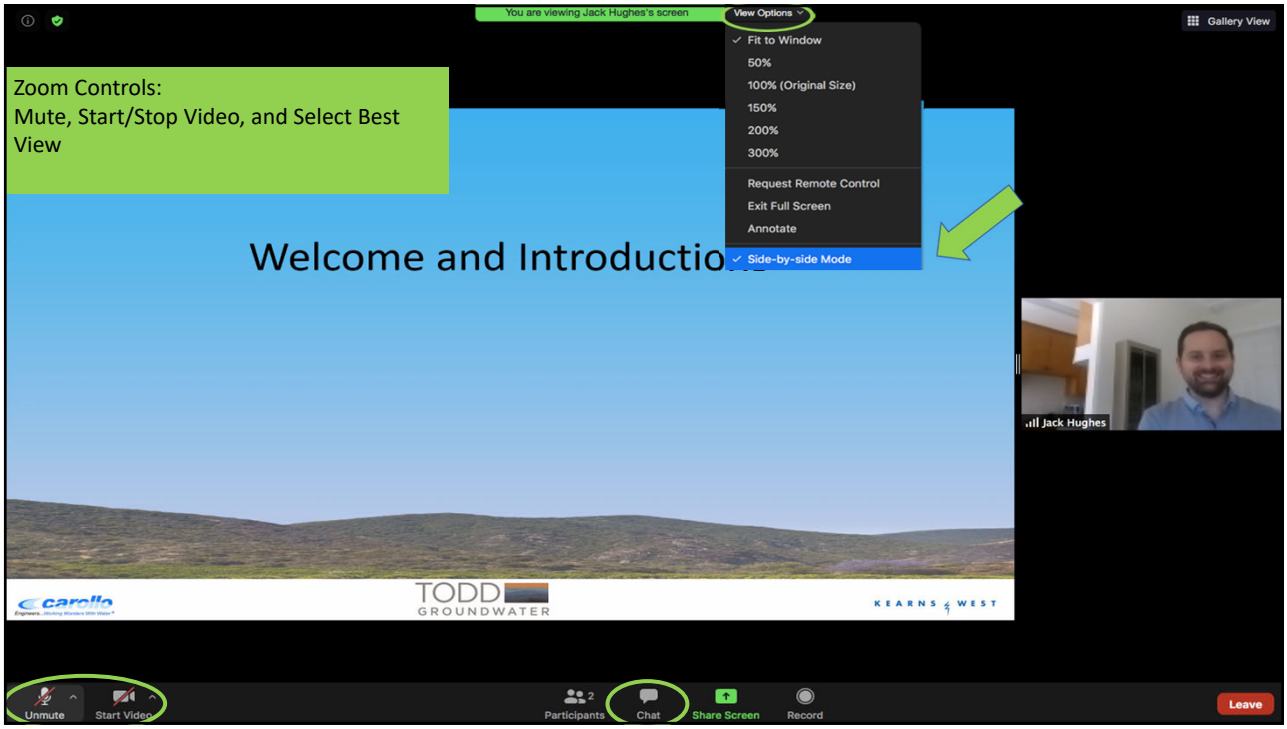


Carollo Engineers...Working Wonders With Water® | TODD GROUNDWATER | KEARNS & WEST

Welcome and Introductions



Carollo Engineers...Working Wonders With Water® | TODD GROUNDWATER | KEARNS & WEST



Tips for a Productive Discussion

- Let one person speak at a time
- Help make sure everyone gets equal time to give input
- Keep your input concise so others have time to participate
- Actively listen to others and seek to understand their perspectives
- Offer ideas to address questions and concerns raised by others

Overview of Meeting Agenda



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Meeting Agenda

1. Welcome and Introductions
2. Overview of Meeting Agenda
3. Temescal GSP Status
4. Draft Sustainability Criteria Presentation and Discussion
5. Public Workshop 2
6. Public Comment
7. Next Steps and Wrap Up



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Temescal GSP Status



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Where are we now in Temescal GSP process?

- Hydrogeologic Conceptual Model (HCM) and Groundwater Conditions chapters posted to GSA website
- Water Budget analyses and chapter and numerical model are underway



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Coordination with Neighboring Basins

- Consultant team and GSA meetings with neighboring groundwater basins:
  - Orange County Water District
  - Chino Basin Watermaster
  - Arlington Basin GSA/Western Municipal Water District
- All willing to share information and data
- Coordination will continue



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Discussion / Q&A



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Draft Sustainability Criteria



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Sustainability Goal

To sustain groundwater resources for the current and future beneficial uses of the Temescal Basin in a manner that is adaptive and responsive to the following objectives:

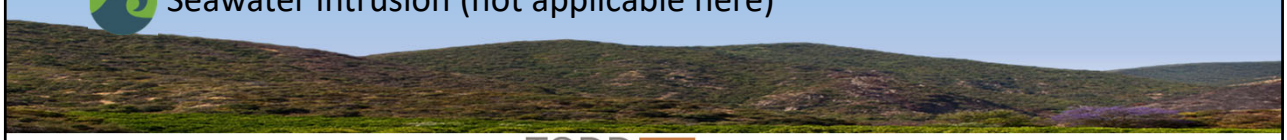
- Provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses
- Provide reliable storage for water supply resilience during droughts and shortages
- Protect groundwater quality
- Support beneficial uses of interconnected surface waters, and
- Support integrated and cooperative water resource management.



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Sustainability Indicators

- Chronic lowering of groundwater levels
- Reduction of groundwater storage
- Degradation of water quality
- Depletions of interconnected surface water affecting beneficial uses
- Land subsidence affecting land uses
- Seawater intrusion (not applicable here)



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Undesirable Results, Minimum Thresholds, and Measurable Objectives

Undesirable Result – significant and unreasonable conditions for any of the six sustainability indicators

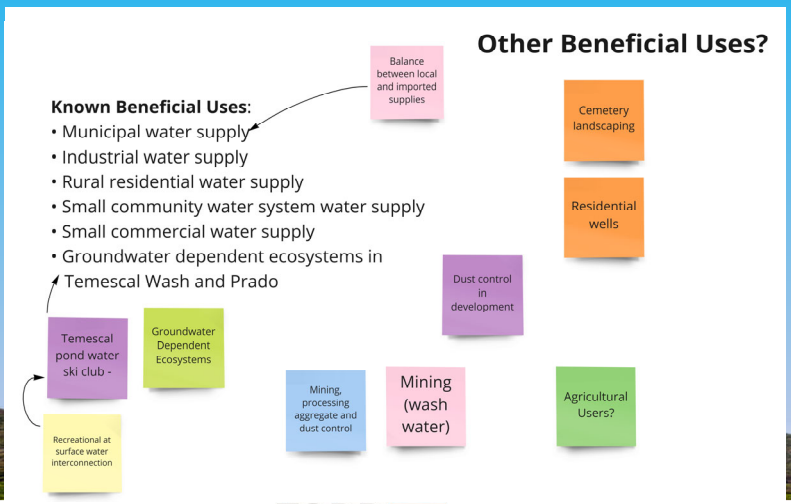
Minimum Threshold (MT) – numeric value used to define undesirable results for each sustainability indicator

Measurable Objective (MO) – specific, quantifiable goal to track the performance of sustainable management



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Beneficial Uses from Last TAC Meeting



carollo Engineers...Working Wonders With Water®

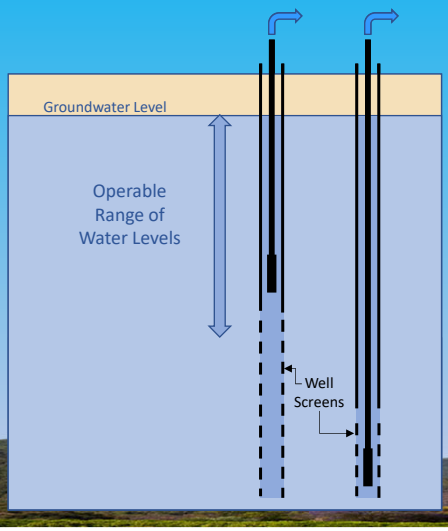
TODD GROUNDWATER

KEARNS & WEST

Undesirable Results - Groundwater Levels

Groundwater level declines result in a sequence of increasing undesirable results:

1. Increased pumping costs and a decrease in pump output
2. Entrained air and or broken suction on pumps
3. Exposed screens, cascading water in the well, increased clogging of screens, and/or accelerated corrosion
4. Reduced saturated aquifer thickness and reduced aquifer capacity



carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST

Minimum Threshold - Groundwater Levels

The Minimum Threshold for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well by the historic minimum static groundwater elevation (maximum historical depth to groundwater)

Undesirable results are indicated when exceedances occur in measurements from two consecutive quarters in each of two consecutive years, in two-thirds or more of the Key Wells

Key Wells are a subset of the current water level monitoring wells with representative records that will continue to be monitored



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Minimum Threshold - Groundwater Levels

Local Well Name	Earliest Monitoring Date	Average Depth to Groundwater (ft bgs)	Pump Intake Depth (ft bgs)	Date of Static Maximum Depth to Groundwater	Maximum Static Depth to Groundwater (ft MSL)
Corona 7A	6/1/2002	156.84	230	1/1/2003	178
Corona 8	12/13/2012	112.6	No Pump	5/4/2014	129.5
Corona 8A	1/1/1998	119.69	200	10/1/2001	169
Corona 9A	7/1/2002	80.72	220	7/1/2002	242
Corona 11	7/18/1959	134.14	180	9/13/2017	158
Corona 11A	12/6/2017	143.48	221.2	5/31/2014	155.2
Corona 12A	3/1/1993	158.59	280	11/2/2005	164
Corona 13	2/1/1977	141.19	182	6/1/1989	174
Corona 14	2/1/1924	184.92	250	5/1/2009	239
Corona 15	8/13/1952	116.63	180	12/1/2004	134
Corona 16	12/13/2012	140.3	No Pump	7/2/2018	159.5
Corona 17A	6/1/2002	110.63	180	5/13/2006	125
Corona 19	4/1/1992	102.73	200	9/1/2003	124.5
Corona 22	4/1/2001	150.19	370	5/1/2004	153.3
Corona 25	4/1/2001	61.71	180	7/1/2003	161.5
Corona 26	5/1/2001	136.86	333	10/1/2004	340.5
Corona 27	3/1/2003	154.19	436.7	3/3/2020	211
Corona 28	3/1/2003	90.59	170	9/6/2016	95.2
Corona 29	3/18/2009	88.63	230	8/1/2018	88.2
Corona 30	8/28/2009	56.9	No Pump	4/24/2014	70.6
Corona 31	3/18/2009	95.13	271	8/7/2009	132.2
Corona 33	3/13/2019	58.80	255	2/4/2020	68.1
Corona 10th/Lincoln	11/17/2011	197.5	No Pump	9/21/2013	204

Measurable Objective - Groundwater Levels

The Measurable Objective is to maintain groundwater levels above the historical maximum depth to water (minimum groundwater elevation), equivalent to the Minimum Threshold.

This maintains groundwater levels within the historical operating range



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Summary/Questions/Comments – Groundwater Levels

Summary:

- Water level conditions are currently sustainable
- Historical static lows will be used as the Minimum Threshold, and Objective is to be above historical static lows



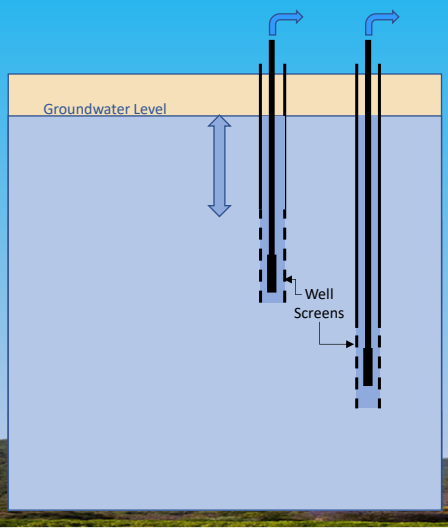
carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Reduction of Groundwater Storage

- Storage is connected to water levels
- GSP regulations allow use of groundwater level Minimum Thresholds and Measurable Objectives as a proxy
- Historical minimum-based water level threshold is well suited to use as a proxy

Undesirable Results - Groundwater Storage

- Insufficient supply to support beneficial uses during droughts.
- Storage is related to groundwater levels and undesirable results are associated with groundwater level declines.



Minimum Threshold - Groundwater Storage

The Minimum Threshold for storage is fulfilled by the minimum threshold for groundwater levels

Groundwater level thresholds have been defined to reflect historical conditions, which is also protective of storage

Groundwater level thresholds and objectives are sufficiently protective to ensure prevention of significant and unreasonable results relating to storage



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Measurable Objective - Groundwater Storage

The Measurable Objective for storage is fulfilled by the Measurable Objective for groundwater levels, which maintain groundwater levels within the historical operating range.



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Summary/Questions/Comments – Groundwater Storage

Summary:

- There is currently sufficient storage in the Temescal Basin
- Water level criteria used as proxy for storage



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Water Quality

The GSA is not responsible for local problems or degradation caused by others and groundwater quality is under regulatory oversight by State Agencies.

The GSA is responsible for increased concentrations in water quality due to management (recharge, pumping).



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

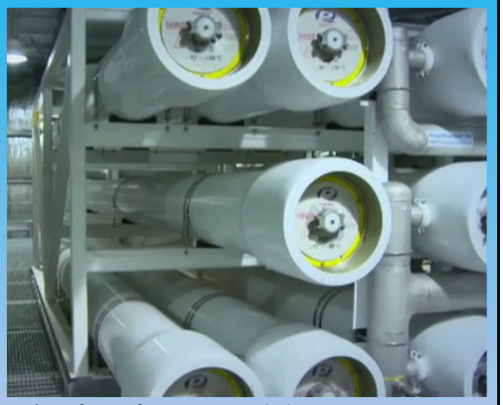
Undesirable Result - Water Quality

Focus will be on total dissolved solids (TDS) and nitrate (other constituents will be tracked, too).

TDS is both naturally occurring and anthropogenic.

High nitrate concentrations in the Temescal Basin may be a result of previous agricultural or wastewater disposal (septic systems and other).

High concentrations of TDS and nitrate could limit beneficial uses. The main users of water treat or blend groundwater before use



(one form of treatment includes Reverse Osmosis pictured here)

carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Minimum Threshold - Water Quality

Beneficial uses of water and water quality objectives are defined in the RWQCB Santa Ana Basin Plan and by the State in drinking water maximum contaminant levels (MCLs).

- Nitrate has a primary MCL for health concern whereas TDS has a secondary MCL for aesthetics.

	RWQCB Basin Plan (mg/L)	MCL (mg/L)
Nitrate (NO3)	45	45
TDS	770	1,000

Current ambient conditions (average concentrations in monitored wells between 2014 and 2019):

- 58 Percent of wells exceed nitrate MCL
- 33 Percent of wells exceed TDS Secondary MCL

While concentrations at some wells exceed the MCLs, all water delivered to end users meet all local, state, and federal standards.

carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Threshold and Objective - Water Quality

Minimum Threshold - Statistically significant increase in the percentage of wells with averages exceeding the MCL for TDS and nitrate, relative to current conditions. *Statistically significant is defined as more than 10 percent increase in number of wells in 5-year period.*

The Measurable Objective for nitrate and TDS is to maintain or reduce the percentage of wells with average concentrations exceeding the threshold, MCL, based on conditions assessed in each 5-year Temescal GSP update



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Summary/Questions/Comments – Water Quality

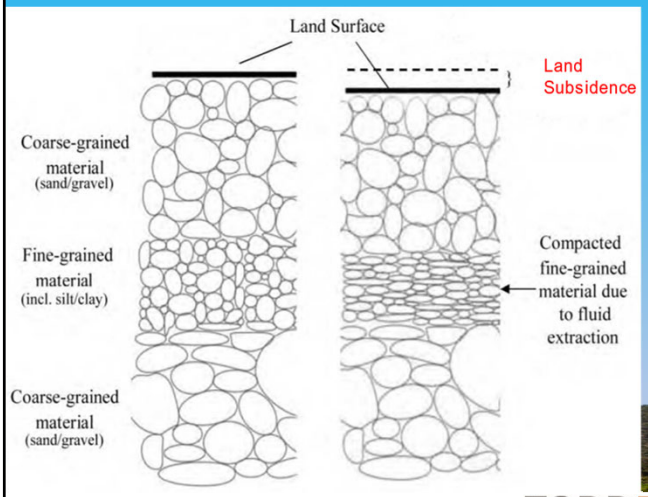
Summary:

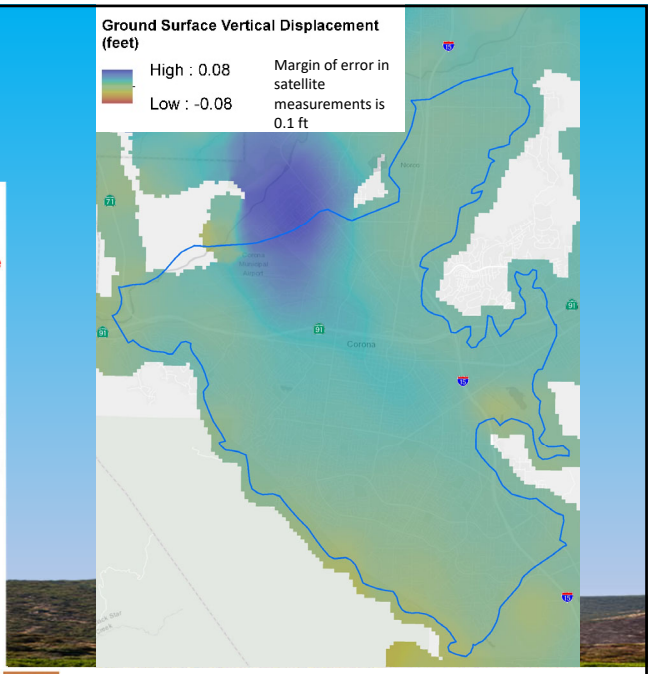
- TDS and nitrate concentrations are elevated in some Temescal Basin wells
- Treatment and blending facilitates municipal use – all water delivered meets local, state, and federal drinking water standards
- Threshold is based on currently affected number of wells



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Subsidence





carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Undesirable Result - Subsidence

Differential subsidence can affect:

- Drainage channels
- Reducing flood management capacity
- Damaging facilities
- Affecting the grade of infrastructure such as pipelines, roads, and highways
- Damaging wellheads or causing casing failure
- Non-recoverable loss of groundwater storage as fine-grained layers collapse

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Minimum Threshold - Subsidence

The Minimum Threshold for subsidence is defined as a rate of decline equal to or greater than 0.2 feet in any five-year period.

This has been considered in terms of a cumulative decline equal to or greater than one foot of decline since 2015.

2015 represents current conditions and the SGMA start date.



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Measurable Objective - Subsidence

The Measurable Objective is conceptually zero subsidence while acknowledging measurement error and other uncertainties.



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Summary/Questions/Comments – Subsidence

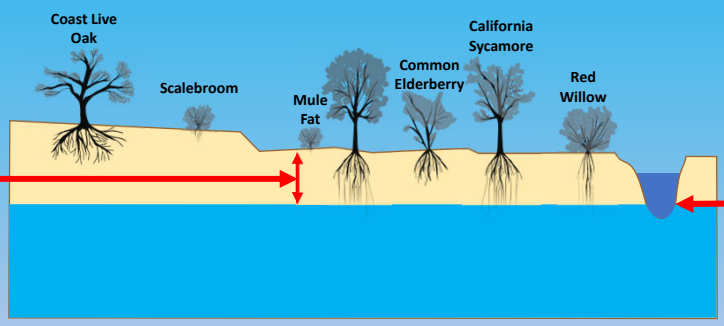
Summary:

- No known current or historical subsidence in the Temescal Basin
- Threshold based on potential impacts to infrastructure using remotely sensed ground surface changes

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

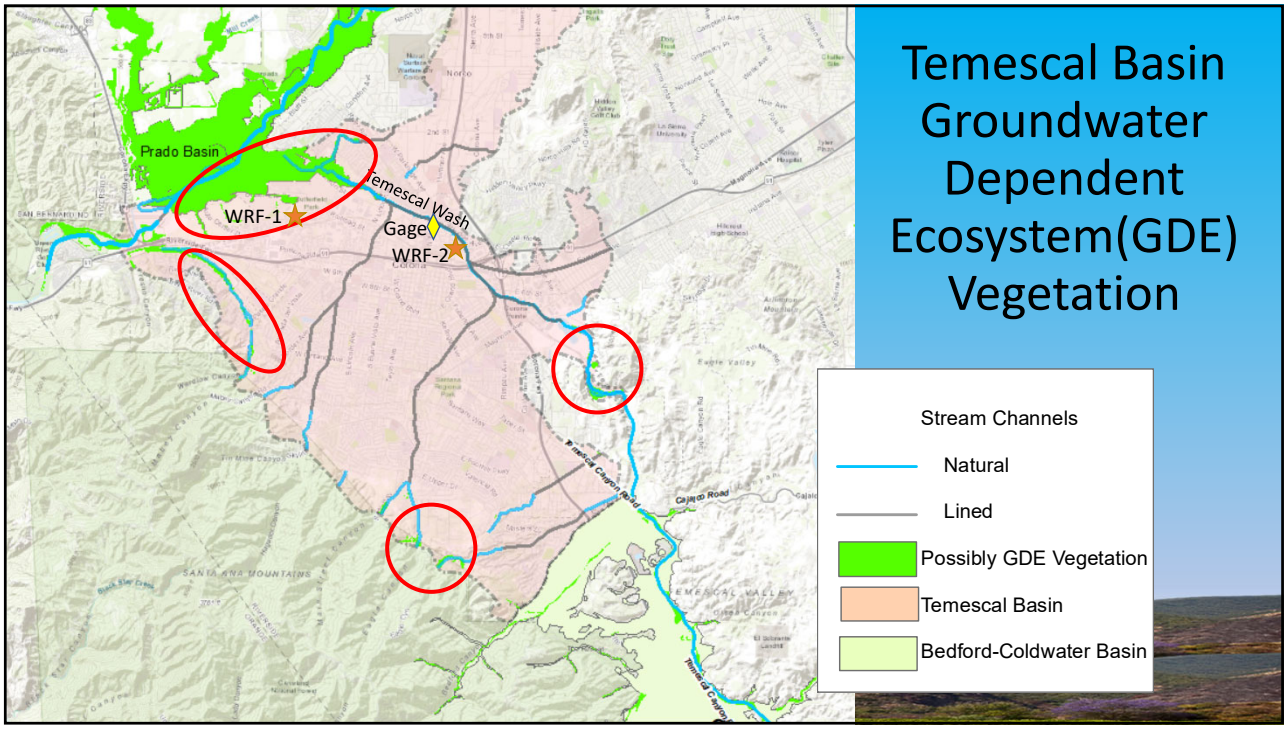
Interconnected Surface Water

For Riparian Vegetation: About 20 to 30 feet

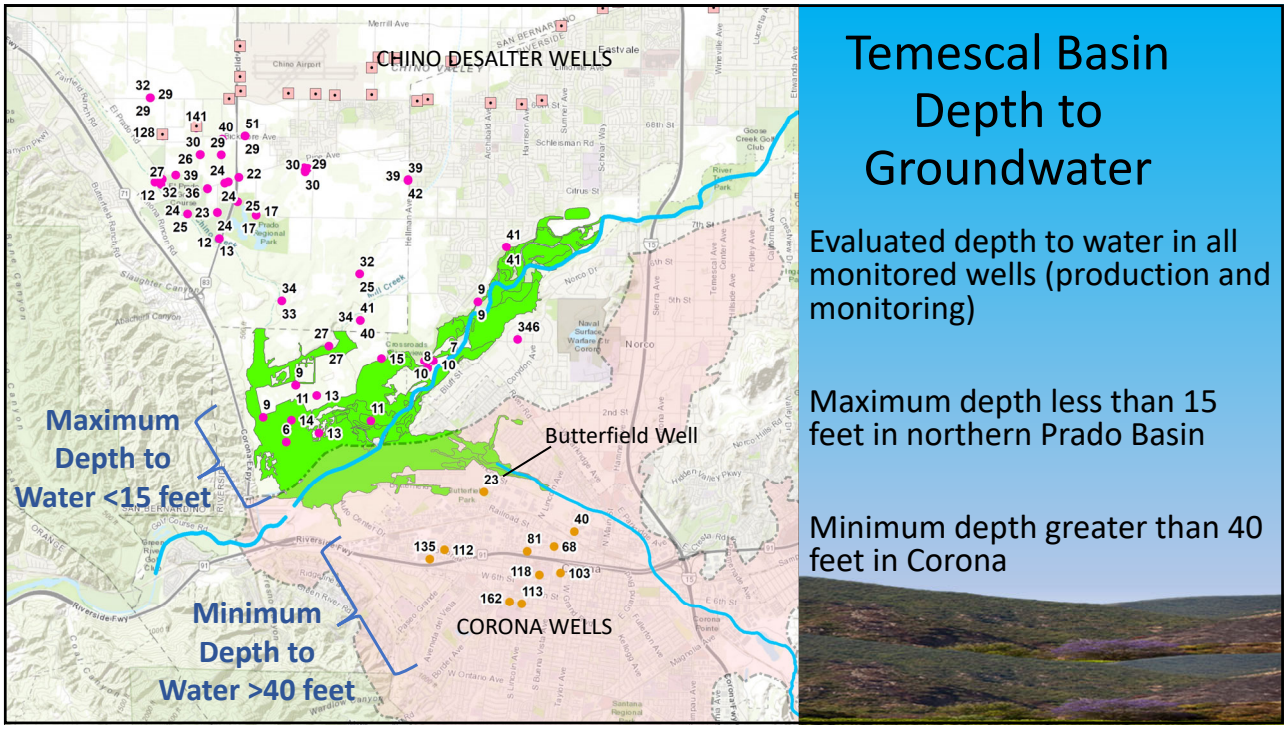


For Stream Flow Depletion: Stream Bed Elevation

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST



Temescal Basin Groundwater Dependent Ecosystem(GDE) Vegetation



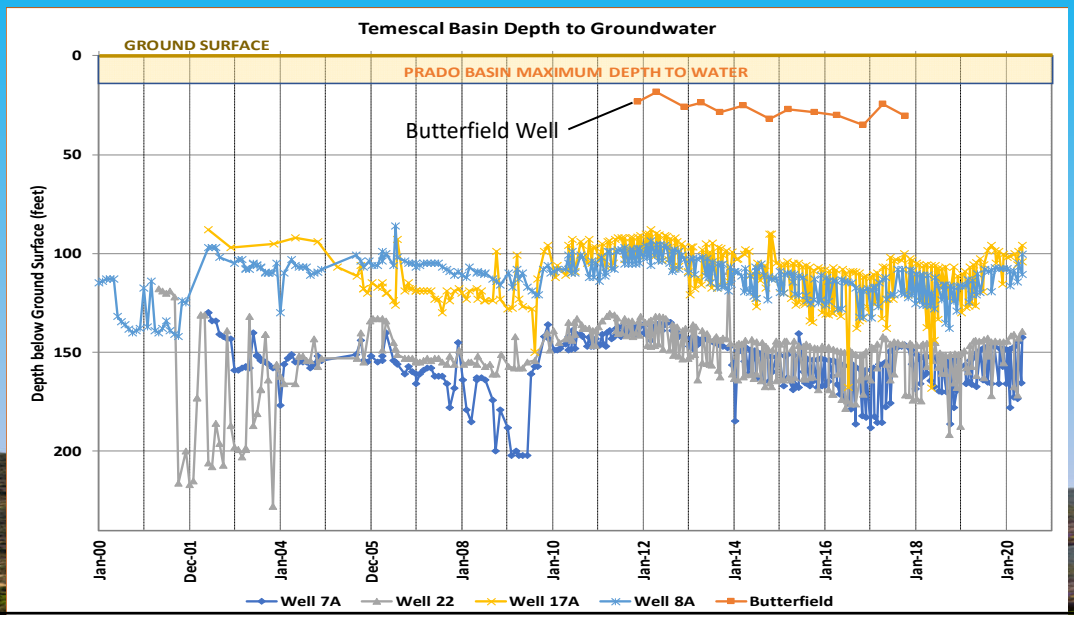
Temescal Basin Depth to Groundwater

Evaluated depth to water in all monitored wells (production and monitoring)

Maximum depth less than 15 feet in northern Prado Basin

Minimum depth greater than 40 feet in Corona

Temescal Basin Depth to Groundwater



Factors Affecting Prado Groundwater Levels

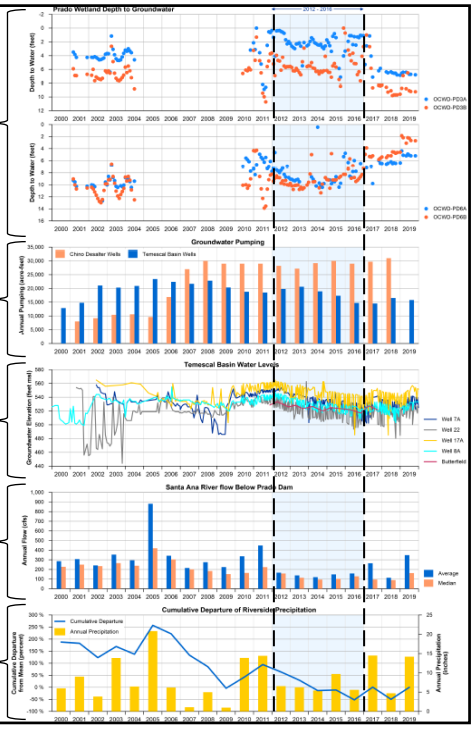
Prado Groundwater Levels

GW Pumping — North / South

Temescal Groundwater Levels

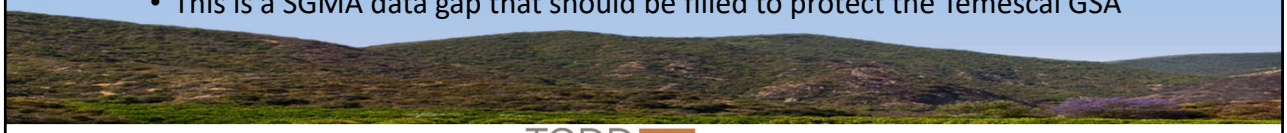
Santa Ana River Flow

Rainfall



Interconnected Surface Water / Groundwater Dependent Ecosystem (GDE) Conclusions:

- Prado wetlands were supported by groundwater prior to development.
- Now they are more dependent on surface inflows
- Changes in surface inflows have much more influence than changes in groundwater pumping or levels to the north or south
- More monitoring is needed in the southern Prado Basin and between Prado and southern Temescal Basin pumping
  - This is a SGMA data gap that should be filled to protect the Temescal GSA



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Undesirable Result - Interconnected Surface Water / Groundwater Dependent Ecosystem

- Declining groundwater levels in areas with riparian vegetation can reduce water availability to phreatophytic plant species, which are ones that extend roots to the water table and extract groundwater during the dry season when soil moisture is depleted.
- Die-back or mortality of Prado Basin vegetation



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Minimum Threshold - Interconnected Surface Water / Groundwater Dependent Ecosystem

The Minimum Threshold for depletion of interconnected surface water is historical minimum water levels (maximum depth to water) in shallow monitoring wells in the southern Prado area, correlated with Temescal Basin pumping or water levels.



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Measurable Objective - Interconnected Surface Water / Groundwater Dependent Ecosystem

The Measurable Objective for interconnected surface water is an amount of depletion that is less than the amount specified as the Minimum Threshold

Given that the objective is based on historical conditions, no specific rise in shallow groundwater levels or increase in stream flow is identified as providing a preferred set of GDE conditions



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Summary/Questions/Comments – Interconnected Surface Water / Groundwater Dependent Ecosystem

Summary:

- Changes in surface inflows have much more influence than changes in groundwater pumping or levels to the north or south
- Additional monitoring in southern Prado is needed



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Discussion / Q&A



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Public Workshop 2



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Public Workshop 2

- March 2, 2021, 4 to 6 PM
- Focused on Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget
- Fact Sheet No. 2 to accompany this workshop will be available soon
- Virtual workshop link: (https://zoom.us/j/93530179115)
- Please forward invite to interested parties



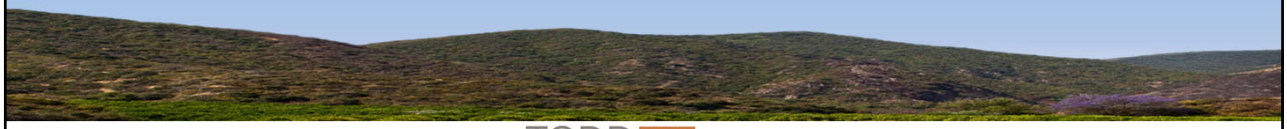
carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Discussion / Q&A

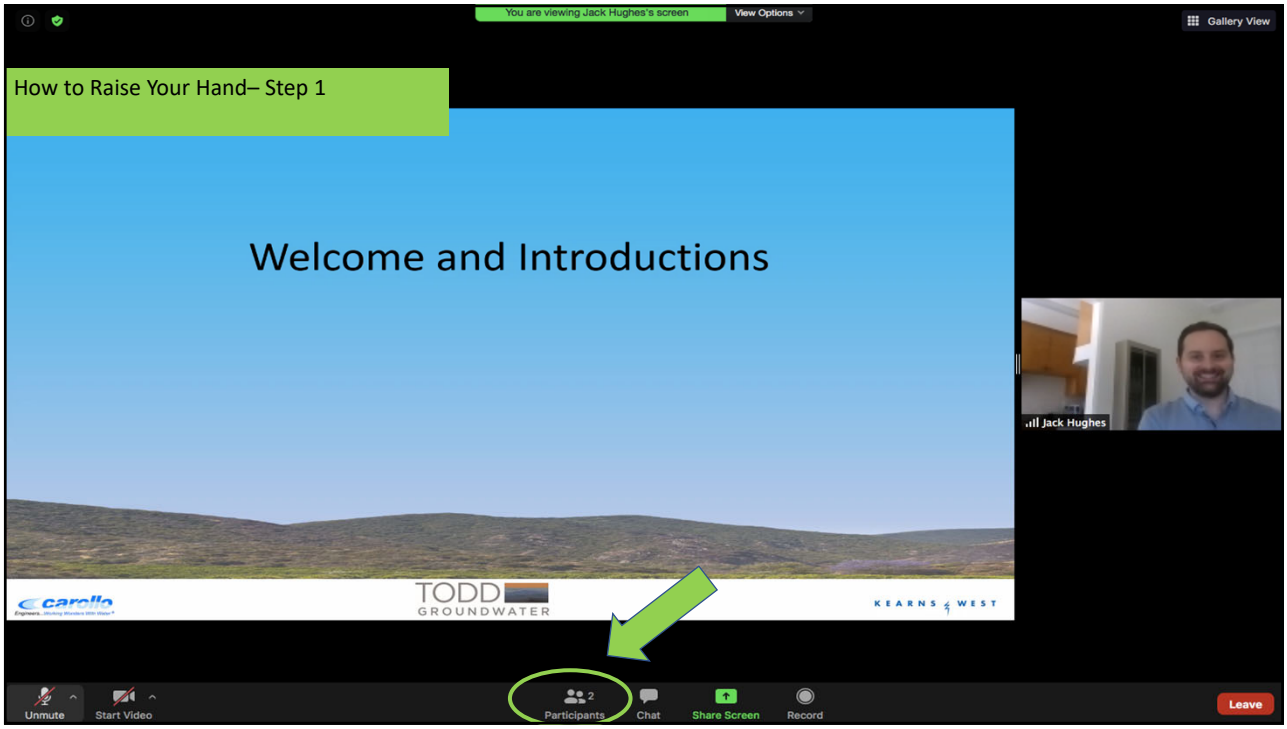


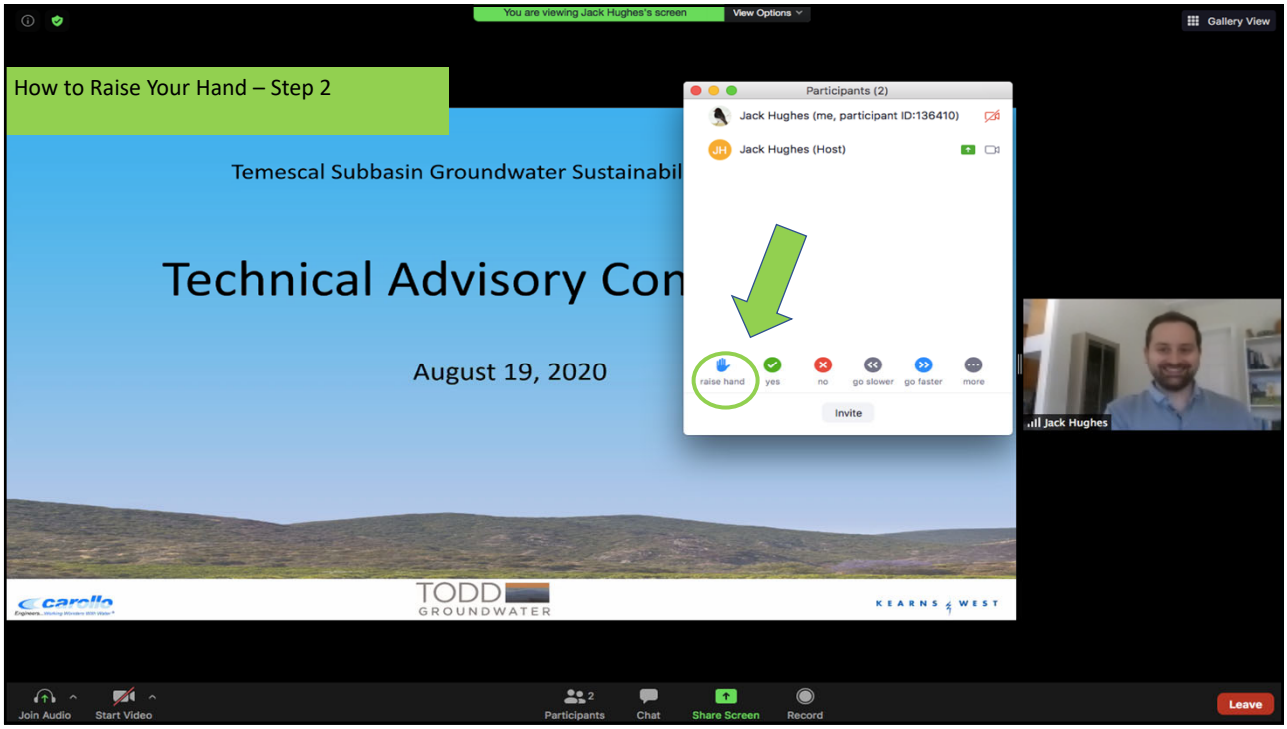
carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Public Comment



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST


How to Raise Your Hand– Step 1
You are viewing Jack Hughes's screen
View Options
Gallery View
Welcome and Introductions
Jack Hughes
Unmute
Start Video
Participants
Chat
Share Screen
Record
Leave


How to Raise Your Hand – Step 2
You are viewing Jack Hughes's screen
View Options
Gallery View
Participants (2)
Jack Hughes (me, participant ID:136410)
Jack Hughes (Host)
raise hand
yes
no
go slower
go faster
more
Invite
Temescal Subbasin Groundwater Sustainabil
Technical Advisory Con
August 19, 2020
Jack Hughes
Join Audio
Start Video
Participants
Chat
Share Screen
Record
Leave

Next Steps and Wrap Up



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Next Steps

- Continue Technical Analyses
  - Continue Water Budget calculations
  - Continue numerical model analysis
  - Prepare draft Sustainability Criteria Temescal GSP chapter
  - Begin work on Monitoring Program Temescal GSP chapter
- Prepare for and hold Public Workshop 2 (March 2, 2021)
  - Zoom Link : https://zoom.us/j/93530179115
- Next TAC meeting May 19, 2021
  - Water budget and groundwater model
  - Discussion of Projects and Management Actions
- Questions or comments to groundwater@coronaca.gov



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST


Thank You!
carollo
Engineers...Working Wonders With Water®
TODD
GROUNDWATER
KEARNS & WEST

Technical Advisory Committee Meeting 4

Meeting Summary

Wednesday, June 16, 2021
1:00 p.m. – 3:00 p.m.
Location: Zoom Virtual Meeting

Attendees

Technical Advisory Committee Members

- Ava Moussavi, Riverside County Flood Control and Water Conservation District
- Eric Lindberg, California Regional Water Quality Control Board – Santa Ana Region
- Jacque Casillas, Mayor, City of Corona
- Katie Hockett, City of Corona Department of Water and Power
- Roberta Reed, 3M Industrial Mineral Products Division
- Tom Moody, City of Corona Department of Water and Power

Additional City of Corona Department of Water and Power Staff

- Kristian Alfelor
- Melissa Estrada-Maravilla

Consultant Team

- Chad Taylor, Todd Groundwater
- Gus Yates, Todd Groundwater
- Phyllis Stanin, Todd Groundwater
- Elisa Garvey, Carollo Engineers
- Inge Wiersema, Carollo Engineers
- Madison Rasmus, Carollo Engineers
- Alyson Scurlock, Kearns & West
- Jack Hughes, Kearns & West
- Joan Isaacson, Kearns & West

Summary

1. Welcome and Introductions

Joan Isaacson, facilitator from Kearns & West, welcomed all to the fourth meeting of the Temescal Groundwater Sustainability Agency (Temescal GSA) Technical Advisory Committee (TAC). She led roundtable introductions for TAC members and the consultants assisting the Temescal GSA with meeting facilitation and preparation of the Temescal Groundwater Sustainability Plan (Temescal GSP).

2. Overview of Meeting Agenda

Isaacson reviewed the meeting agenda (see Appendix A). The focus of the meeting was providing an update on the status of the Temescal GSP and the water budget, presenting the draft projects and management actions and getting input from TAC members, and giving an overview of the third public workshop.

3. Temescal Groundwater Sustainability Plan Status

Chad Taylor, Principal Hydrogeologist at Todd Groundwater, provided a status update on the Temescal GSP. The Monitoring Network (Chapter 7), Projects and Management Actions (Chapter 8), Plan Implementation (Chapter 9), and Introduction (Chapter 1) chapters are currently in review by the Temescal GSA and will be distributed to the TAC for review in late June. The Water Budget (Chapter 5) and Sustainability Criteria (Chapter 6) chapters are in final review by the consultant team and will be distributed to the Temescal GSA in late June and to the TAC in early July. After receiving comments from the Temescal GSA and TAC on the remaining chapters, a draft of the Temescal GSP will be compiled and prepared for public release.

Taylor described the Temescal GSP review period and adoption process. The draft Temescal GSP will be posted in late July or early August and will have a 90-day public review period that will extend to October or November. The revised GSP is estimated to be ready for adoption by the Temescal GSA in November or December 2021 to meet the submittal deadline to the California Department of Water Resources (DWR) by January 31, 2022.

Taylor discussed the role of the TAC moving forward, which includes reviewing and providing comments on the draft chapters and inviting their constituents, communities, and any other interested parties to the upcoming third public workshop that will take place on July 8, 2021. He also asked the TAC to help spread the word when the draft of the Temescal GSP is posted for public review.

After the Temescal GSP is adopted, the TAC may be involved in the implementation phase; any future TAC meetings will be convened on an as-needed basis. The TAC will be informed of other Temescal GSP activities through routine notifications. For more information on the Temescal GSP Status, see pages 4 through 5 in Appendix B.

Discussion/Q&A

There were no questions or comments from the TAC members for this agenda item.

4. Water Budget Presentation

Gus Yates, Senior Hydrogeologist at Todd Groundwater, presented on the water budget, what it is, and how it is being developed. The water budget quantifies the inflows and outflows of the Temescal Basin over time in addition to the change in groundwater storage. Both inflows and outflows vary from year to year depending on hydrology and management. Yates described the process for estimating items in the water budget. Items that can be measured or calculated directly and thus serve as model inputs include dispersed recharge, wastewater percolation, groundwater pumping, and surface water inflows at the model boundary. Other items that are derived from model outputs are stream percolation, groundwater discharge to streams and the Prado Wetlands, subsurface boundary flows, and changes in storage.

Yates reviewed dispersed recharge using a rainfall-runoff-recharge model diagram. He detailed the different ways in which water percolates through land including rainfall recharge, irrigated recharge, and runoff from impervious surfaces that can flow into pipes, the Prado Wetlands, or to pervious surfaces to become focused recharge. He noted that all percolation goes to the shallow groundwater zone, some of which becomes baseflow in streams. In the main part of the Temescal Basin, most deep percolation enters the regional aquifer system. Yates also reviewed a map of the 286 recharge polygons under evaluation, which the consultant team identified based on locations where recharge occurs and specific land uses that contribute to recharge. The recharge polygons extend east and west of the Temescal Basin to cover surface tributaries that drain into the basin. The model extends into the southern Chino Basin to characterize the interaction between basins and the Prado Wetlands.

Yates next described stream recharge in the Temescal Basin. He displayed the natural stream channels where percolation occurs and the cement-lined stream channels or pipelines where no percolation occurs that are included in the model. Stream channels in the Temescal Basin are far above the water table and the depth to groundwater decreases moving towards the northwest portion of the basin. In the Prado Wetlands area, the land surface and water table are close enough together that vegetation roots can reach the groundwater. Overall, percolation is not affected by groundwater levels except in the Prado Wetlands area.

Yates described subsurface inflow and outflow, which includes mountain-front recharge and percolation through fractures in the bedrock. The Temescal Basin was separated into four different zones and water budgets were developed for each. These water budget zones include the channel aquifer in the middle of the basin where most groundwater pumping occurs, the alluvial fan aquifer which makes up the remainder of the basin, the tributary watersheds which contribute inflows to the Temescal Basin, and the Chino Basin. Yates noted that groundwater pumping is concentrated in the channel aquifer.

Yates next discussed the water budget analysis periods that were selected. The Sustainable Groundwater Management Act (SGMA) requires three time periods be analyzed: historical, current, and future. For the historical time period, 1993-2007 was chosen, and for the current time period, 2010-2013 was chosen; both time periods were chosen based on average climate conditions. The future time period is represented by 1993-2017 repeated twice since the required time period was 50 years. In addition, Yates discussed a graph showing the cumulative departure of rainfall, which is how the analysis periods were chosen, noting that there were much bigger wet and dry events in the 1993-2017 portion of graph.

Lastly, Yates presented the surface water and groundwater budgets. The surface water budget looks at inflows and outflows to surface waterways. Since creek channels are mostly concrete-lined and far above the water table in the Temescal Basin, there is little percolation, and the percolation rate is not affected by the groundwater level. The Prado Wetlands is the only area where groundwater and surface water interact. For the groundwater budget, Yates noted that quantitative results are still under review but that some general patterns are emerging. First, the largest sources of recharge in the Temescal Basin are reclaimed water percolation, followed by rain, irrigation, and pipe leaks, and stream percolation and subsurface inflow. Next, the yield of the channel aquifer depends on the inflow from the alluvial fan aquifer area; groundwater pumping is 60-75% of basin outflows. Lastly, the channel aquifer yields approximately the same amount as current pumping. Increasing pumping will not increase yield. For more information on the Water Budget (Chapter 5), see pages 6 through 12 in Appendix B.

Discussion/Q&A

Isaacson opened the floor for questions and discussion. Discussion, comments, and questions are summarized below.

- The first question asked if the general patterns for recharge consider changes in land use over time. A consultant team member replied that the basin was mostly urbanized in the past as it is today.
- Another question asked if there was an estimate of how much of the area was developed and how much runoff increased with urbanization. A consultant team member explained that in the 1990s, about one-third to one-half of the basin was not urbanized and most development occurred in the 1990s and early 2000s. A TAC member added that there was a study conducted in the last few years that estimated a 6,000 acre-feet loss of recharge due to urbanization in the watershed.
- A TAC member asked about the relationship between cumulative deviation from the mean, production, and groundwater levels during the period where the Temescal Basin may be in overdraft. A consultant team member stated that the measured hydrographs are variable with some dating back to the 1990s where large declines in groundwater levels can be seen. In the last 10 years, the level of urban development has been steady but in 2012, wastewater management changed slightly along with continued drought conditions, so there might have been a slight decline in the groundwater levels in wells. The decline in storage in the water budget seen to date is approximately 4 percent of the total outflow, which is within the margin of error for most water budget analyses. The future baseline scenario in the model will provide more information to confirm or disprove that and answer this question.

5. Draft Projects and Management Actions Presentation and Discussion

Elisa Garvey, Engineer at Carollo Engineers, presented the draft projects and management actions for the Temescal GSP. She explained the three groupings of actions: baseline, planned, and potential future. Baseline refers to existing or established commitments to projects or actions. Planned actions are developed and evaluated projects or actions. Potential future actions describe projects or actions to be implemented later to achieve sustainability goals.

Garvey began by describing the baseline projects. The first is groundwater treatment at the Temescal Desalter to reduce nitrates, total suspended solids (TSS), total dissolved solids (TDS), and other contaminants of concern for the drinking water supply. The second project is water reclamation facility (WRF) percolation ponds that discharge from City of Corona-owned WRFs to percolation ponds that recharge the Temescal Basin. The third project includes water-level quality assurance and quality control activities that maintain the reliability of ongoing groundwater elevation data. The final project Garvey presented was the Western Riverside County Regional Authority (WRCRWA) plant that will soon produce recycled water for local irrigation use.

Garvey next reviewed the baseline management actions. These include Water Shortage Contingency Plans, which are plans that detail the stages of water shortage and conservation response based on a city's available supply and deficit, and Water Conservation Programs, which include response actions to reduce water use in the stages of a water shortage. Additional management actions include the Western

Municipal Water District Integrated Regional Water Management Plan, which is a coordinated, long-range regional water quantity and quality management strategy, and the Temescal GSA's involvement in the Santa Ana Watershed Project, which is a coordinated management group formed to protect the Santa Ana River Basin and associated water resources.

Garvey then reviewed the three projects included in planned actions. First, the Potable Reuse Feasibility Study will look at the possible use of future reclaimed water supply. Second, the mountain runoff capture investigation would explore options for operational changes to allow for additional benefit of groundwater recharge using storm event runoff at the edges of the basin adjacent to the Santa Ana mountains that is collected in Riverside County Flood Control and Water Conservation District basins. Lastly, the interconnected surface water monitoring wells project would include three shallow monitoring wells drilled into the Prado Management Area to allow for groundwater elevation monitoring.

Madison Rasmus, Environmental Engineer at Carollo Engineers, provided more information on the interconnected surface water monitoring wells project since its implementation date is within the first year of Temescal GSP adoption. Wells will be sited in the southern area of the Prado Management Area. There is no active groundwater monitoring in this location so drilling wells will allow the Temescal GSA to better understand the relationship between the basin and interconnected water in the Prado Wetlands. The project will consist of three groundwater wells about 40-60 feet deep that will allow for continuous groundwater elevation data collection in the area. The data will be incorporated in the 5-year GSP update and monitoring wells will inform future management actions in the Santa Ana River Watershed.

Lastly, Garvey presented potential future actions. Data collected from the Prado Management Area monitoring wells will be used as part of monitoring for undesirable results to interconnected surface water in Prado. If this monitoring identifies potential undesirable results to interconnected surface water in the Prado Management Area, then coordination will be needed with upstream Santa Ana River partners as a management action. If groundwater levels in the Prado Management Area are falling, this approach will allow for coordinated solutions. There are two additional future management actions. One is for future groundwater treatment, which would entail implementing advanced treatment for previously detected per- and polyfluoroalkyl substances (PFAS), TDS, nitrate, and trichloropropane (TCP). The other future management actions is for urban stormwater treatment, capture, and recharge, which is an exploration of urban stormwater harvesting to offset water supply and/or provide for groundwater recharge. For more information on the Projects and Management Actions (Chapter 8), see pages 13 through 16 in Appendix B.

Discussion/Q&A

There were no questions or comments from the TAC members for this agenda item.

6. Public Outreach

Jack Hughes, Senior Associate from Kearns & West, provided an overview of upcoming outreach and engagement activities. The third public workshop will be held virtually on July 8, 2021 from 4:00-6:00 p.m. on the Zoom platform. It will be streamed on the City of Corona Facebook page, website, and on Corona TV. Spanish interpretation will be available for those in the Zoom meeting. The third public workshop will focus on the sustainability criteria and projects and management actions. The third fact sheet will accompany the emails sent to interested parties. The fact sheet will also be posted to the Temescal GSP website to provide the public an opportunity to learn about the topics prior to the

workshop. Hughes invited TAC members to attend the third public workshop and to help spread the word to others who might be interested.

In addition, the consultant team is preparing for a community leader meeting that will take place prior to the third public workshop to ensure the team is reaching a variety of stakeholders and hearing diverse interests. The purpose of the community leader meeting is to provide information on local water supply and learn about needs and perspectives in vulnerable communities. See pages 17 through 18 in Appendix B for more information.

Discussion/Q&A

There were no questions or comments from the TAC members for this agenda item.

7. Public Comment

No members of the public provided comment.

8. Next Steps and Wrap Up

Isaacson summarized next steps for the consultant team and TAC members. The consultant team will revise Chapters 1, 5, 6, 7, 8, and 9 based on GSA and TAC comments prior to compiling the complete GSP for public release. Additional next steps include the upcoming third public workshop on July 8, 2021 and preparation, finalization, adoption, and submittal of the GSP to DWR.

Discussion/Q&A

The team opened the floor for questions and discussion. Discussion, comments, and questions are summarized below.

- A TAC member expressed excitement for upcoming community leader engagement.
- A TAC member thanked the TAC for providing valuable input throughout the GSP process.

Appendix A

Meeting Agenda

Temescal GSP

Technical Advisory Committee Meeting 4

June 16, 2021

1:00 – 3:00 p.m.
Zoom Meeting: https://zoom.us/j/99711646541

Agenda

1) Welcome and Introductions

2) Overview of Meeting Agenda

3) Temescal GSP Status
   - Draft Chapters
   - GSP Review and Adoption
   - Technical Advisory Committee Look Ahead
   - Discussion/Q&A

4) Water Budget Presentation
   - Discussion/Q&A

5) Draft Projects and Management Actions Presentation and Discussion
   - Discussion/Q&A
     - Are there other potential groundwater related projects we should consider?
     - Do you have ideas for how the volume of groundwater in the Basin could be increased?
     - Do you have ideas for making groundwater more sustainable in the Basin?

6) Public Outreach
   - Virtual Workshop, July 8, 2021
   - Community Leader Meeting
   - Fact Sheet 3
   - Discussion/Q&A

7) Public Comment

8) Next Steps and Wrap Up

Appendix B

Presentation Slides

Temescal Groundwater Sustainability Agency

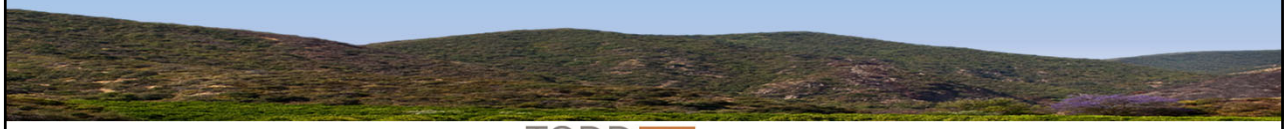
Technical Advisory Committee

June 16, 2021

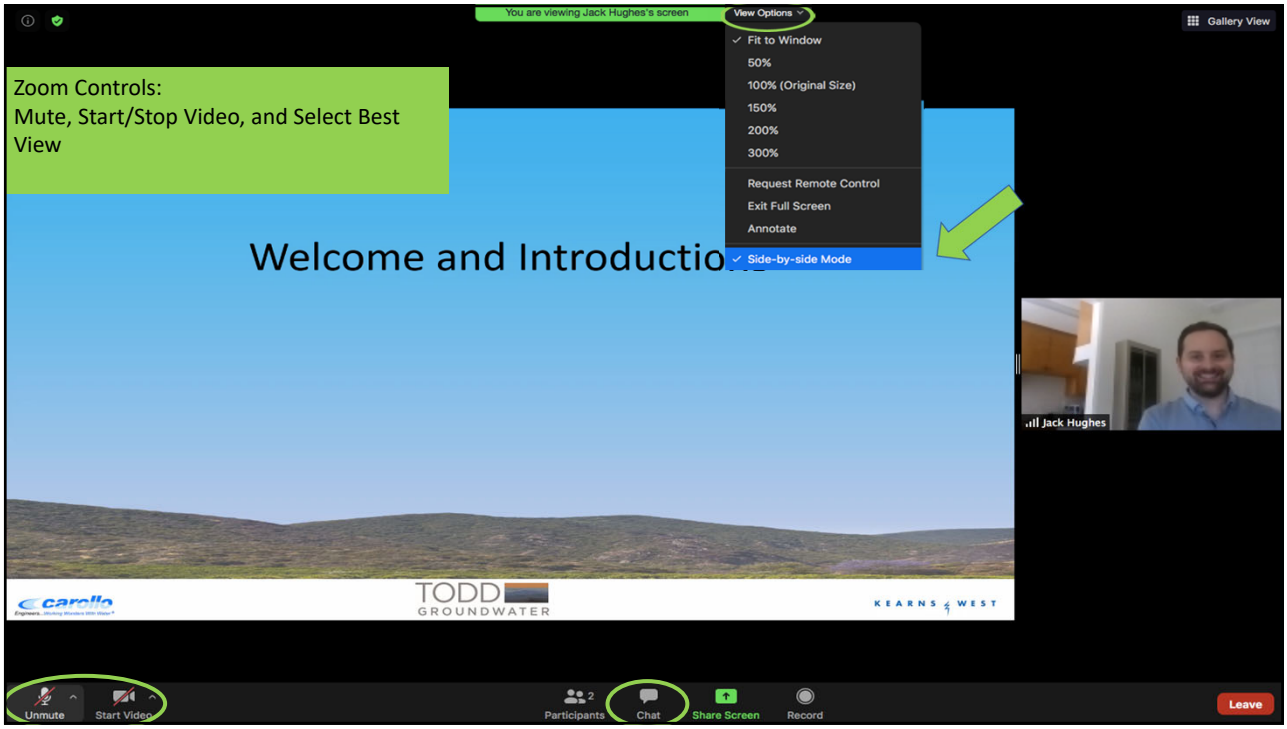


carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Welcome and Introductions



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST



Tips for a Productive Discussion

- Let one person speak at a time
- Help make sure everyone gets equal time to give input
- Keep your input concise so others have time to participate
- Actively listen to others and seek to understand their perspectives
- Offer ideas to address questions and concerns raised by others

Overview of Meeting Agenda



Carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Meeting Agenda

1. Welcome and Introductions
2. Overview of Meeting Agenda
3. Temescal GSP Status
4. Water Budget Presentation
5. Draft Projects and Management Actions Presentation and Discussion
5. Public Outreach
6. Public Comment
7. Next Steps and Wrap Up



Carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Temescal GSP Status



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Where are we in the Temescal GSP process?

- Monitoring Network (7), Projects and Management Actions (8), Plan Implementation (9), and Introduction (1) chapters in review by GSA now and will be distributed to TAC for review in the next two weeks
- Water Budget (5) and Sustainability Criteria (6) chapters are in final review by the consultant team and will be distributed to the GSA later this week with TAC distribution in early July
- This represents all remaining chapters of the GSP
- After receiving comments from the GSA and TAC, the complete GSP will be compiled and prepared for public release



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

GSP Review and Adoption Process

- The complete GSP will be posted for public review in late July/early August
- 90-day public review period through October/November
- Revised GSP slated to be ready for GSA adoption November/December 2021
- Submittal deadline to State Department of Water Resources January 31, 2022



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Technical Advisory Committee Look-Ahead

- Review chapters 1, 5, 6, 7, 8, and 9, deadline for comments will be transmitted with chapter distribution
- Spread the word about the upcoming GSP activities
  1. Public workshop July 8th
  2. Fact Sheet 3
  3. Release of the complete GSP
  4. Community leader meeting
- Future TAC meetings during GSP implementation



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Temescal Basin Water Budget



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

What is a Water Budget?

- A water budget quantifies the inflows and outflows of the Temescal Basin over time
- Both inflows and outflows vary from year to year, depending on hydrology or management
- Inflows - Outflows = Change in Storage



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

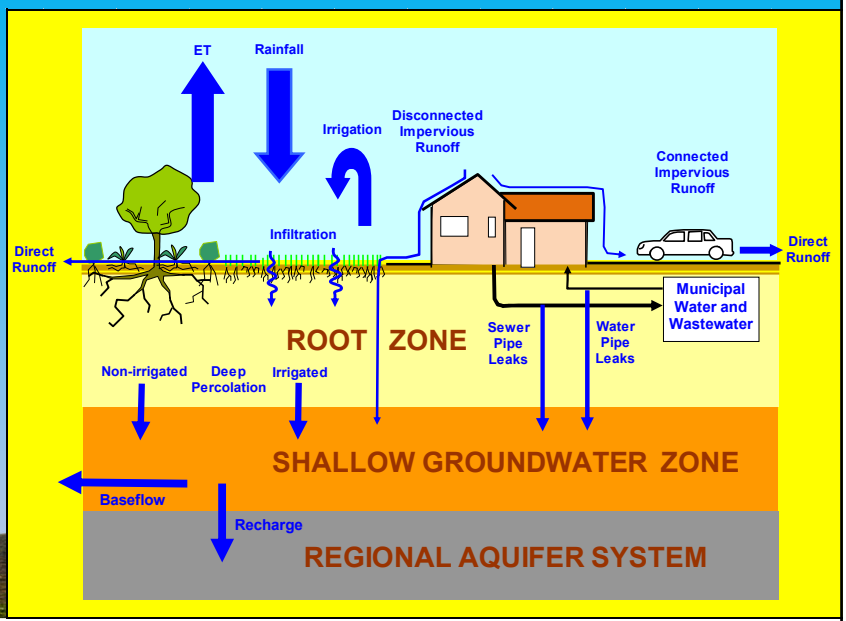
Preliminary Historical Groundwater Budgets

- Water budget items
  - Measured or calculated; input to model
    - Dispersed recharge
    - Wastewater percolation
    - Pumping
    - Surface water inflows at model boundary
  - Head-dependent; ouput from model
    - Stream percolation
    - GW discharge to streams and Prado Wetlands
    - Subsurface boundary flows
    - Storage change

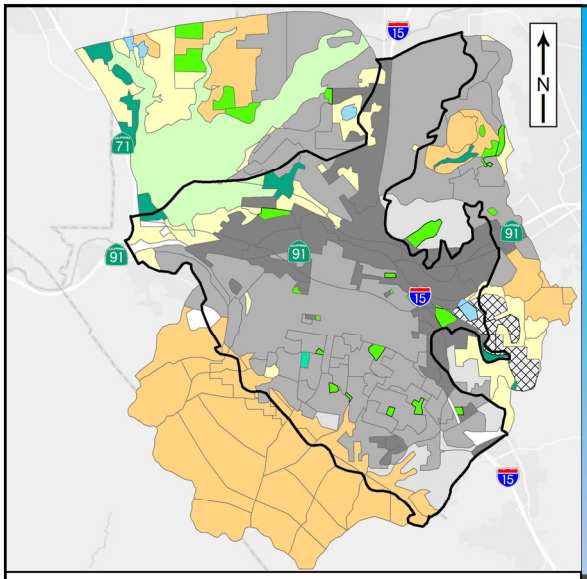
carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Dispersed Recharge

Rainfall-Runoff-Recharge Model



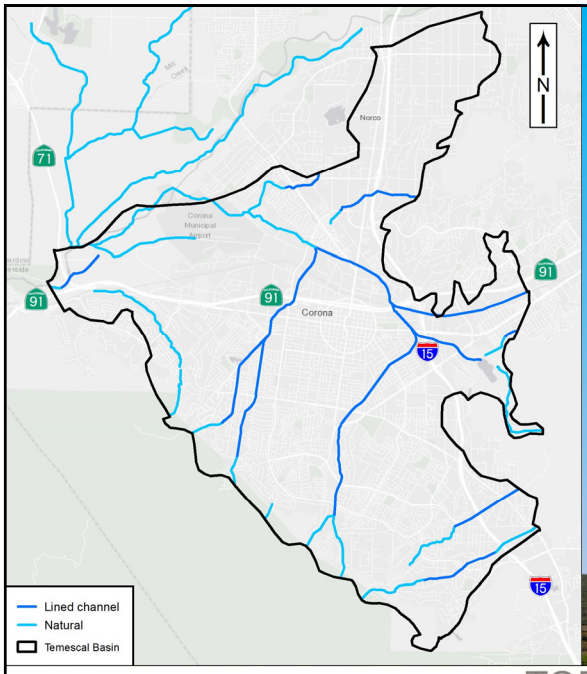
carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST



Recharge Polygons

- 286 polygons, which have been identified based on:
  - Areas where recharge occurs
  - Land uses that contribute to recharge
- Evolving land use
- Includes tributary watersheds
- Extends into southern Chino Basin

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST



Stream Recharge

Stream Channel in Model

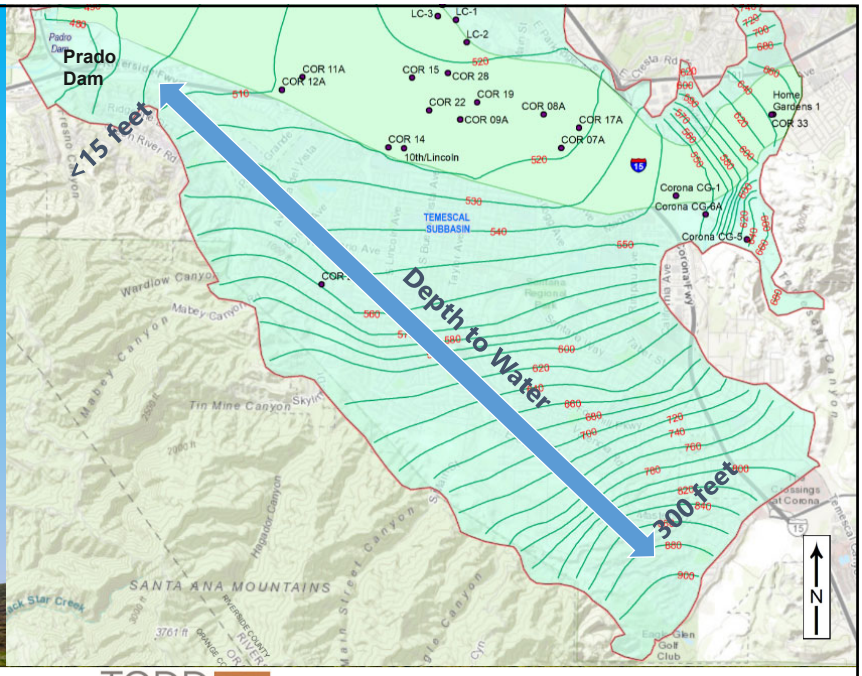
- Natural bed
- Cement-lined or pipeline

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Stream Recharge

Stream channels are far above the water table

Percolation not affected by groundwater level except at Prado

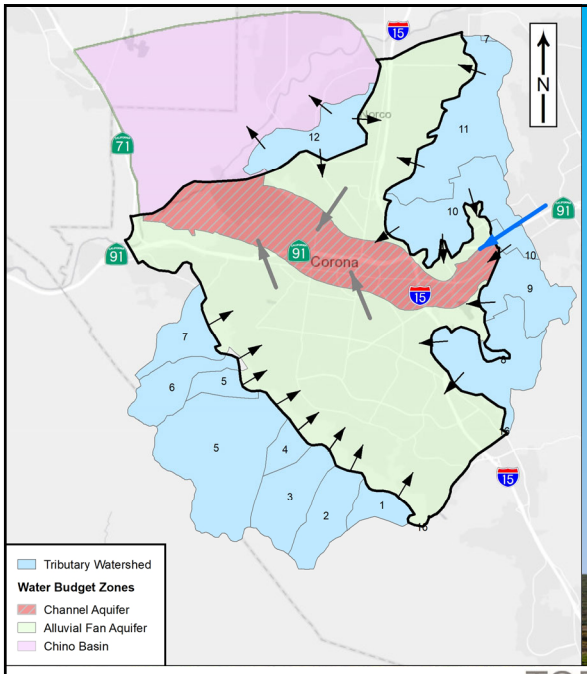


carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST

Subsurface Inflow/Outflow



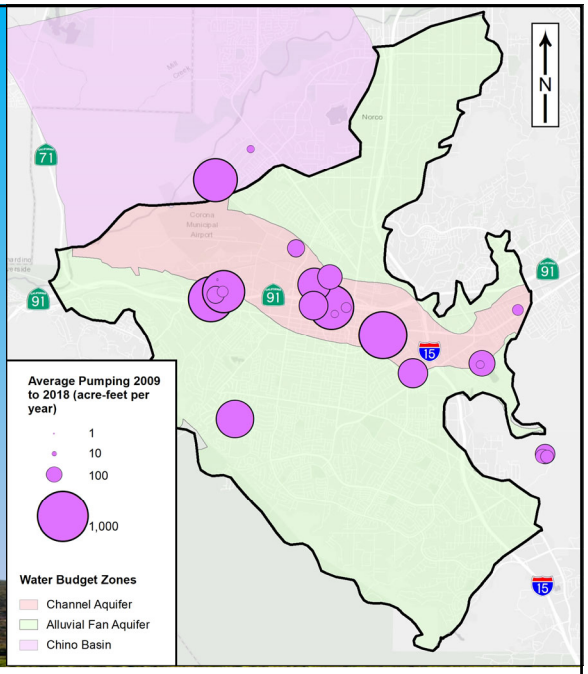
carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST

Groundwater Pumping

Concentrated in Channel Aquifer



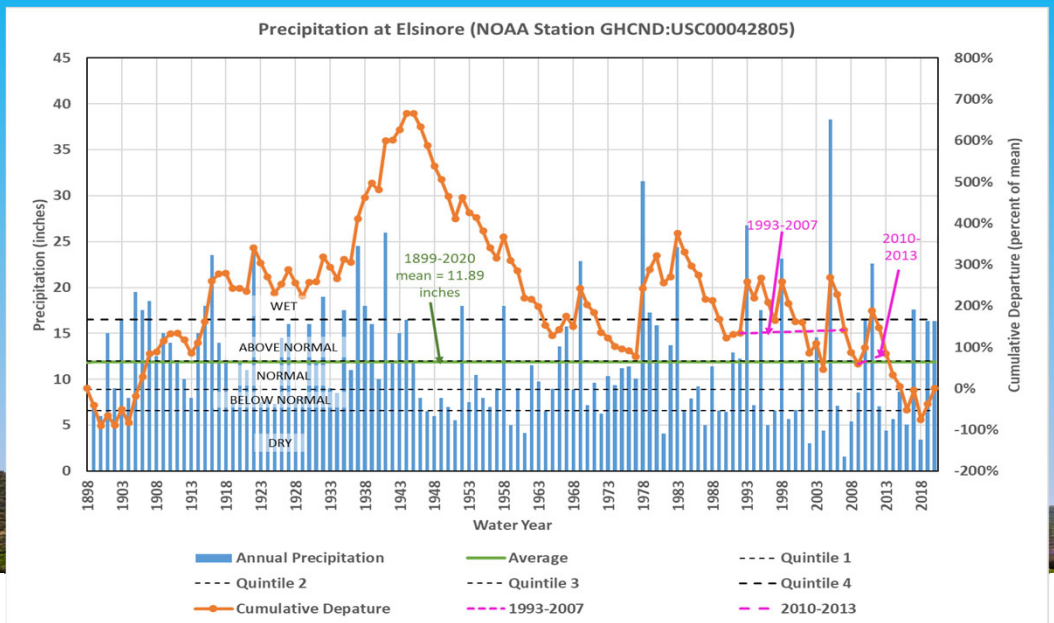
carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Water Budget Analysis Periods

- Three periods required by SGMA:
  - "Historical" = water years 1993 to 2007
  - "Current" = 2010 to 2013
  - "Future" = 1993 to 2017 (repeated twice)

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Water Budget Analysis Periods



Surface Water Budget

- Large volumes of water pass through the basin
- Inflows = outflows. No storage change.
- Creek channels mostly concrete-lined ➔ little percolation
- Creek channels mostly far above water table ➔ percolation rate not affected by groundwater level
- Prado wetlands is only area where groundwater and surface water interact

Groundwater Budget

- Quantitative results still under review
- General patterns:
  - Sources of recharge in descending order:
    - reclaimed water percolation,
    - Rain, irrigation, and pipe leaks
    - stream percolation, subsurface inflow
  - Yield of channel aquifer depends on inflow from alluvial fan aquifer area
  - Pumping is 60-75% of Basin outflow
  - Channel aquifer yield approximately current pumping. Increasing pumping will not increase yield.



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Discussion / Q&A

- What do you think the future of groundwater supply and demand will look like?



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Draft Projects and Management Actions



Project Management/Action Groupings

Group 1 Baseline Actions

Existing or established commitments to projects/ actions

Group 2 Planned Actions

Developed and evaluated projects/ actions

Group 3 Potential Future Actions

Potential projects/ actions to achieve sustainability goals

Group 1 Projects/ Management Actions

Description	Involved Agencies	Status
Groundwater Treatment: Treatment at the Temescal Desalter to reduce nitrates, TSS and TDS, and other contaminants of concern for the City's drinking water supply.	City of Corona	Ongoing
Water Reclamation Facility (WRF) Percolation Ponds: Discharge from City-owned WRFs to percolation ponds that recharge the Basin.	City of Corona	Ongoing
Water Level QA/QC: Activities to maintain reliability of ongoing groundwater elevation data.	City of Corona	Ongoing
Western Riverside County Regional Wastewater Authority (WRCRWA): This plant will soon produce recycled water for local irrigation use.	GSA, Jurupa CSD, and WMWD	Pending coordination with WRCRWA and partner agencies
Water Shortage Contingency Plans: Stages of water shortage and conservation response based on a City's available supply/deficit.	Cities of Corona and Norco	Ongoing
Water Conservation Programs: Response actions to reduce water use in stages of water shortage.	Cities of Corona and Norco	Ongoing
Western Municipal Water District IRWMP: Coordinated, long-range regional water quantity and quality management strategy.	10 local cities/agencies including the GSA	Ongoing
Santa Ana Watershed Involvement: Coordinated management group to protect the Santa Ana River basin and associated water resources.	GSA and Santa Ana Watershed Project Authority (SAWPA) members	Ongoing

Key
Project
Mgmt. Action

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

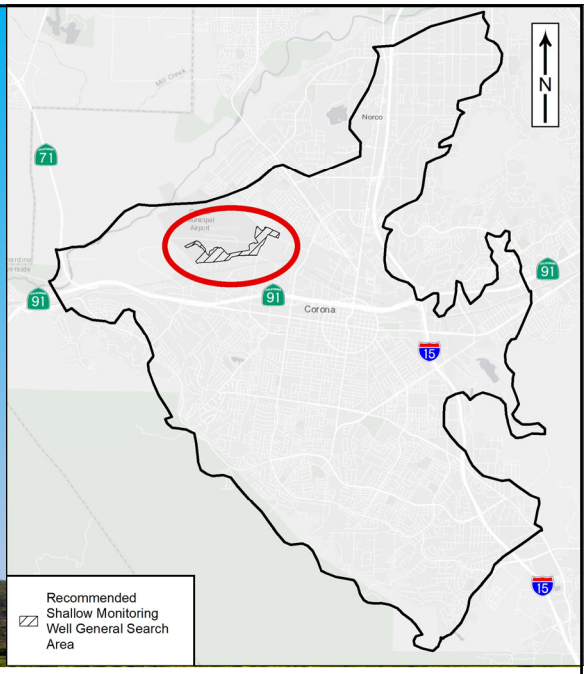
Group 2 Projects/ Management Actions

Description	Involved Agencies	Estimated Cost	Status
Potable Reuse Feasibility Study: Study to look at use potential for near to future reclaimed water supply.	GSA	$150,000 to $200,000	Study initiation within second year of GSP adoption.
Mountain Runoff Capture Investigation: Runoff during storm events is collected into existing RCFCWCD basins to mitigate flooding. This study would explore options for operational changes to allow for additional benefit of groundwater recharge.	GSA and RCFCWCD	$75,000	Study initiation within five years of GSP adoption.
Interconnected Surface Water Monitoring Wells Implementation: Three shallow monitoring wells drilled into the Prado Management Area (MA) to allow for groundwater elevation monitoring.	GSA	$40,000 to $50,000	Implementation within first year of GSP adoption.

Key
Project
Mgmt. Action

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

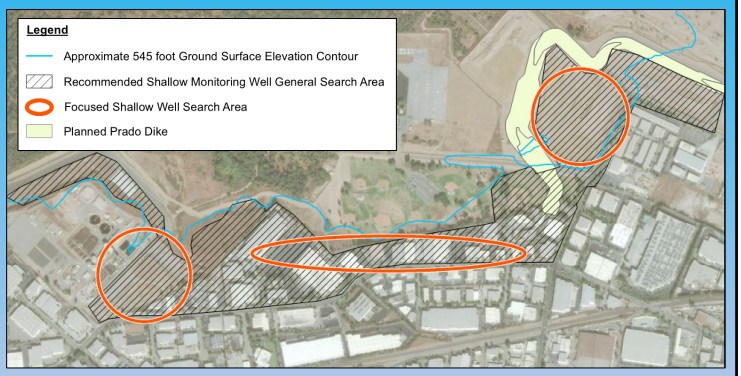
Group 2 – Monitoring Wells Project



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Group 2 – Monitoring Wells Project

- 3 wells, 40-60 feet deep
- Continuous groundwater elevation data collection
- Data to be incorporated in the 5-year GSP update
- Monitoring wells will inform future management actions in the Santa Ana River Watershed



carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Group 3 Projects/Management Actions

Description	Involved Agencies	Status
Coordination with Upstream Santa Ana River Partners: Contingent on Prado MA monitoring well installation. If groundwater levels in the MA are falling, this approach will entail coordination with upstream partners for solutions.	GSA and Santa Ana Watershed Project Authority (SAWPA) members	No current anticipated timeline.
Future Groundwater Treatment: Implementation of advanced treatment to treat for previously detected PFAS as well as TDS, nitrate, and TCP.	GSA	No current anticipated timeline.
Urban Stormwater Treatment, Capture, and Recharge: Exploration of urban stormwater harvesting to offset water supply and/or provide for groundwater recharge.	GSA	No current anticipated timeline.

Key
Project
Mgmt. Action

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Discussion / Q&A

- Are there other potential groundwater related projects we should consider?
- Do you have ideas for how the volume of groundwater in the Basin could be increased?
- Do you have ideas for making groundwater more sustainable in the Basin?

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

Public Outreach

carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST

Public Workshop 3

- July 8, 2021, 4:00-6:00 PM
- Fact Sheet 3
- Please invite others!



TEMESCAL GSA

FACT SHEET 3

GROUNDWATER FOR PEOPLE, THE ENVIRONMENT, AND THE FUTURE

GET INVOLVED! Community input is needed! Visit CoronaCA.gov/Groundwater or send an email to Groundwater@CoronaCA.gov to attend a workshop, review draft chapters, and learn more!

To learn more about background information prepared for the GSP see Fact Sheet 2.

DEFINING SUSTAINABILITY AND TAKING ACTION

Now that the background information and modeling is complete, we will define groundwater sustainability for the Temescal Basin. Then, management actions and projects will keep us on course, so we have enough groundwater for current and future generations. This fact sheet gives more information of these important parts of the Temescal Groundwater Sustainability Plan (GSP).

WHAT IS SUSTAINABILITY IN A GROUNDWATER SUSTAINABILITY PLAN?

The Temescal GSP must include an overall goal that states the desired objectives and conditions for the Temescal Basin. That goal then helps define a sustainability framework to **avoid** lowering groundwater levels, reduction of storage, degraded water quality, surface water depletion, and land subsidence. The framework defines the concepts below, so that we will know if we need to take action to maintain sustainability:

1) **Undesirable results** are conditions we want to avoid in the Temescal Basin
2) **Minimum thresholds** set quantifiable measures for undesirable results
3) **Measurable objectives** establish quantifiable goals to maintain or improve groundwater conditions

Groundwater Dependent Ecosystems

GSPs must protect against surface water depletion. This is because surface water that is connected to groundwater is important for groundwater dependent ecosystems (GDEs). GDEs can include plants or animals that depend on groundwater. The Temescal Basin includes GDEs, primarily in the Prado Basin.

HOW CAN WE MAINTAIN SUSTAINABILITY?

With goals defined, we next turn to how we can meet the standards we have set! Management actions and projects help us maintain sustainability by managing the groundwater resource to avoid undesirable results. Some of the actions and projects that will be included in the GSP are already happening, some are planned and will be implemented within the next few years, and others are potential actions that will be taken in response to changing groundwater conditions in the Temescal Basin in the future.

Examples of Management Actions and Projects

CURRENT	PLANNED	POTENTIAL FUTURE
▸ Groundwater treatment ▸ Water Shortage Contingency Plans ▸ Water Conservation Programs	▸ Interconnected surface water monitoring ▸ Groundwater recharge feasibility studies	▸ Additional groundwater treatment ▸ Stormwater capture, treatment, and recharge

TEMESCAL GROUNDWATER SUSTAINABILITY PLAN

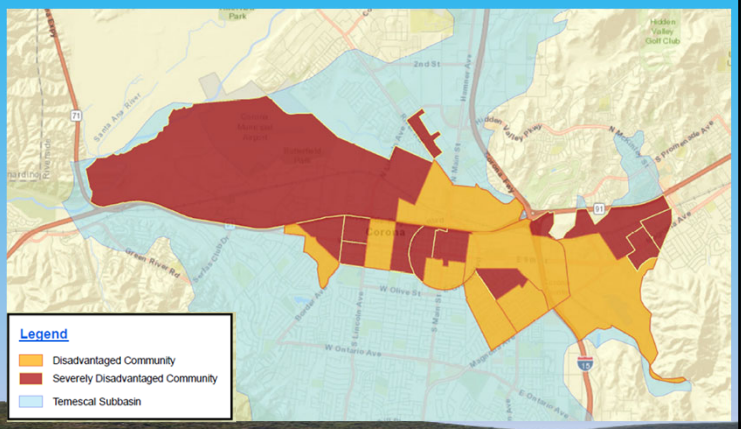
carollo Engineers...Working Wonders With Water®

TODD GROUNDWATER

KEARNS & WEST

Community Leader Meeting

- Provide information on local water supply and learn about needs and perspectives in vulnerable communities

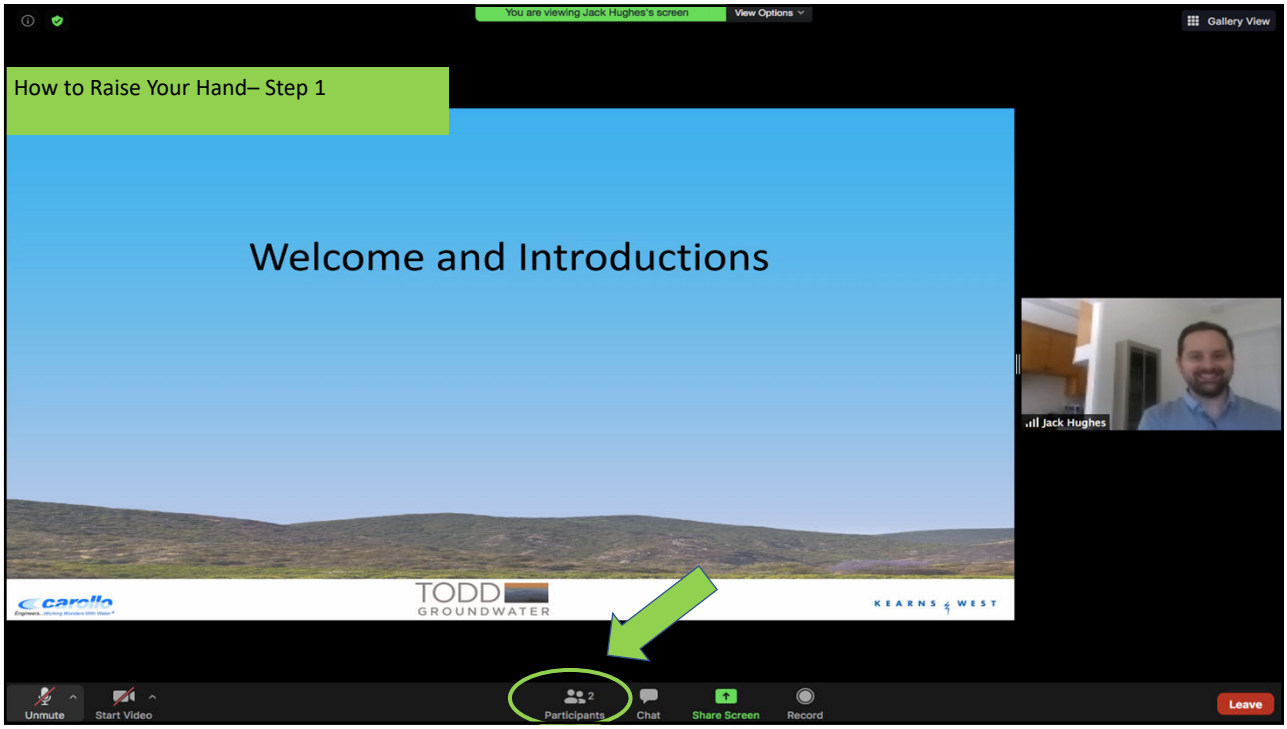


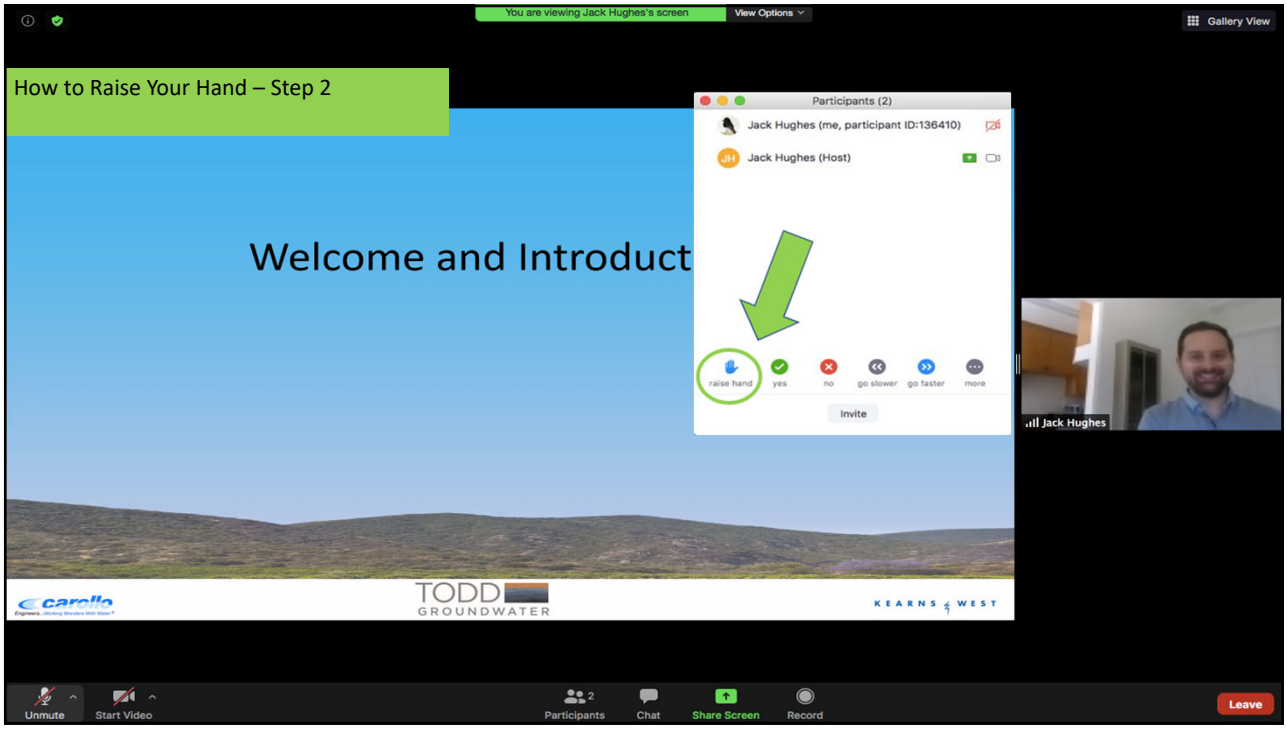
carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST

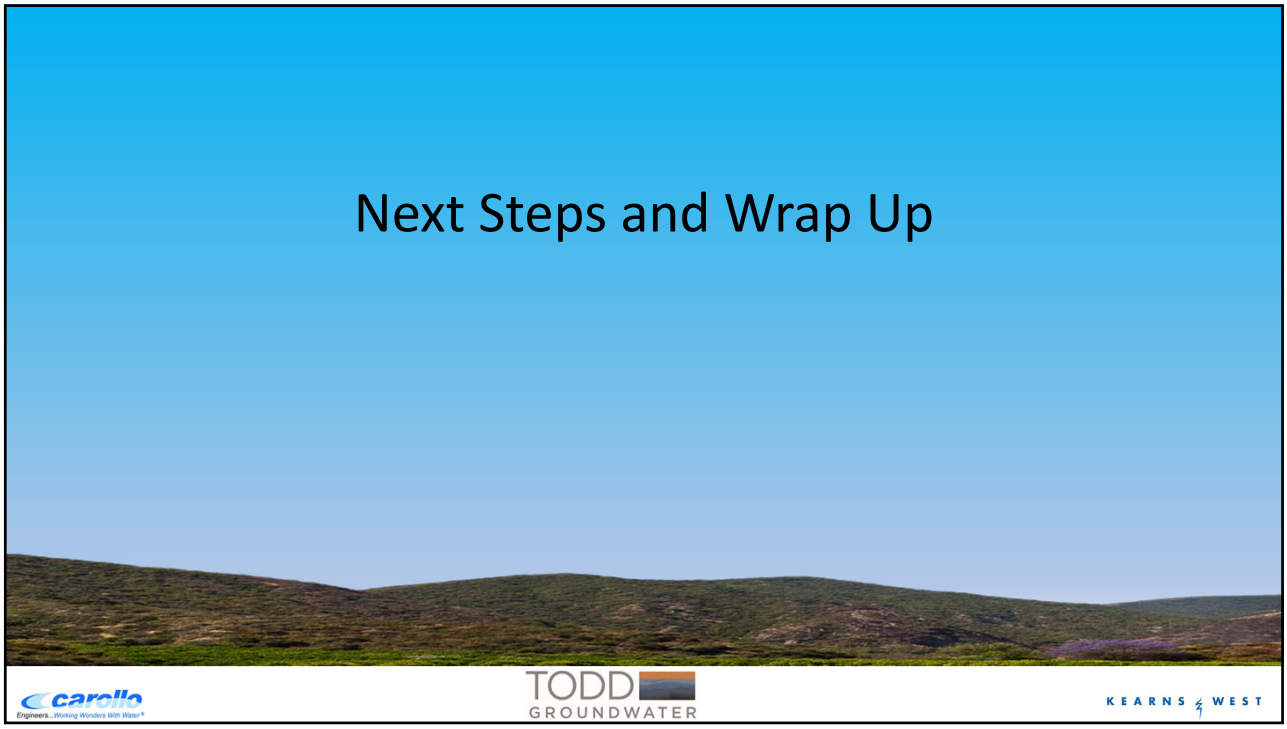
Discussion / Q&A

carollo Engineers...Working Wonders With Water®
TODD GROUNDWATER
KEARNS & WEST


Public Comment
carollo
Engineers...Working Wonders With Water®
TODD
GROUNDWATER
KEARNS WEST


You are viewing Jack Hughes's screen
View Options
Gallery View
How to Raise Your Hand– Step 1
Welcome and Introductions
Jack Hughes
carollo
TODD
GROUNDWATER
KEARNS WEST
Unmute
Start Video
Participants
2
Chat
Share Screen
Record
Leave


How to Raise Your Hand – Step 2
You are viewing Jack Hughes's screen
View Options
Gallery View
Participants (2)
Jack Hughes (me, participant ID:136410)
Jack Hughes (Host)
raise hand
yes
no
go slower
go faster
more
Invite
Jack Hughes
Welcome and Introduct
carollo
TODD GROUNDWATER
KEARNS WEST
Unmute
Start Video
Participants
Chat
Share Screen
Record
Leave


Next Steps and Wrap Up
carollo
TODD GROUNDWATER
KEARNS WEST

Next Steps

- Revise Chapters 1, 5, 6, 7, 8, and 9 based on GSA and TAC comments
- Compile complete GSP for public release
- Prepare for and hold Public Workshop 3 (July 8, 2021)
  - Zoom Link : https://zoom.us/j/93530179115
- Prepare for GSP finalization, adoption, and submittal to DWR
- Questions or comments to groundwater@coronaca.gov



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

Thank You!



carollo Engineers...Working Wonders With Water® TODD GROUNDWATER KEARNS & WEST

APPENDIX G

Summaries of Public Workshops and Associated Fact Sheets

Temescal Basin Public Workshop 1

Workshop Summary

October 2, 2020

Contents

1. Background....3
2. Pre-Workshop Outreach....3
3. When and Where....4
4. Attendance....4
5. Summary....4
   Introduction to Groundwater....5
   Introduction to the Sustainable Groundwater Management Act....6
   Introduction to the Temescal Basin....6
   Groundwater Sustainability Plan Development....7
   Indicators for Sustainability....7
   How to Get Involved....8
6. Wrap-up and Closing....9

1. Background

On September 16, 2014, the Governor of California signed into law a legislative package comprised of three bills: Assembly Bill (AB) 1739, Senate Bill (SB) 1168, and SB 1319. These laws are collectively known as the Sustainable Groundwater Management Act (SGMA). SGMA (pronounced sigma) defines sustainable groundwater management as the "management and use of groundwater in a manner that can be maintained without causing undesirable results." This means keeping balanced levels of pumping and recharge of groundwater while assuring reliable water quality. SGMA provides a comprehensive framework for basin sustainability, additional technical analysis, and quantification of many aspects of basin sustainability and management. This includes extensive and detailed descriptions of the basin setting and conditions and more comprehensive monitoring of groundwater use, quality, and levels, including metering of groundwater usage.

SGMA requires the formation of a locally controlled Groundwater Sustainability Agency (GSA), which is responsible for developing and implementing a Groundwater Sustainability Plan (GSP). The GSP outlines how to achieve groundwater sustainability within 20 years of its adoption. The City of Corona, City of Norco, and Home Gardens County Water District have formed the Temescal Subbasin Groundwater Sustainability Agency (Temescal GSA) to create a GSP for the Temescal Basin.

GSAs must consider the interests of all beneficial uses and users of groundwater. The GSA must provide opportunities for public engagement and active involvement of diverse social, cultural, and economic elements of the population. The Temescal GSA recognizes that stakeholder and public engagement is critical to ensuring that the full range of interests of all beneficial uses and users of groundwater are represented during GSP development.

To share information and get input from stakeholders and the public, the Temescal GSA is holding a series of public workshops. The first public workshop, conducted on September 29, 2020, focused on communicating basic information about SGMA, the Temescal Basin, GSP development, and what sustainability means in a GSP. This summary documents the outreach methods, time and location, attendance, and major topics presented and discussed at the workshop.

2. Pre-Workshop Outreach

The Temescal GSA used a variety of methods to inform stakeholders and community members about the workshop and encourage participation, as shown in the table on the next page.

Table 1: Pre-Workshop Outreach Methods

Method	Description
Website	Workshop information was posted on the project website, hosted by the City of Corona's Department of Water and Power, and was included in a calendar post. The City of Norco and Home Gardens County Water District posted workshop information on their websites.
Social Media Posts	The City of Corona posted information about the workshop through a Facebook Event and on its Instagram and Twitter accounts. The City of Norco posted on its Facebook page.
Newsletters	The City of Corona advertised the workshop in its *Inner Circle* newsletter, which is accessible online and distributed via email.
Emails	Invitation emails were sent to those on the interested parties list.
Phone calls	Phone calls were made to community groups and stakeholder organizations to make them aware that the GSP was being prepared and to invite them to the public workshop.

3. When and Where

The workshop was held on September 29, 2020 from 4:00 to 5:30 p.m.

The workshop was held virtually on the Zoom platform. People also had the option to view and participate from the City of Corona Council Chambers. The workshop was streamed on the City of Corona's website, Facebook, and YouTube channels and on Corona TV, viewable on Channel 29 on Time Warner Spectrum and Channel 99 on AT&T.

4. Attendance and Social Media Views

Fifteen participants joined the Zoom meeting. Others viewed workshop on Facebook Live, YouTube, and Corona TV. Post-workshop statistics showed seventeen views on Youtube.

5. Summary

Welcome and Introductions

Jack Hughes, facilitator from Kearns & West, welcomed everyone to the first public workshop for the Temescal GSP. Christian Mendez from Kearns & West gave instructions in Spanish for accessing Spanish interpretation on Zoom. To begin the workshop, participants answered the following poll questions:

1. Where does the water in your tap come from?
    a. Local rivers and lakes
    b. Local groundwater
    c. Imported surface water

2. How much water comes from nearby sources?
    a. 0 to 20 percent
    b. 20 to 40 percent
    c. 40 to 60 percent
    d. 60 to 100 percent

After workshop participants responded to the poll, Chad Taylor, Senior Hydrogeologist at Todd Groundwater, discussed the answers. The water supply for Corona and Norco comes from local groundwater and is also imported. About half of the water delivered to Corona, Norco, and Home Gardens is imported and the rest comes from local groundwater sources. Next, participants watched a short video that showed how the City of Corona treats the groundwater it pumps at the Temescal Desalter and the Corona Ion Exchange Treatment Plant.

Hughes then invited the attendees to make introductions. Melissa Estrada-Maravilla, City of Corona Department of Water and Power Operations Analyst, introduced herself and thanked all for attending. Taylor then introduced the consultant team from Todd Groundwater, Carollo Engineers, and Kearns & West. Hughes next invited the attending stakeholders to introduce themselves in the Zoom chat and thanked them for being there as it is important to involve the many diverse communities and stakeholders of Corona, Norco, and Home Gardens to create a strong GSP for the Temescal Basin.

Introduction to Groundwater

Taylor provided a general introduction to groundwater (presentation slides for this and the following sections can be viewed in Appendix A). In many places, water is present between grains of soil beneath the surface. When there is a lot of space between grains of soil, there can be significant groundwater, also known as a groundwater aquifer. In some areas, there are connections between water on the surface and groundwater. A large area of connected groundwater is called a groundwater basin. Wells are the most common way to access groundwater. Well are used to pump water for different uses such as for city or agricultural uses. Some wells are small and shallow, producing only a few gallons of water per minute, while other wells are large and deep, producing thousands of gallons of water per minute.

Taylor showed a cross-section of an aquifer and described how groundwater gets there. Water enters the ground by soaking into soils from rainfall, streams, lakes, or other surface water. There are unconfined and confined aquifers. Water can enter the upper aquifer, called the unconfined or water table aquifer, from the ground surface or stream. A confined aquifer, however, sits below a layer of impermeable material. Most of the water in the Temescal Basin is in an unconfined aquifer system. Groundwater conditions change over time in response to increased pumping or decreased rainfall. Water level declines can lead to problems with wells not having access to water for pumping and can also cause problems for interconnected surface water, such as potentially reducing flow in streams and affecting plants and animals that rely on water.

Taylor discussed the importance of groundwater as a source of water in California. He compared the storage capacity of surface water reservoirs in California, totaling 50 million acre-feet of water, to a recent assessment of the storage capacity of groundwater basins. This capacity is estimated between 850 million and 1.3 billion acre-feet in the over 500 groundwater basins in California. Groundwater is important locally and statewide.

Discussion/Q&A

Hughes opened the floor for questions and comments. Participants were encouraged to answer the following questions: 1) What interests you about groundwater? and 2) Do you have questions or concerns about groundwater? Questions and comments from participants are summarized below.

- How is water cleaned?
- Why might water taste bad?
- Why does water taste different in different areas?
- Education on water use is important.

Introduction to the Sustainable Groundwater Management Act

Taylor presented the background and purpose of the SGMA. SGMA is California State legislation established in 2014 following a long period of state-wide drought. SGMA has altered how water is managed in California. It established requirements for state agencies to assess groundwater basin priorities and assign them as very low, low, medium, or high priority basins for sustainability planning. The Department of Water Resources (DWR) has designated the Temescal Basin as medium priority basin. SGMA gives local agencies guidance for how to assess sustainability. There is the option for the state to intervene if local agencies are not acting, but that is a last resort. There is also financial assistance in the form of grants available from the state. The Temescal GSA, comprised of the City of Corona, the City of Norco, and Home Gardens County Water District, has received a grant for plan preparation.

Taylor explained that SGMA establishes requirements and specifies deadlines for achieving and maintaining groundwater sustainability. These requirements include forming a GSA and preparing a GSP to facilitate local groundwater management informed by stakeholders. SGMA requires that groundwater basins designated as medium or high priority form GSAs and file GSPs by January 31, 2022. They must then demonstrate sustainable groundwater management by 2042. GSPs outline how to achieve sustainability based on SGMA guidelines. This includes ongoing monitoring and management, annual reporting of groundwater conditions, and updates to the GSP every 5 years.

Introduction to the Temescal Basin

Taylor reviewed the Temescal Basin, which covers most of the City of Corona, about half of the City of Norco, and the western part of the Home Gardens County Water District. The Temescal Basin is bounded by the Chino Subbasin to the north, the Riverside-Arlington Subbasin to the east, the Bedford-Coldwater Subbasin to the south, and the Coastal Plain of Orange County on the west. The Temescal Basin and surrounding basins are one connected hydrologic area that has historically been managed together. DWR has designated the Temescal Basin as medium priority due to significant reliance on groundwater supplies.

Taylor described the organization of the Temescal GSA. The Temescal GSA provides for decision-making, technical support, and outreach to the community. The City of Corona, the City of Norco, and

Home Gardens County Water District formed the Temescal GSA in 2017 through a memorandum of understanding. The City of Corona is leading the GSP effort with support from the Corona Department of Water and Power staff and additional consultants. The Technical Advisory Committee (TAC) provides input during GSP preparation, and TAC members communicate with other agencies and interested parties about GSP development. The GSP process is founded on public engagement and stakeholder outreach, which is the purpose of the public workshops.

Taylor explained that more information on the Temescal Basin and the Temescal GSP can be found in the Draft Plan Area Chapter that has been prepared. It is available for review on the Temescal GSA website (CoronaCA.gov/Groundwater). The Draft Plan Area Chapter includes the location of the Temescal Basin in relation to other basins and local hydrology, the public agencies with jurisdictional authority in the area, the general density of existing wells by type, and the current and historical land uses.

Groundwater Sustainability Plan Development

Taylor next provided a summary of the Temescal GSP workplan and schedule. Major Temescal GSP elements include data compilation; plan area; hydrogeologic conceptual model; groundwater model; sustainability goals and criteria; management actions, projects, and monitoring; and plan development. Data compilation and a Draft Plan Area Chapter are already complete. The next steps are to develop the hydrogeological conceptual model, assess current and historical groundwater conditions, and construct a numerical groundwater model. These will be used to calculate groundwater budgets and sustainable yield, so it is known how much groundwater is available for use. After that comes creation of sustainability goals and criteria, which define sustainability in the Temescal Basin. Management actions to meet sustainability goals will then be identified, and a monitoring program will be established. The Draft Temescal GSP will be made available for public review in Summer 2021 after completion of these steps. The final Temescal GSP will be completed by Fall 2021 prior to submittal to DWR.

Indicators for Sustainability

Taylor provided an overview of the six indicators for evaluating groundwater sustainability in a basin: chronic lowering of groundwater levels, reduction of groundwater storage, degradation of water quality, depletion of interconnected surface water affecting beneficial uses, land subsidence affecting land uses, and seawater intrusion (not applicable in the Temescal Basin). Sustainability is defined as local management and use of groundwater in a way that can be maintained without experiencing undesirable results. Undesirable results will be determined for each of the criteria and minimum thresholds will be developed to avoid those results.

Taylor explained the process for achieving sustainability in the Temescal Basin. First, goals and thresholds will be set for each sustainability indicator in the Temescal GSP. Next, the implementation phase will occur, and a monitoring plan will be established. Monitoring will focus on assessing each indicator and will likely include measures for monitoring groundwater levels, water quality, and land subsidence. In addition, the Temescal GSA will undertake projects, such as ones that increase water supply availability, and management actions, such as reducing water use or demand. All components for achieving sustainability will be revisited every 5 years. Monitoring results will be used to refine the Temescal GSP to help better reflect local conditions and changes so that sustainability can be a dynamic long-term practice for the Temescal GSA and Temescal Basin.

Discussion/Q&A

Hughes opened the floor for questions and discussion. Participants were encouraged to answer the following questions: 1) What water supply and quality goals are important to you? and 2) Is there information the project team should review?

- Are there more workshops scheduled?
- Can you share a bit about the efforts being taken to engage people and any future plans to engage the community in the plan?
- Orange County Water District (OCWD) thanks you for reaching out about the GSP process and will be submitting written comments. In 2017, OCWD submitted an alternative to a GSP for the Orange County Groundwater Basin that was approved in 2019. The Temescal Basin is adjacent to that basin, and coordination with Chino and our basin will be important in moving this item forward.
- OCWD owns and manages a large wetland and riparian habitat behind the Prado Dam. That area is dependent on interconnected surface water, so it will be important for the GSP to invest in groundwater dependent ecosystems.

How to Get Involved

Hughes explained how members of the public could be involved throughout GSP preparation, noting the importance of involving the many diverse communities and stakeholders of Corona, Norco, and Home Gardens to create a strong GSP for the Temescal Basin. There will be three public workshops, including the current one, to allow for people to get information about the GSP and give their feedback on its development. Prior to each workshop there will be several outreach methods to circulate information and boost attendance. These methods include emails, social media posts, and fact sheets. The next workshop will be held in winter of 2021 and will focus on sustainability criteria. Another workshop focused on management actions will be held in the spring of 2021.

Hughes spoke about other opportunities to get information about GSP development and provide comment. In addition to the workshops, TAC meetings are open to the public. The public may listen in on those meetings and speak during the public comment portion. The project team will also be giving periodic updates at City Council and Board Meetings, which the public can also attend and comment on. This will be true as well for the Adoption Hearing for the final GSP. Before the Adoption Hearing, there will be a 90-day public comment period.

In addition to these opportunities, draft chapters and other materials will be posted on the project website hosted by the City of Corona Department of Water and Power: CoronaCA.gov/Groundwater. The public can use the form on the website to make comments. Anyone who wants to be included on the mailing list should email Groundwater@CoronaCA.gov. People on the mailing list will receive updates on upcoming public workshops, meetings open to the public, and the availability of draft chapters for comment on the website.

Discussion/Q&A

Comments and questions are summarized below.

- It would be helpful to send out questions or topics for discussion ahead of the workshops to give people time to think about their responses.

6. Wrap-up and Closing

Hughes thanked everyone for participating and encouraged people to sign up for updates on upcoming workshops by emailing Groundwater@CoronaCA.gov to be added to the mailing list. The next public workshop will be held in winter of 2021.

Appendix A

Presentation Slides

TEMESCAL GSP PUBLIC WORKSHOP 1
TEMESCAL GSP TALLER COMUNITARIO 1

About the GSP

The Sustainable Groundwater Management Act or "SGMA" is a California law that gives local agencies new tools for managing groundwater and planning for the future. The City of Corona, City of Norco, and Home Gardens County Water District have formed the Temescal Groundwater Sustainability Agency (Temescal GSA) in order to make a **Groundwater Sustainability Plan** for the Temescal Basin. Since groundwater is such an important resource for everyone, we need your help!



Sobre el GSP

La Ley de Gestión Sostenible de Aguas Subterráneas o "SGMA", por sus siglas en inglés, es una ley de California que otorga a las agencias locales nuevas herramientas para gestionar las aguas subterráneas y planificar para el futuro. La Ciudad de Corona, la Ciudad de Norco y el Distrito Hídrico del Condado de Home Gardens han formado la Agencia de Sostenibilidad de Aguas Subterráneas de la Cuenca de Temescal (Temescal Groundwater Sustainability Agency) o Temescal GSA a fin de crear un **Plan de Sostenibilidad de Aguas Subterráneas** para la Cuenca de Temescal. Dado que las aguas subterráneas son un recurso muy importante para todos, ¡necesitamos su ayuda!

TEMESCAL GSA

TEMESCAL GROUNDWATER SUSTAINABLY PLAN PUBLIC WORKSHOP 1

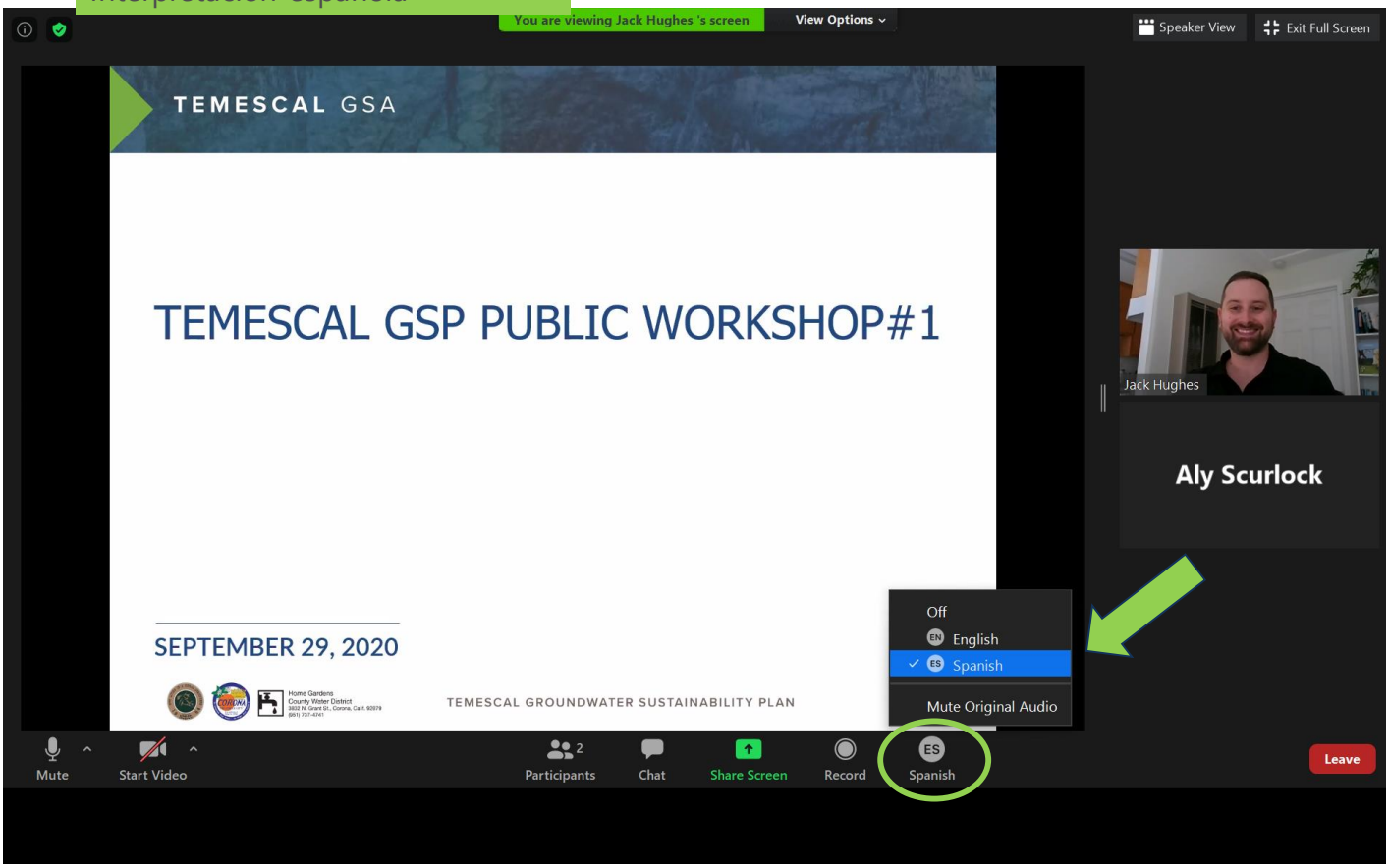
TEMESCAL GSP TALLER COMUNITARIO 1

SEPTEMBER 29, 2020 / 29 DE SEPTIEMBRE DE 2020

Home Gardens County Water District
3832 N. Grant St., Corona, Calif. 92879
(951) 737-4741

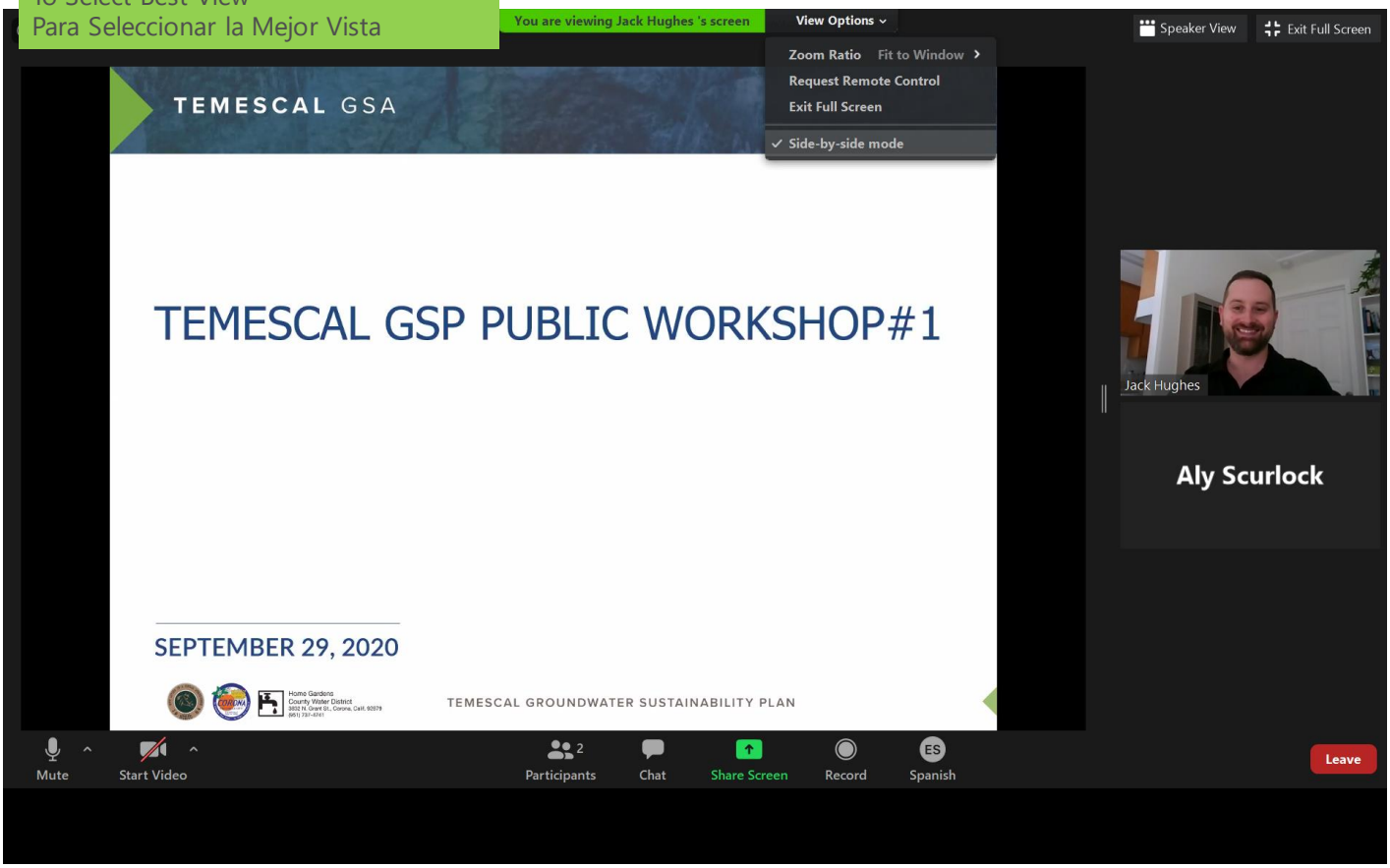
WELCOME
BIENVENIDOS

Interpretación española

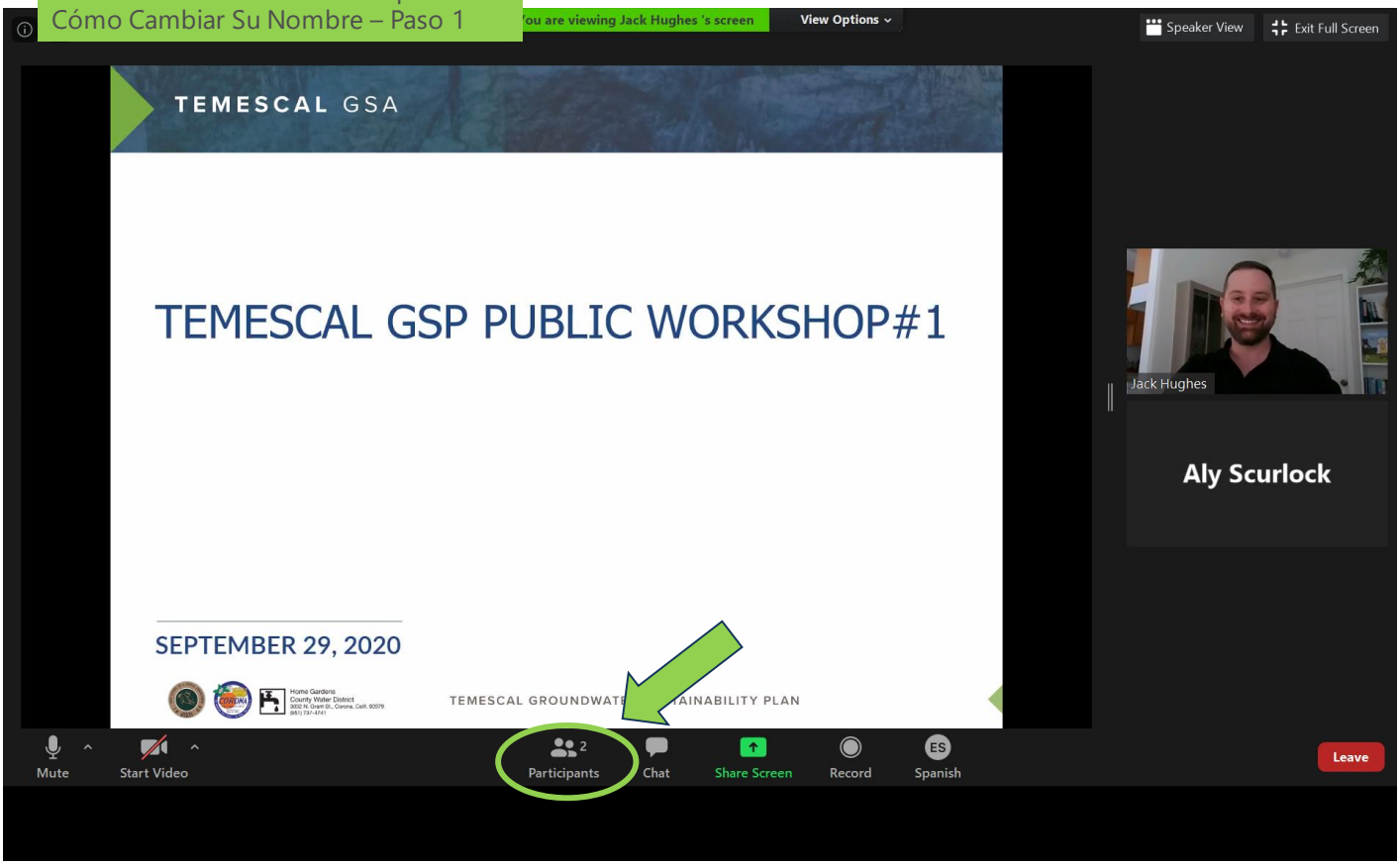


HOW TO USE ZOOM
CÓMO UTILIZAR ZOOM

To Select Best View
Para Seleccionar la Mejor Vista



How to Rename Yourself – Step 1
Cómo Cambiar Su Nombre – Paso 1



How to Rename Yourself – Step 2
Cómo Cambiar Su Nombre – Paso 2



WARM UP QUESTIONS
PREGUNTAS DE CALENTAMIENTO

» Where does the water in your tap come from?

» ¿De dónde viene el agua de tu grifo/llave?

a. Local rivers and lakes / Ríos o lagos locales
b. Local groundwater / Aguas subterráneas locales
c. Imported surface water / Agua superficial importada

» How much water comes from nearby sources?

» ¿Cuánta agua proviene de fuentes cercanas?

a. 0 to 20 percent / 0 a 20 por ciento
b. 20 to 40 percent / 20 a 40 por ciento
c. 40 to 60 percent / 40 a 60 por ciento
d. 60 to 100 percent / 60 a 100 por ciento

TEMESCAL GSA

WORKSHOP PURPOSE
PROPÓSITO DEL TALLER

» Give information about groundwater
Dar información sobre las aguas subterráneas.

» Introduce Sustainable Groundwater Management Act, the Temescal Groundwater Sustainability Agency, the Temescal Basin, and Groundwater Sustainability Plans.
Introducir la Ley de Gestión Sostenible de las Aguas Subterráneas, la Agencia de Sostenibilidad de las Aguas Subterráneas Temescal y la Cuenca del Temescal.

» Learn about your groundwater interests and what is important for you for the future of groundwater in the Temescal Basin.
Conocer sus intereses sobre el agua subterránea y lo que es importante para usted para el futuro del agua subterránea en la Cuenca del Temescal.

INTRODUCTIONS
PRESENTACIONES

TEMESCAL GSA

TIPS FOR A PRODUCTIVE DISCUSSION
CONSEJOS PARA UNA DISCUSIÓN PRODUCTIVA

- One speaker at a time
  Habla solo una persona la vez
- Keep input concise
  Sea conciso
- Actively listen
  Escuche activamente
- Offer solutions
  Ofrezca soluciones

YOUR INPUT MATTERS
SU OPINIÓN ES IMPORTANTE

» The planning team will consider your comments as they prepare the Groundwater Sustainability Plan.
El equipo de planificación considerará sus comentarios mientras prepara el Plan de sostenibilidad de aguas subterráneas.

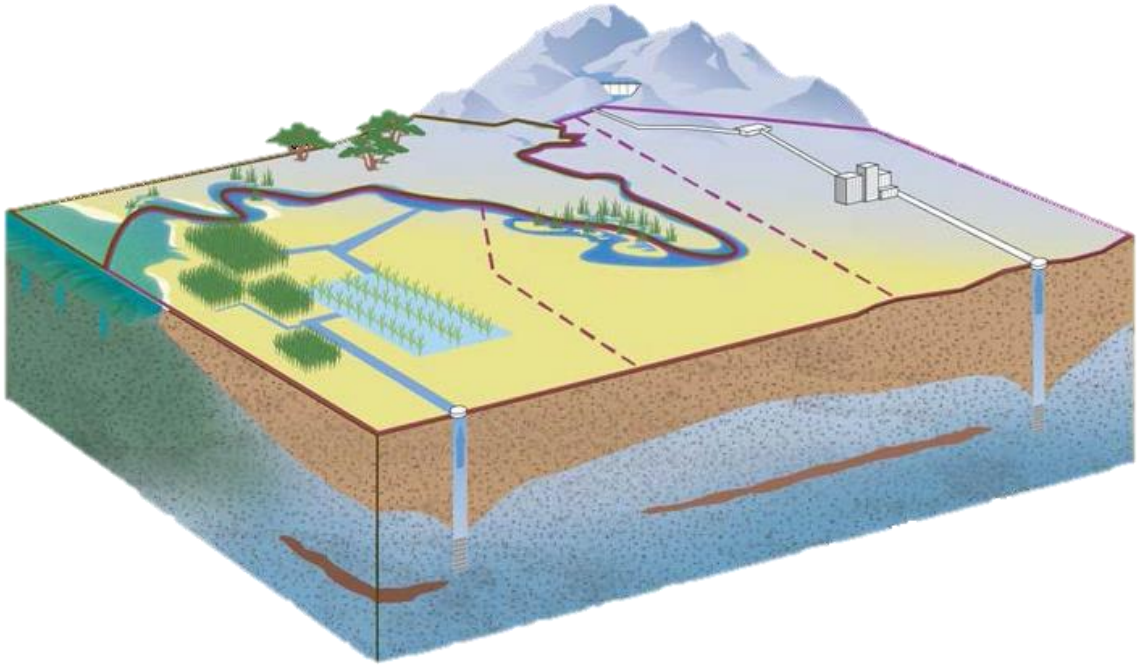
» Your input will be recorded, organized thematically, and presented in a workshop summary on the project website.
Su aportación será registrada, organizada temáticamente y presentada en un resumen del taller en el sitio web del proyecto.

TEMESCAL GSA

INTRODUCTION TO GROUNDWATER

INTRODUCCIÓN A LAS AGUAS SUBTERRÁNEAS

WHAT IS GROUNDWATER?
¿QUÉ SON LAS AGUAS SUBTERRÁNEAS?

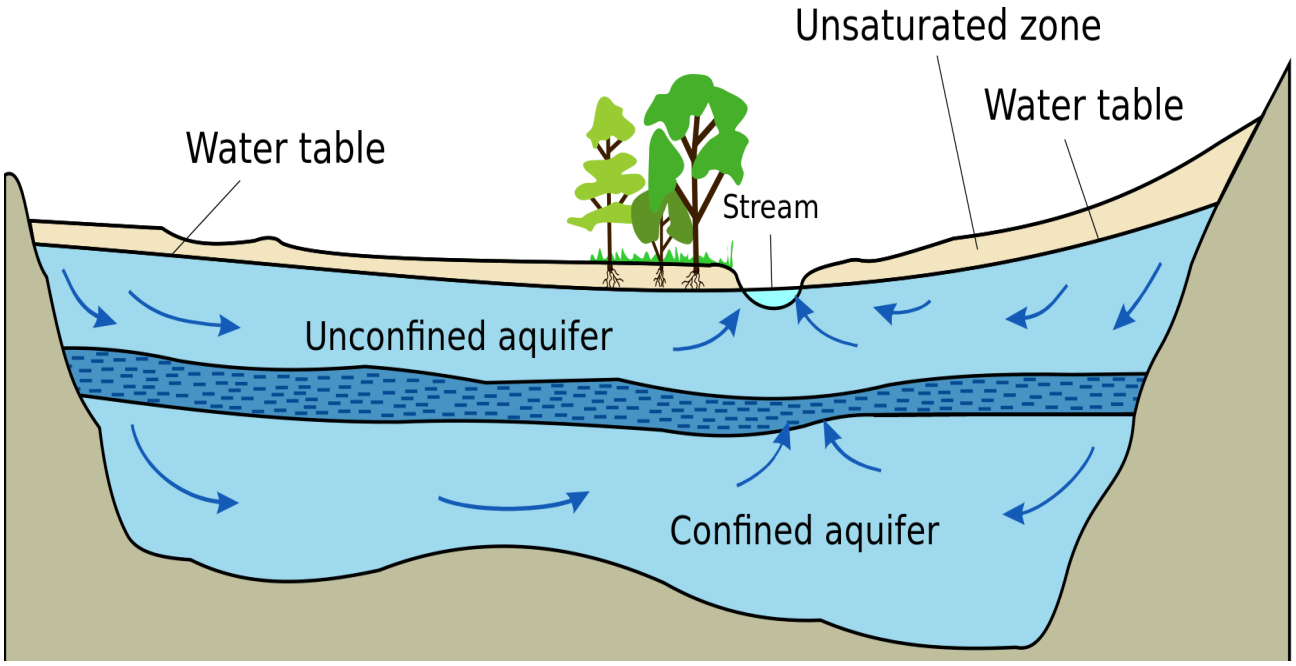


TEMESCAL GSA

HOW IS GROUNDWATER ACCESSED?
¿CÓMO SE ACCEDE A LAS AGUAS SUBTERRÁNEAS?



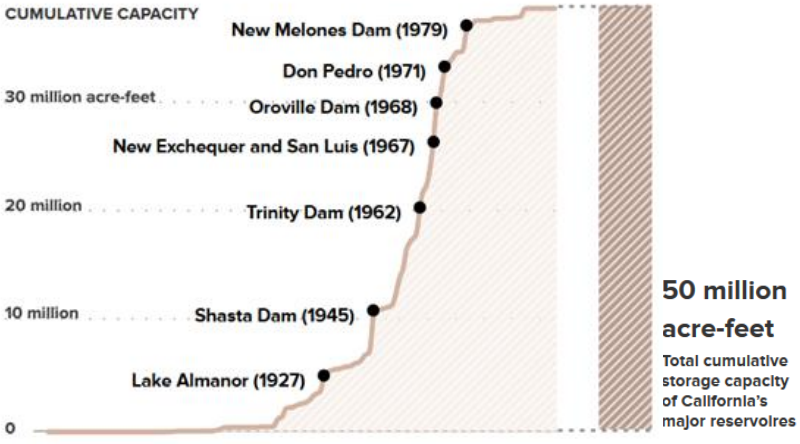
HOW DOES GROUNDWATER OCCUR?
¿CÓMO SURGEN LAS AGUAS SUBTERRÁNEAS?



TEMESCAL GSA

GROUNDWATER IS IMPORTANT
LAS AGUAS SUBTERRÁNEAS SON IMPORTANTES

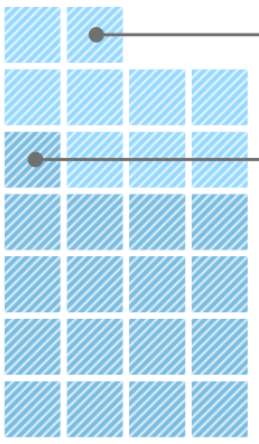
Reservoir Capacity



50 million acre-feet

Total cumulative storage capacity of California's major reservoirs

Groundwater Basin Capacity



1.3 billion

to

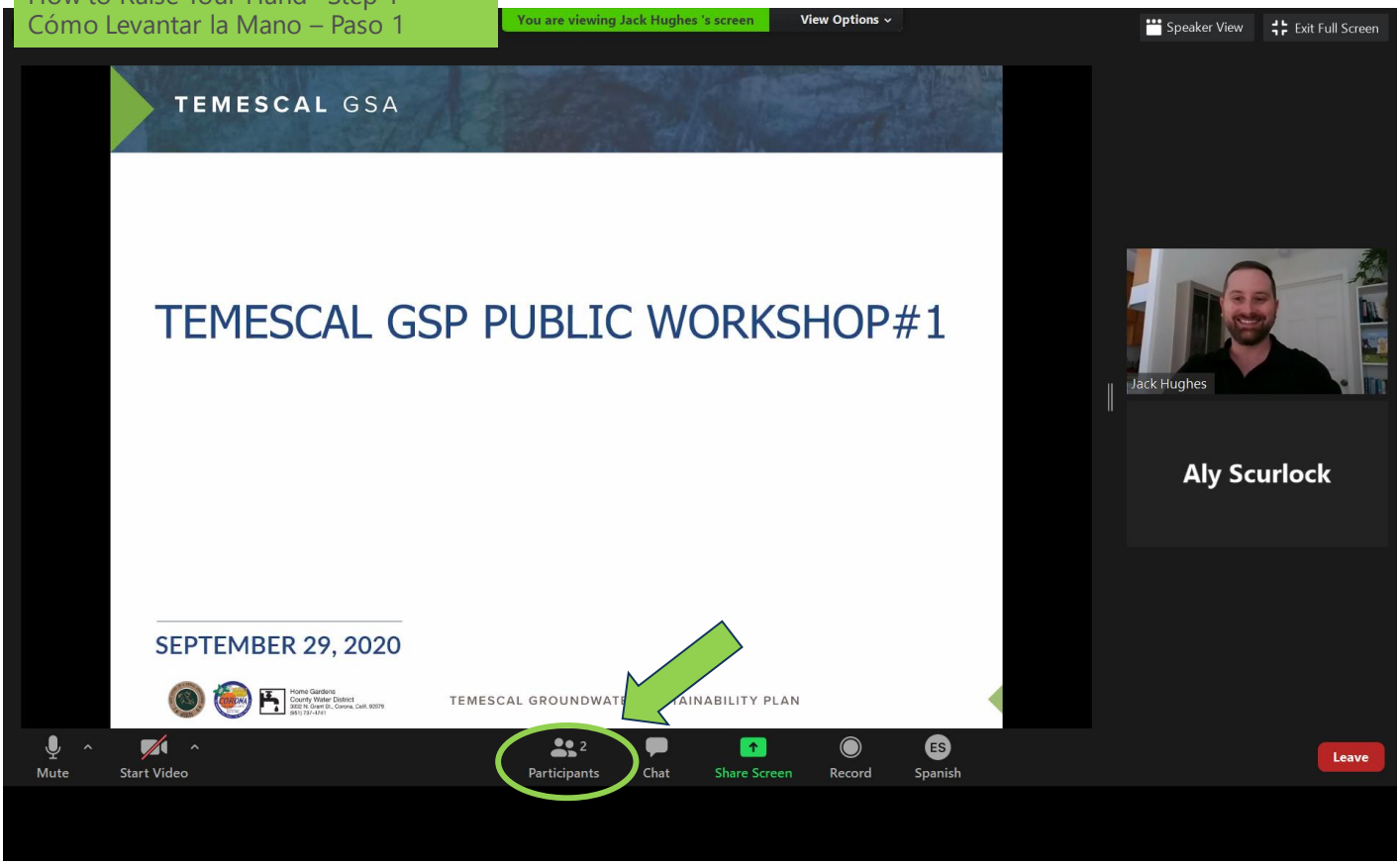
850 million acre-feet

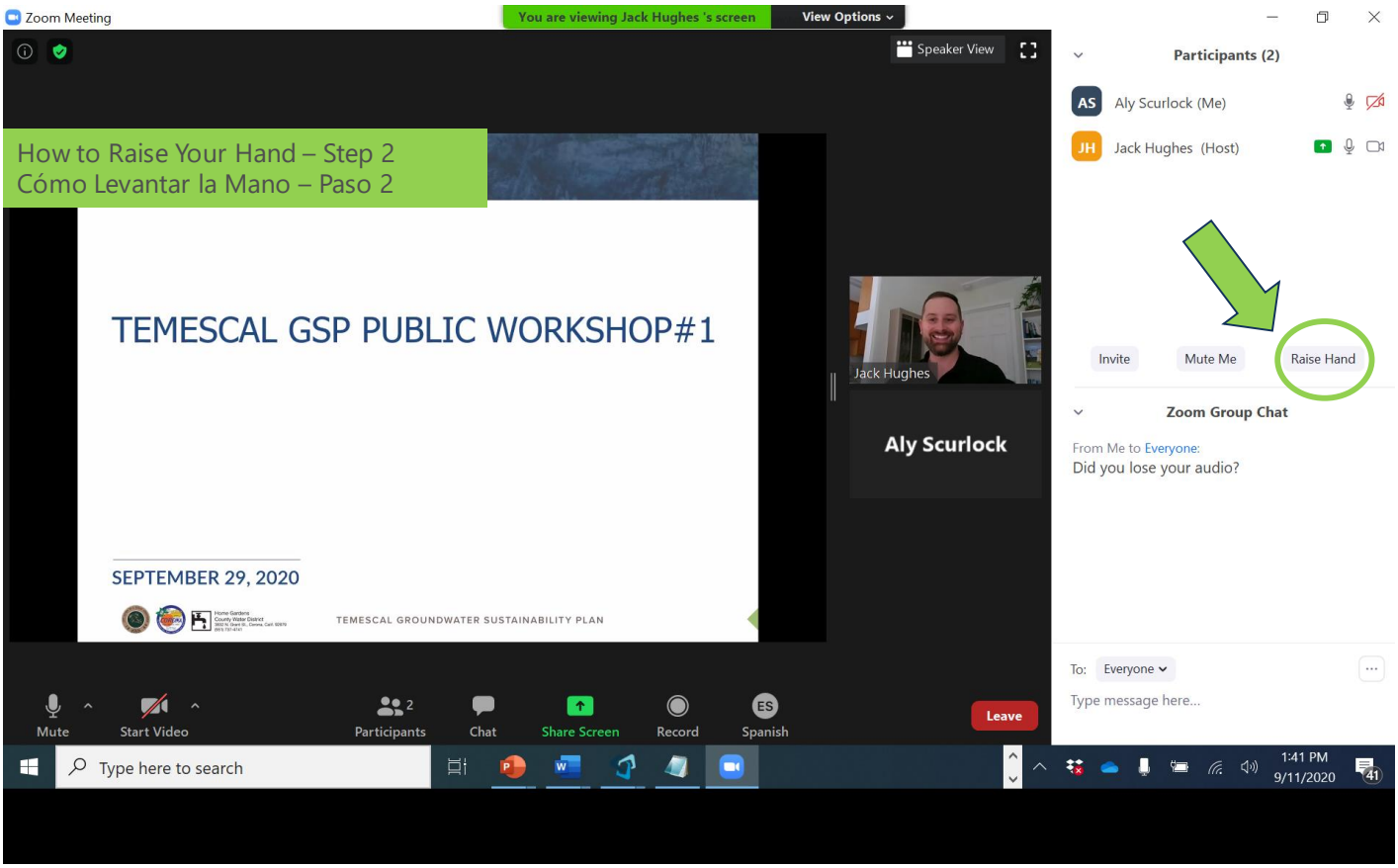
Total storage capacity in California's 515 groundwater basins

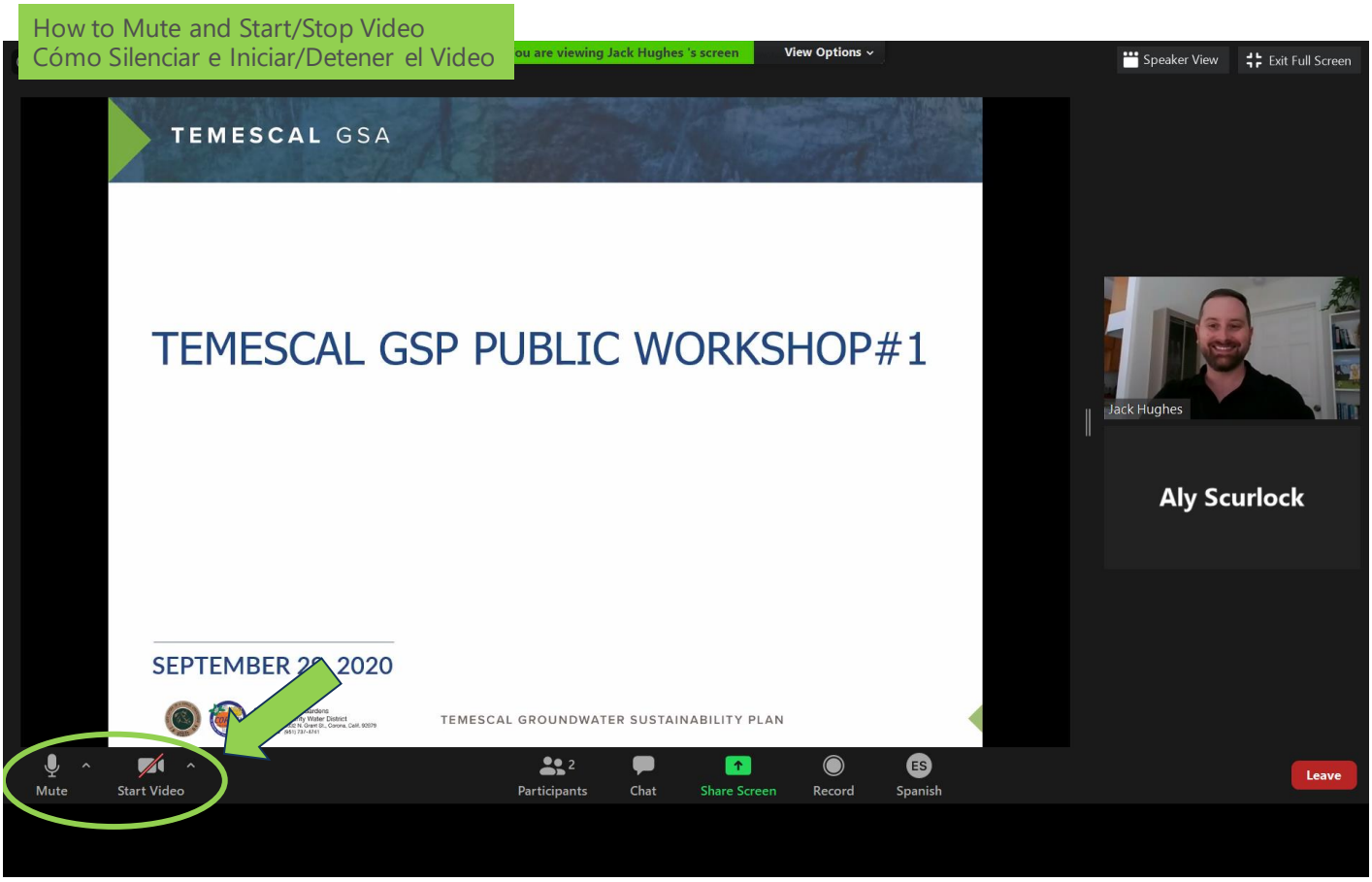
DISCUSSION AND Q&A
DISCUSIÓN / PREGUNTAS Y RESPUESTAS

- What interests you about groundwater?
  ¿Qué le interesa sobre las aguas subterráneas?
- Do you have questions or concerns about groundwater?
  ¿Tiene dudas o preocupaciones sobre las aguas subterráneas?
- What else?
  ¿Qué más?

How to Raise Your Hand– Step 1
Cómo Levantar la Mano – Paso 1




How to Raise Your Hand – Step 2
Cómo Levantar la Mano – Paso 2
Zoom Meeting
You are viewing Jack Hughes 's screen
View Options
Speaker View
TEMESCAL GSP PUBLIC WORKSHOP#1
SEPTEMBER 29, 2020
TEMESCAL GROUNDWATER SUSTAINABILITY PLAN
Jack Hughes
Aly Scurlock
Participants (2)
Aly Scurlock (Me)
Jack Hughes (Host)
Invite
Mute Me
Raise Hand
Zoom Group Chat
From Me to Everyone:
Did you lose your audio?
To: Everyone
Type message here...
Mute
Start Video
Participants
Chat
Share Screen
Record
Spanish
Leave
Type here to search
1:41 PM
9/11/2020


How to Mute and Start/Stop Video
Cómo Silenciar e Iniciar/Detener el Video
View Options
Speaker View
Exit Full Screen
TEMESCAL GSA
TEMESCAL GSP PUBLIC WORKSHOP#1
TEMESCAL GROUNDWATER SUSTAINABILITY PLAN
Jack Hughes
Aly Scurlock
Mute
Start Video
Participants
Chat
Share Screen
Record
Spanish
Leave

DISCUSSION AND Q&A
DISCUSIÓN / PREGUNTAS Y RESPUESTAS

- What interests you about groundwater?
  ¿Qué le interesa sobre las aguas subterráneas?
- Do you have questions or concerns about groundwater?
  ¿Tiene dudas o preocupaciones sobre las aguas subterráneas?
- What else?
  ¿Qué más?

Groundwater@CoronaCA.gov

TEMESCAL GSA

WHAT IS THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT?

¿QUÉ ES LA LEY DE GESTIÓN SOSTENIBLE DE LAS AGUAS SUBTERRÁNEAS?

SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)

Landmark legislation in 2014

- » Recognizes that groundwater management in California is best accomplished locally
- » Includes State intervention if necessary
- » State assistance is also available

Legislación histórica en 2014

- » Reconoce que la gestión de las aguas subterráneas en California se logra mejor a nivel local
- » Incluye intervención estatal si es necesario
- » La asistencia estatal también está disponible

TEMESCAL GSA

SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)

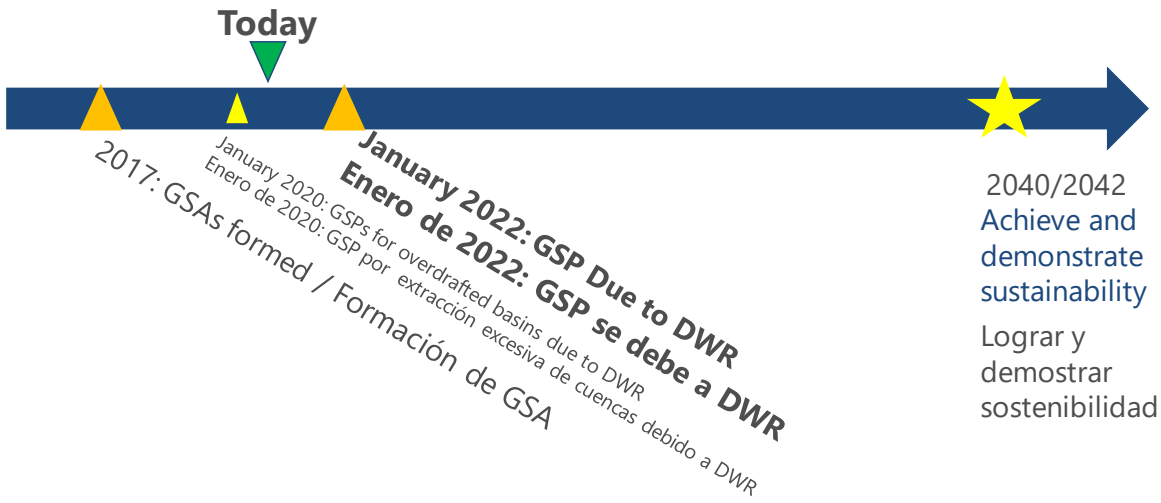
Includes comprehensive requirements for:

- » Forming groundwater sustainability agency (GSA)
- » Preparing groundwater sustainability plan (GSP)

Incluye diversos requisitos para:

- » Agencia de sostenibilidad de las aguas subterráneas (GSA)
- » Preparación de un plan de sostenibilidad de las aguas subterráneas (GSP)

SGMA HAS A REQUIRED TIMELINE
SGMA TIENE UN CRONOGRAMA REQUERIDO



TEMESCAL GSA

INTRODUCTION TO THE TEMESCAL BASIN
INTRODUCCIÓN A LA CUENCA DEL TEMESCAL

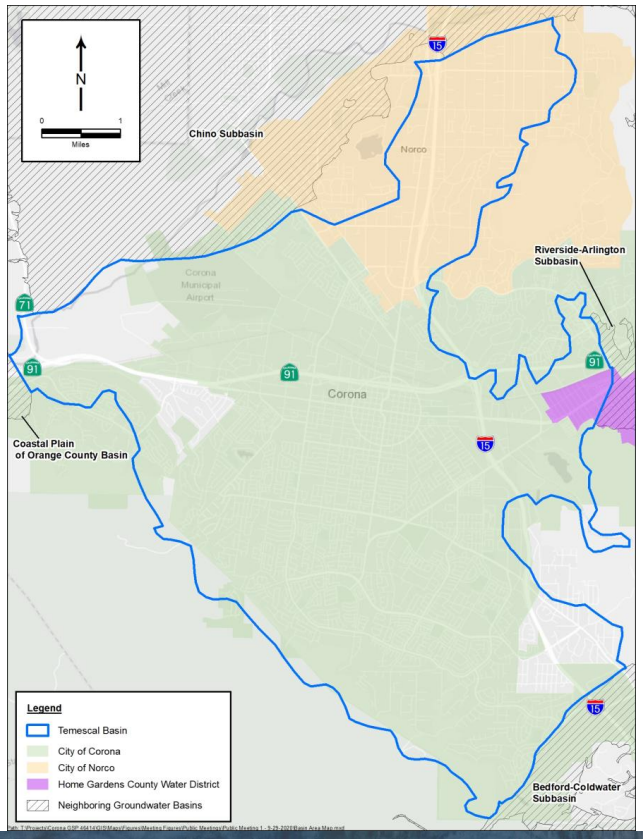
THE TEMESCAL BASIN
LA CUENCA DEL TEMESCAL

» DWR categorized as a Medium Priority Basin

Catalogada por DWR como Cuenca de prioridad media

» Contiguous and connected

Contigua y conectada



TEMESCAL GSA

GSA ORGANIZATION / ORGANIZACÍON

City of Corona

City of Norco

Home Gardens County Water District

Department of Water and Power
Departamento de Aqua y Energía

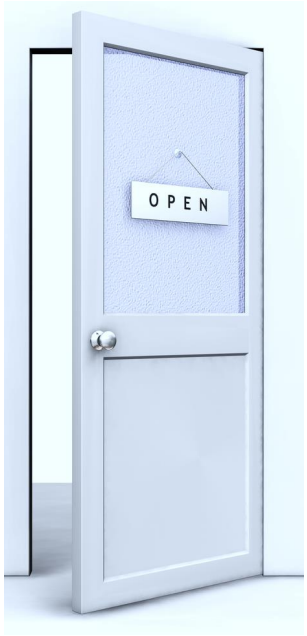
Staff and Consultants
Personal y Consultores
- Corona DWP Staff
- Todd Groundwater
- Carollo Engineers
- Kearns & West

Technical Advisory Committee
Comité Asesor Técnico
- Public agencies/Agencias públicas
- Local businesses/Empresas locales
- Well owners/Propietarios de pozos
- Community interests/Intereses comunitarios

Other agencies and interested parties/Otras agencias y partes interesadas

DRAFT PLAN AREA CHAPTER
ESQUEMA DEL ÁREA DEL PLAN

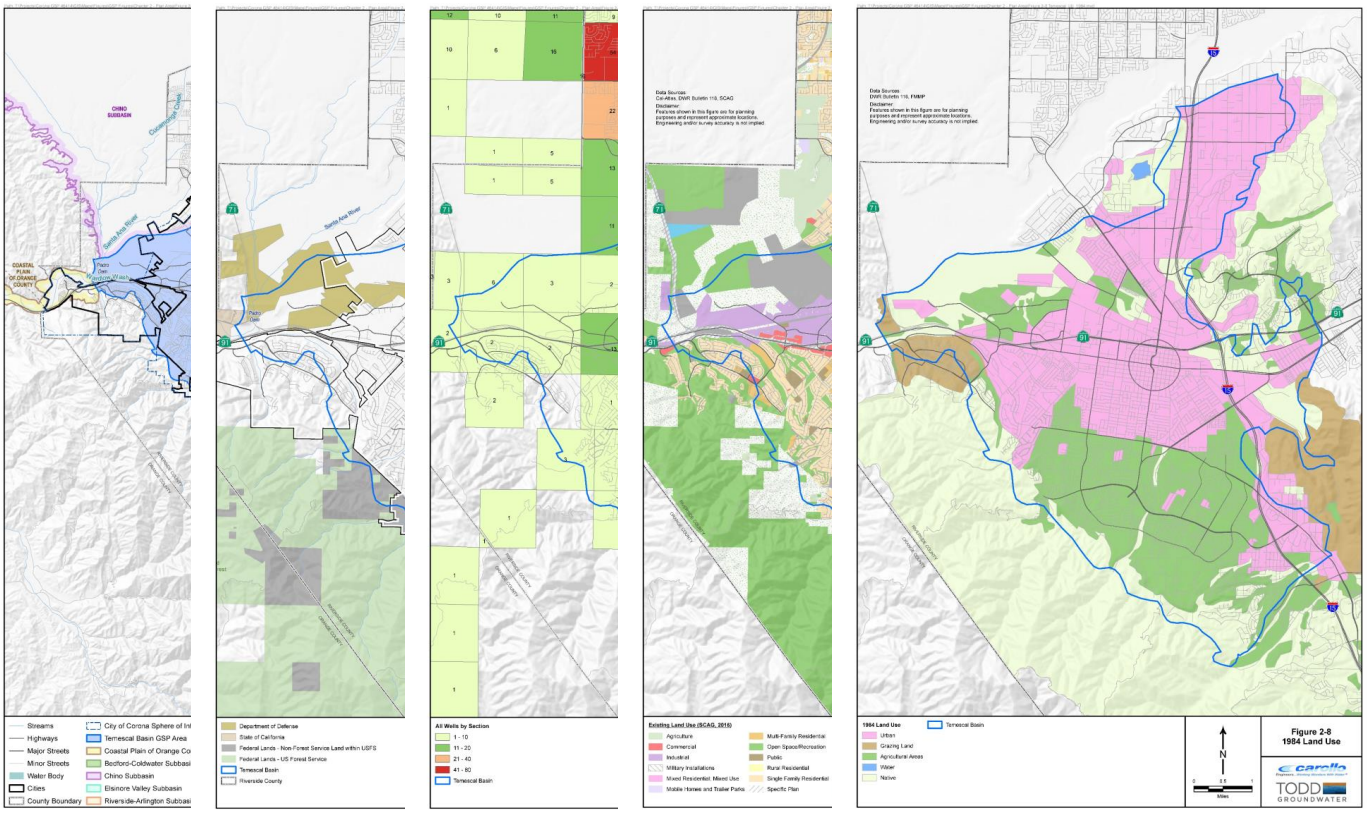
Description of Plan Area
Descripción del Área de Plan



- Jurisdictional boundaries
  Limites jurisdiccionales
- Existing monitoring and management
  Monitoreo y gestión existentes
- Well distribution
  Distribución de pozos
- Land use designations and description
  Designaciones y descripción del uso de la tierra

TEMESCAL GSA

PLAN AREA / ÁREA DEL PLAN

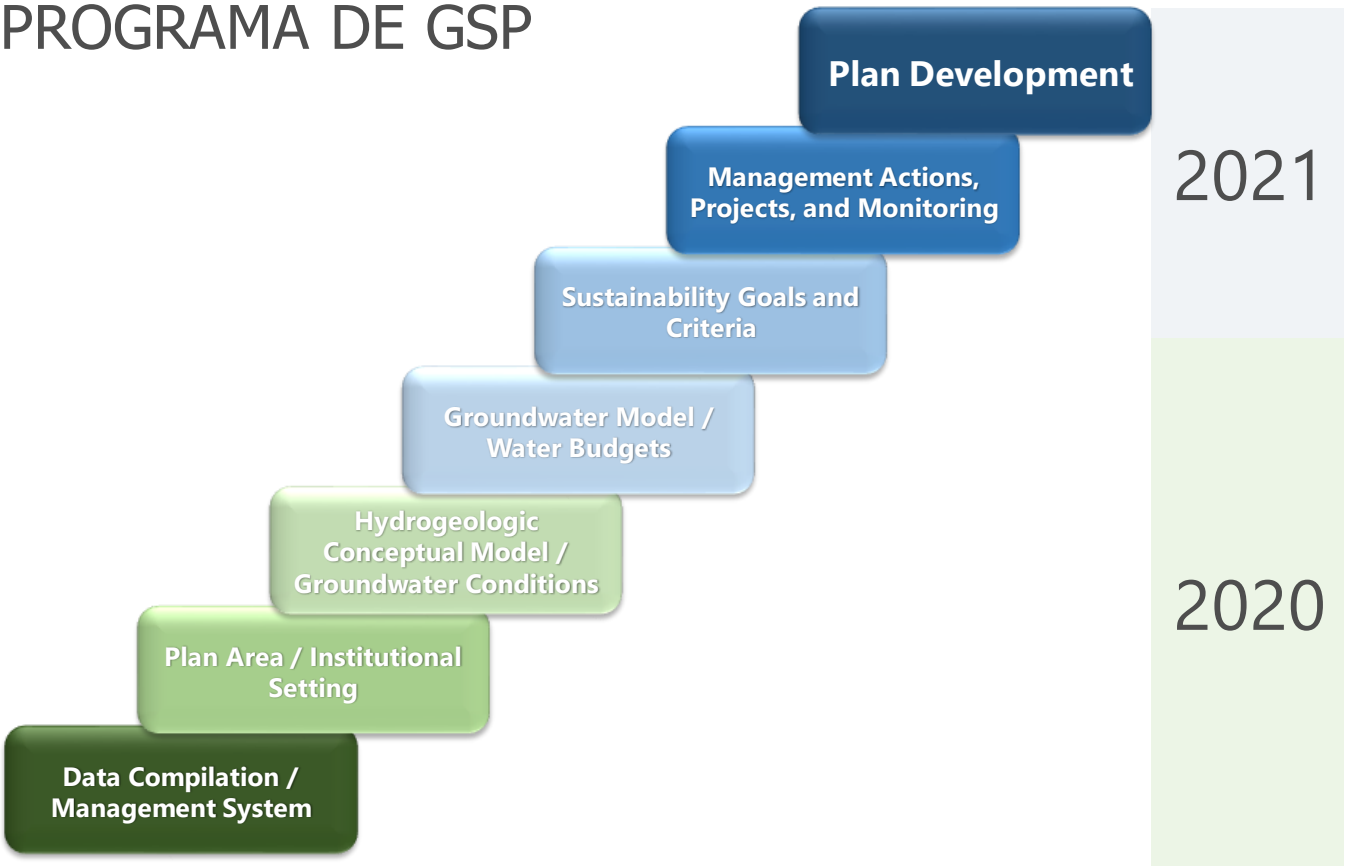


GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT

DESARROLLO DE PLAN DE SOSTENIBILIDAD DE AGUAS SUBTERRÁNEAS

TEMESCAL GSA

GSP SCHEDULE
PROGRAMA DE GSP



GSP SCHEDULE
PROGRAMA DE GSP



TEMESCAL GSA

WHAT IS SUSTAINABILITY?
¿QUÉ ES LA SOSTENIBILIDAD?

SUSTAINABILITY CRITERIA
CRITERIOS DE SOSTENIBILIDAD

Chronic lowering of groundwater levels
Disminución crónica de los niveles de aguas subterráneas

Reduction of groundwater storage
Reducción del almacenamiento de aguas subterráneas

Degradation of water quality
Degradación de la calidad del agua

Depletions of interconnected surface water affecting beneficial uses
Agotamiento de las aguas superficiales interconectadas que afectan a los usos beneficiosos

Land subsidence affecting land uses
El hundimiento de la tierra que afecta a los usos de la tierra

Seawater intrusion (not applicable here)
Intrusión de agua de mar (no aplicable aquí)

TEMESCAL GSA

EXAMPLE SUSTAINABILITY CRITERIA: GROUNDWATER LEVELS
EJEMPLO DE CRITERIOS DE SOSTENIBILIDAD: NIVELES DE AGUAS SUBTERRÁNEAS

What undesirable effects do we want to avoid?

» Impacts to shallow wells?

» Maintenance of municipal and industrial water supply?

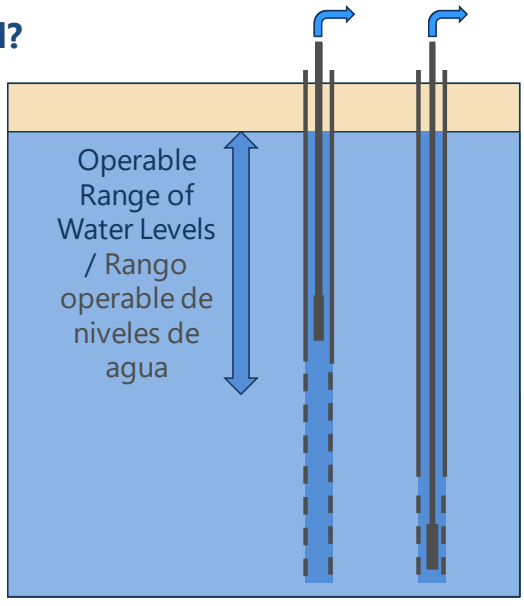
» Other?

¿Qué efectos indeseables queremos evitar?

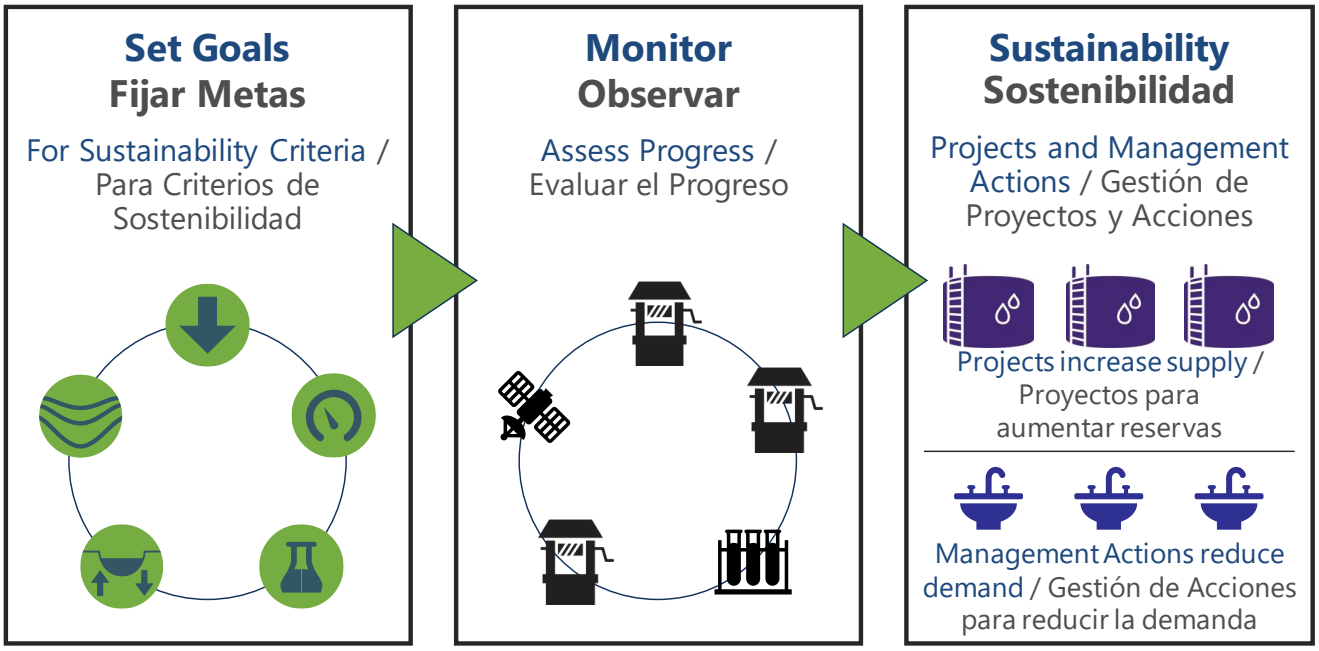
» ¿Impactos en pozos poco profundos?

» ¿Mantenimiento del suministro de agua municipal e industrial?

» ¿Otros?



ACHIEVING SUSTAINABILITY
LOGRAR LA SOSTENIBILIDAD



TEMESCAL GSA

DISCUSSION AND Q&A
DISCUSIÓN / PREGUNTAS Y RESPUESTAS

» What water supply and quality goals are important to you?

¿Qué objetivos de suministro y calidad de agua son importantes para usted?

» Is there information the project team should review?

¿Hay información que el equipo del proyecto debe revisar?

» What else?

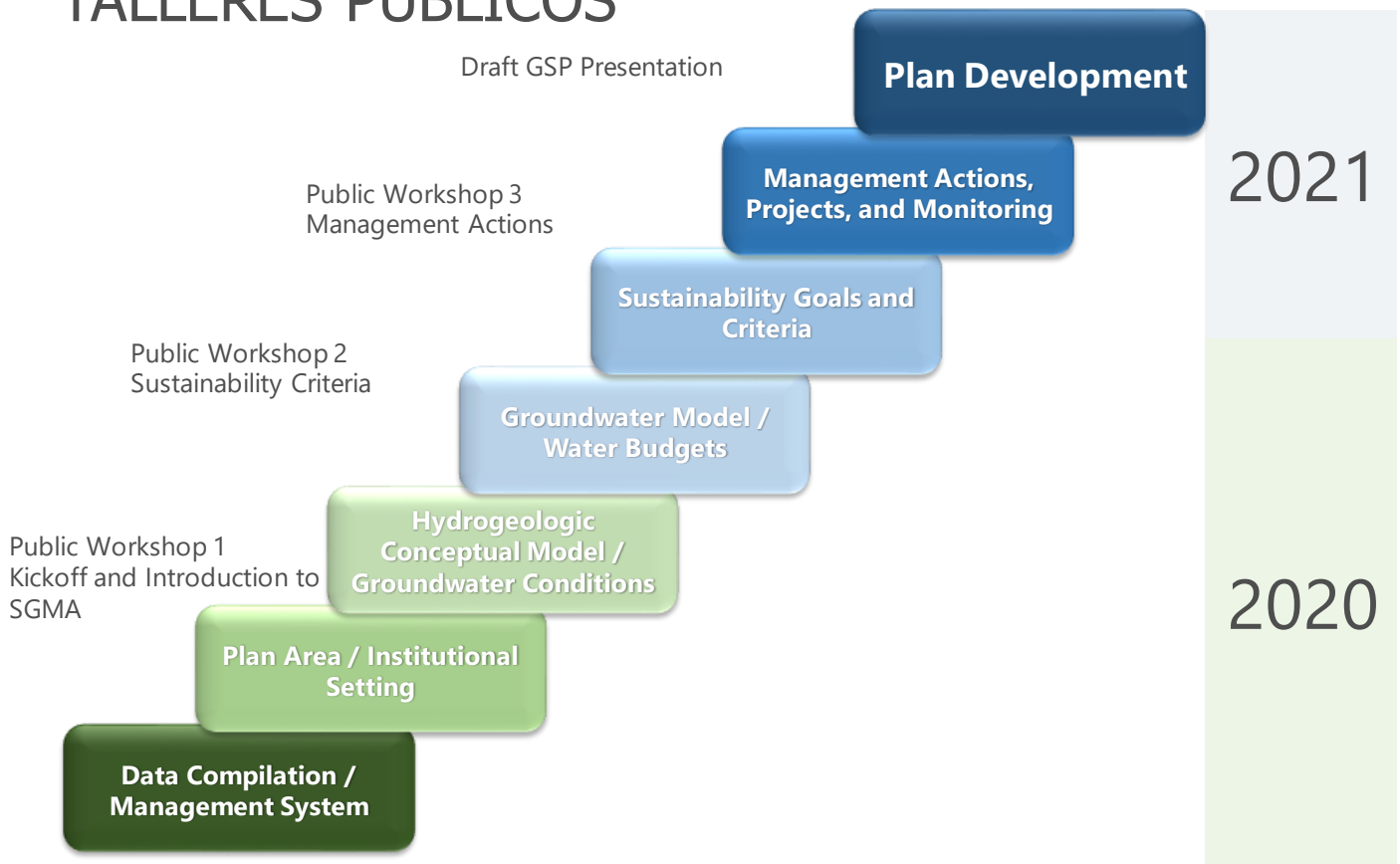
¿Qué más?

Groundwater@CoronaCA.gov

HOW CAN YOU GET INVOLVED?
¿CÓMO PUEDE INVOLUCRARSE?

TEMESCAL GSA

PUBLIC WORKSHOPS
TALLERES PÚBLICOS



PUBLIC WORKSHOPS
TALLERES PÚBLICOS



TEMESCAL GSA

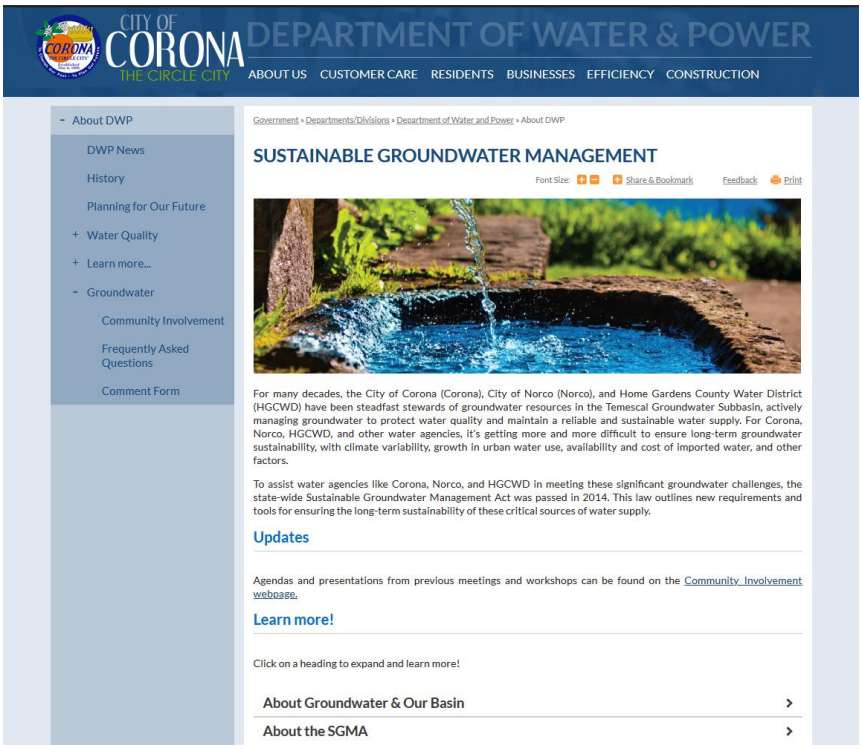
OTHER MEETINGS
OTRAS REUNIONES

» Technical Advisory Committee Meetings
Reuniones del Comité Asesor Técnico

» Updates at City Council and Board Meetings
Actualizaciones en las reuniones del consejo y la junta de la ciudad

» Adoption Hearing for Final GSP
Audiencia de adopción del GSP final

WEBSITE
SITIOS WEB



TEMESCAL GSA

HOW TO KEEP IN TOUCH
CÓMO MANTENERSE EN CONTACTO

» Sign up for the mailing list by emailing Groundwater@CoronaCA.gov
Regístrese en la lista de correo enviando un correo electrónico a Groundwater@CoronaCA.gov

» Visit the website to view information, review draft chapters and other materials, and to submit comments : www.CoronaCA.gov/Groundwater
Visite el sitio web para ver información, revisar borradores de capítulos y otros materiales, y enviar comentarios: www.CoronaCA.gov/Groundwater

THANK YOU

GRACIAS

Temescal Basin Public Workshop 2

Workshop Summary

Contents

1. Background 1
2. Pre-Workshop Outreach 1
3. When and Where 2
4. Attendance and Social Media Views 2
5. Summary 2
    Review of Groundwater Sustainability Plan Development 2
    Hydrogeologic Conceptual Model 3
    Groundwater Conditions 4
    Water Budget 5
    How to Stay Involved 6
6. Wrap Up and Closing 6

Appendix

A. Presentation Slides

1. Background

On September 16, 2014, the Governor of California signed into law a legislative package comprised of three bills: Assembly Bill (AB) 1739, Senate Bill (SB) 1168, and SB 1319. These laws are collectively known as the Sustainable Groundwater Management Act (SGMA). SGMA (pronounced sigma) defines sustainable groundwater management as the "management and use of groundwater in a manner that can be maintained without causing undesirable results." This means keeping balanced levels of pumping and recharge of groundwater while assuring reliable water quality. SGMA provides a comprehensive framework for basin sustainability, additional technical analysis, and quantification of many aspects of basin sustainability and management. This includes extensive and detailed descriptions of the basin setting and conditions and more comprehensive monitoring of groundwater use, quality, and levels, including metering of groundwater usage.

SGMA requires the formation of a locally controlled Groundwater Sustainability Agency (GSA), which is responsible for developing and implementing a Groundwater Sustainability Plan (GSP). The GSP outlines how to achieve groundwater sustainability within 20 years of its adoption. The City of Corona, City of Norco, and Home Gardens County Water District have formed the Temescal Basin Groundwater Sustainability Agency (Temescal GSA) to create a GSP for the Temescal Basin.

GSAs must consider the interests of all beneficial uses and users of groundwater. The GSA must provide opportunities for public engagement and active involvement of diverse social, cultural, and economic elements of the population. The Temescal GSA recognizes that stakeholder and public engagement is critical to ensuring that the full range of interests of all beneficial uses and users of groundwater are represented during GSP development.

To share information and get input from stakeholders and the public, the Temescal GSA is holding a series of public workshops. The first public workshop, conducted on September 29, 2020, focused on communicating basic information about SGMA, the Temescal Basin, GSP development, and what sustainability means in a GSP. The second public workshop, conducted on March 2, 2021, focused on providing updates on the Temescal GSP development and introducing the hydrogeologic conceptual model, groundwater conditions, and water budget. This summary documents the outreach methods, time and location, attendance, and major topics presented and discussed at the second public workshop.

2. Pre-Workshop Outreach

The Temescal GSA used a variety of methods to inform stakeholders and community members about the workshop and encourage participation, as shown in Table 1 on the next page.

Table 1: Pre-Workshop Outreach Methods

Method	Description
Website	Workshop information was posted on the project website, hosted by the City of Corona's Department of Water and Power, and was included in a calendar post.
Social Media Posts	The City of Corona posted information about the workshop through a Facebook Event. The City of Norco posted on its Facebook page.
Newsletters	The City of Corona advertised the workshop in its *Inner Circle* newsletter, which is accessible online and distributed via email.
Emails	Invitation emails were sent to those on the interested parties list.

3. When and Where

The workshop was held on March 2, 2021 from 4:00 to 6:00 p.m.

The workshop was held virtually on the Zoom platform. The workshop was streamed on the City of Corona's website, Facebook, and YouTube channels and on Corona TV, viewable on Channel 29 on Time Warner Spectrum and Channel 99 on AT&T.

4. Attendance and Social Media Views

Approximately 24 people attended the Zoom virtual meeting, including 10 stakeholder participants. Others viewed the workshop on Facebook Live, YouTube, and Corona TV. Post-workshop statistics indicated 17 views on YouTube.

5. Summary

Welcome and Introductions

Jack Hughes, facilitator from Kearns & West, welcomed everyone to the second public workshop for the Temescal GSP. Christian Mendez from Kearns & West gave instructions in Spanish for accessing Spanish interpretation on Zoom. Hughes reviewed the workshop purpose, which was to provide Temescal GSP development updates and introduce the hydrogeologic conceptual model, groundwater conditions, and water budget. Additionally, the consultant team wanted to learn from participants what they thought the most important uses of groundwater were and if they know of any current or historical problems regarding the use of groundwater in the Temescal Basin.

Hughes invited the workshop attendees to make introductions using the Zoom chat and recognized the Temescal GSA representatives and elected officials in attendance. Hughes then introduced the additional workshop presenters: Chad Taylor, Principal Hydrogeologist at Todd Groundwater, and Maureen Reilly, Senior Engineer at Todd Groundwater.

Review of Groundwater Sustainability Plan Development

Taylor first presented the background and purpose of SGMA (see Appendix A for presentation slides for this and the following sections). The State can intervene if local agencies are not acting, but that is a

last option. Under SGMA, local agencies are provided guidance for how to assess sustainability, tools for achieving or maintaining sustainability, and financial assistance in the form of grants available from the State. The Temescal GSA, comprised of the City of Corona, the City of Norco, and Home Gardens County Water District, has received a grant to prepare the GSP for the Temescal Basin.

Taylor explained that GSPs are detailed road maps for how groundwater basins will achieve or maintain long-term sustainability. Similar to other state planning requirements that agencies have been undertaking for many years, GSPs have periodic review processes and annual reporting requirements. These include long-term planning components, such as 50-year simulations of future conditions, to ensure long-term sustainability can be maintained.

Taylor described the Temescal Basin area, which covers most of the City of Corona, about half of the City of Norco, and the western part of the Home Gardens County Water District. The Temescal Basin is bounded by the Chino Subbasin to the north, the Riverside-Arlington Subbasin to the east, the Bedford-Coldwater Subbasin to the south, and the Coastal Plain of Orange County on the west. One GSA, Temescal GSA, was formed for the Temescal Basin because the area is hydrologically connected and has historically been managed as one unit. The Department of Water Resources has designated the Temescal Basin as a medium priority basin, which required the Temescal GSA to prepare the Temescal GSP.

Taylor next described the organization of the Temescal GSA. The Temescal GSA provides for decision-making, technical support, and community outreach. The City of Corona, the City of Norco, and Home Gardens County Water District formed the Temescal GSA in 2017 through a memorandum of understanding. The City of Corona is leading the GSP effort with support from Corona Department of Water and Power staff and additional consultants. The Technical Advisory Committee provides input during GSP preparation, and Technical Advisory Committee members communicate with other agencies and interested parties about GSP development. The GSP process is founded on public engagement and stakeholder outreach, which is the purpose of the public workshops.

Participants then answered the following warm up question using a Zoom poll: How many major aquifers are there in the Temescal Basin?

- Two
- Three
- Five
- Ten

Taylor provided and discussed the answer once the poll was closed. There are two major aquifers in the Temescal Basin, depending on how a major aquifer is defined. The section below on the hydrogeologic conceptual model has more information on the aquifers in the basin.

Hydrogeologic Conceptual Model

Taylor presented the hydrogeologic conceptual model. The model is a summary description along with a series of maps and graphics that defines where groundwater is in the Temescal Basin, how it gets there, and how it moves. It considers what areas of the Temescal Basin are made up of coarse or fine materials and includes descriptions of basin boundaries, geology, aquifers and aquitards, aquifer properties, and groundwater use. The model is accompanied by maps and graphics that show

topography, surface water features, geology, soils, aquifer locations, basin thickness, and cross-sections.

Taylor reviewed the surficial geology and the location and characteristics of the channel aquifer in the Temescal Basin. The Temescal Basin in primarily made up of young, unconsolidated deposits surrounded by older bedrock on the western and eastern portions of the basin. There are also some older, partially consolidated deposits in the northern portion of the Temescal Basin. Faulting affects groundwater in much of the Temescal Basin and can restrict groundwater flow laterally. Taylor noted that the principal aquifer in the Temescal Basin is the channel aquifer. The channel aquifer is coarser grained and the more productive wells in the basin draw from the channel aquifer. As a result, most of the municipal supply wells are in the channel aquifer and it is an important component of the groundwater system.

Taylor presented one of the three cross-sections that have been prepared for the Temescal Basin that illustrate the underground conditions. Taylor reviewed the A to A' cross-section that extends from the southwest to northeast. The cross-section starts in the Santa Ana mountains. Moving from southwest to northeast in the Temescal Basin, there are alluvial fan aquifers underlaid by sandstone aquifers, which are the secondary aquifers in the basin. Next is the channel aquifer that is adjacent to the Temescal Wash. The channel aquifer and Temescal Wash have similar deposits, so they are considered functionally similar and connected. They are underlaid by granitic bedrock, which is not very conducive to groundwater presence or flow. Many wells draw groundwater only from the channel aquifer, whereas some wells have screens below the channel aquifer. Lastly, Taylor presented a three-dimensional block diagram that shows the relationship between subsurface materials, ground surface, and basin activities in the Temescal Basin.

Discussion/Q&A

Hughes opened the floor for questions and comments. There were no questions or comments from participants after this presentation.

Groundwater Conditions

Taylor presented groundwater conditions in the Temescal Basin, which include current and historical conditions such as groundwater elevations, water quality, interconnected surface water, and subsidence. The Draft Hydrogeologic Conceptual Model and Groundwater Conditions chapters are available for review on the Temescal GSA website (CoronaCA.gov/Groundwater).

Taylor began by describing groundwater elevation as the height of water above sea level and displayed a groundwater elevation contour map. Water levels can mean groundwater elevation or depth to water. Groundwater elevation contours are used to show water levels in an area to determine what flow is like underground. Flows in the Temescal Basin point toward the northwest and turn to the west in Prado. Taylor noted that groundwater flow direction is generally consistent over time in the basin.

Taylor described groundwater conditions over time in the Temescal Basin and displayed a hydrograph of a representative well. Seasonal and larger-scale patterns can be viewed on the hydrograph. These show responses to changes in climate conditions, weather conditions, wet and dry cycles, and pumping. Taylor explained that the highest water levels occurred in the 1980s following heavy rains during the late 1970s. In the 1990s, there were some wet periods where water levels did not recover as much as in the 1980s because of increased pumping. Many wells have had their lowest water levels in the last

10 years because of the drought that occurred between 2013 and 2017. Water levels have been recovering since then, but it is slow process due to limited precipitation.

Taylor next explained groundwater quality in the Temescal Basin. Primary constituents of concern are total dissolved solids and nitrate. Total dissolved solids are a variety of salts that mostly comes from rocks and are elevated in the channel aquifer. Nitrate is also high in some areas and mostly comes from human-caused activities such as historic agriculture and wastewater treatment and disposal. It is important to note that groundwater that is pumped for public consumption in the Temescal Basin is treated and blended before being distributed. The water served to homes and businesses in the Temescal Basin meets federal, state, and county requirements for public health. Other water quality constituents of concern are being tracked and are discussed in the Groundwater Conditions chapter.

Taylor described interconnected surface water, which means that groundwater is shallow enough to be connected to a surface water body. In these areas, high volumes of pumping could lower groundwater elevations. This can become problematic when there are ecosystems that rely on the groundwater, known as groundwater dependent ecosystems. In the Temescal Basin, the primary interconnected surface waters are in the Prado area, which includes wetlands and plants that rely on groundwater. The Temescal GSA does not want to do anything through groundwater management that will damage the wetlands. Taylor mentioned that subsidence, deformation of the ground surface as a result of groundwater pumping or reduction in groundwater levels, is discussed in the Groundwater Conditions chapter and was not included in the presentation for the sake of brevity since it was not a major issue in the Temescal Basin.

Discussion/Q&A

Hughes opened the floor for questions and comments. Participants were encouraged to answer the following question verbally or using the chat: Do you know of any current or historical problems regarding the use of groundwater in the Temescal Basin? No responses were received.

Water Budget

Reilly presented the purpose of the water budget. The water budget quantifies the inflows and outflows of the Temescal Basin, which vary over time and depend on hydrology and/or management. Inflows in the Temescal Basin include recharge from rainfall, stormwater, and streamflow; reclaimed water from percolation ponds; and subsurface flow from neighboring basins. Outflows occur when water leaves the basin due to pumping, flow to the Santa Ana River, and evapotranspiration.

Reilly explained that the water balance can be viewed as a change in storage, or inflows minus outflows. The numerical model uses inflows and outflows to calculate the change in storage and elements of the hydrogeologic conceptual model to simulate the groundwater aquifer. This tool can be used to simulate what has happened historically in the Temescal Basin and to simulate future conditions. It will be used to look at the sustainability of the Temescal Basin over the next 50 years and test different scenarios.

Discussion/Q&A

Hughes opened the floor for questions and comments. The following are the questions and comments received in the chat box from participants:

- How do you use the Santa Ana River for groundwater recharge?
- Can you discuss or explain sustainability in the Temescal GSP?

How to Stay Involved

Prior to learning how to stay involved in the process, participants answered a question using a Zoom poll. Hughes explained that all beneficial uses and users would be considered in the Temescal GSP, but the project team wanted to know the interests of stakeholders. Participants responded to the following question: What do you think are the most important uses of groundwater from the Temescal Basin?

- Groundwater Dependent Ecosystems
- Industrial Water Supply
- Municipal Water Supply
- Rural Residential Water Supply
- Small Commercial Water Supply
- Small Community Water Supply

The most common answers included groundwater dependent ecosystems, municipal water supply, and rural residential water supply.

Hughes explained how members of the public could be involved throughout GSP preparation, which will continue until January 2022. This was the second public workshop for people to get information about the GSP and give feedback on its development. The third public workshop will be held in summer of 2021 and will focus on sustainability criteria and management actions. The draft GSP presentation in the summer of 2021 will present another opportunity for involvement.

Hughes spoke about other opportunities to learn about GSP development and provide comment. In addition to the workshops, the Technical Advisory Committee meetings are open to the public. The public may listen in on those meetings and speak during the public comment portion. Lastly, the public will have the opportunity to attend and comment at the Adoption Hearing for the final GSP in the fall of 2021.

Draft chapters and other materials such as fact sheets can be found on the project website hosted by the City of Corona Department of Water and Power: CoronaCA.gov/Groundwater. Members of the public can use the form on the website to provide comments. Anyone who wants to be included on the mailing list should email Groundwater@CoronaCA.gov. People on the mailing list will receive updates on upcoming public workshops.

6. Wrap Up and Closing

Hughes thanked everyone for participating. The next public workshop will be held during the summer of 2021.

Appendix A

Presentation Slides

TEMESCAL GSP PUBLIC WORKSHOP 2
TEMESCAL GSP TALLER COMUNITARIO 2

About the Groundwater Sustainability Plan (GSP)

The Sustainable Groundwater Management Act or "SGMA" is a California law that gives local agencies new tools for managing groundwater and planning for the future. The City of Corona, City of Norco, and Home Gardens County Water District have formed the Temescal Groundwater Sustainability Agency (Temescal GSA) in order to make a **Groundwater Sustainability Plan** for the Temescal Basin. Since groundwater is such an important resource for everyone, we need your help!



Un poco sobre el plan de sostenibilidad de las aguas subterráneas (GSP)

La Ley de Gestión Sostenible de Aguas Subterráneas o "SGMA", por sus siglas en inglés, es una ley de California que otorga a las agencias locales nuevas herramientas para gestionar las aguas subterráneas y planificar para el futuro. La Ciudad de Corona, la Ciudad de Norco y el Distrito Hídrico del Condado de Home Gardens han formado la Agencia de Sostenibilidad de Aguas Subterráneas de la Cuenca de Temescal (Temescal Groundwater Sustainability Agency) o Temescal GSA a fin de crear un **Plan de Sostenibilidad de Aguas Subterráneas** para la Cuenca de Temescal. Dado que las aguas subterráneas son un recurso muy importante para todos, ¡necesitamos su ayuda!

TEMESCAL GSA

TEMESCAL GROUNDWATER SUSTAINABLY PLAN PUBLIC WORKSHOP 2

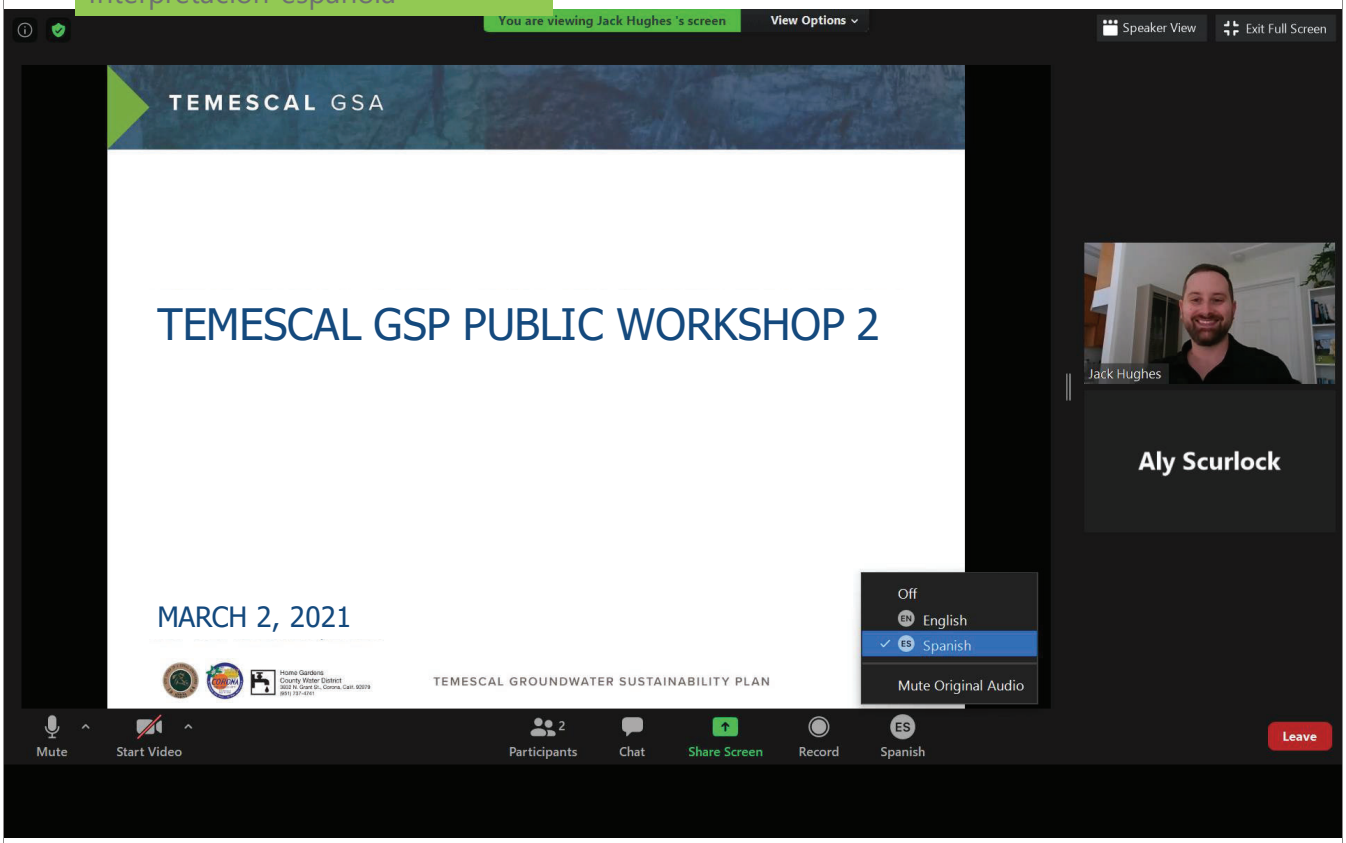
PLAN DE SOSTENIBILIDAD DE LAS AGUAS SUBTERRÁNEAS (GSP) DE TEMESCAL TALLER COMUNITARIO 2 DE TEMESCAL

MARCH 2, 2021 / 2 DE MARZO DE 2021

Home Gardens County Water District
3832 N. Grant St., Corona, Calif. 92879
(951) 737-4741

WELCOME
BIENVENIDOS

Interpretación española



This public workshop is being recorded and will be posted on the website:
www.CoronaCA.gov/Groundwater

Este taller público sera grabado y se publicará en el sitio web:
www.CoronaCA.gov/Groundwater

TEMESCAL GSA

WORKSHOP PURPOSE
PROPÓSITO DE TALLER COMUNITARIO

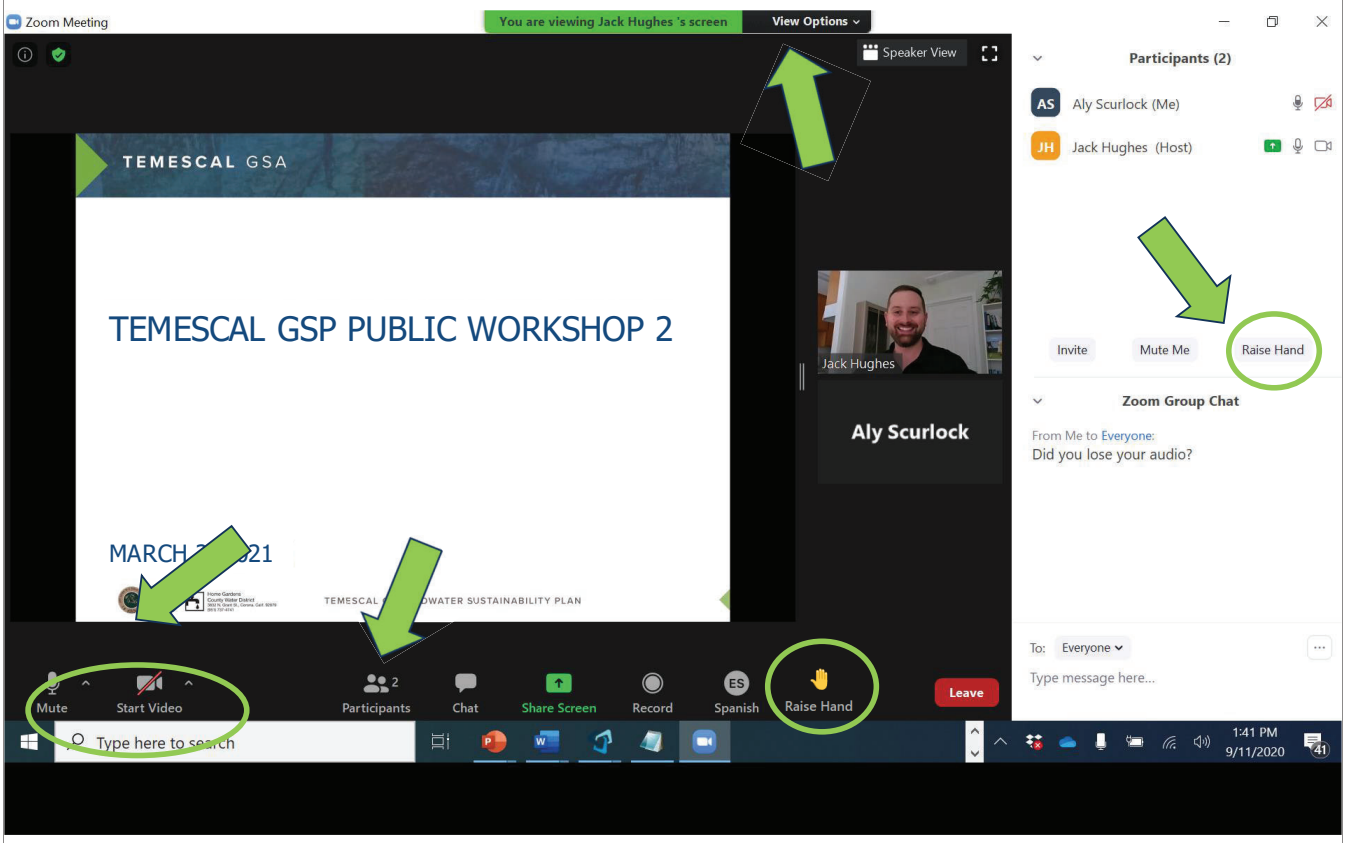
- Give Temescal Groundwater Sustainability Plan development updates.
  Proporcionar actualizaciones del desarrollo del Plan de sostenibilidad de aguas subterráneas de Temescal.
- Introduce the hydrogeologic conceptual model, groundwater conditions, and water budget.
  Introducir el modelo conceptual hidrogeológico, las condiciones del agua subterránea y el presupuesto de agua.

WORKSHOP PURPOSE
PROPÓSITO DE TALLER COMUNITARIO

» Learn what you think the most important uses of groundwater are and if you know of any current or historical problems regarding the use of groundwater in the Temescal Basin.
Conozca cuáles son los usos más importantes de las aguas subterráneas y si conoce algún problema actual o histórico con respecto al uso de las aguas subterráneas en la Cuenca del Temescal.

TEMESCAL GSA

HOW TO USE ZOOM
CÓMO UTILIZAR ZOOM



INTRODUCTIONS
INTRODUCCIONES

TEMESCAL GSA

Home Gardens
County Water District
3832 N. Grant St., Corona, Calif. 92879
(951) 737-4741

TEMESCAL GSA

CONSULTANT TEAM
EQUIPO DE CONSULTORES



Chad Taylor
Todd Groundwater



Maureen Reilly
Todd Groundwater



Jack Hughes
Kearns & West

TIPS FOR A PRODUCTIVE DISCUSSION
CONSEJOS PARA UNA DISCUSIÓN PRODUCTIVA

- One speaker at a time
  Solo una persona habla a la vez
- Keep input concise
  Sea conciso al hablar
- Actively listen
  Escuche activamente
- Offer solutions
  Ofrezca soluciones

TEMESCAL GSA

YOUR INPUT MATTERS
SU OPINIÓN ES IMPORTANTE

- The planning team will consider your comments as they prepare the Groundwater Sustainability Plan.
  El equipo de planificación considerará sus comentarios mientras preparan el Plan de sostenibilidad de aguas subterráneas.
- Your input will be recorded, organized thematically, and presented in a workshop summary on the project website.
  Sus comentarios serán registrados, organizados temáticamente y presentados en un resumen del taller en el sitio web del proyecto.

REVIEW OF GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT

REPASO DEL PLAN DE SOSTENIBILIDAD DE LAS AGUAS SUBTERRÁNEAS

TEMESCAL GSA

SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)

Landmark legislation in 2014

- » Recognizes that groundwater management in California is best accomplished locally

Legislación histórica en 2014

- » Reconoce que la gestión de las aguas subterráneas en California se logra mejor a nivel local

GROUNDWATER SUSTAINABILITY PLANS
PLANES DE SOSTENIBILIDAD DE LAS AGUAS SUBTERRÁNEAS

- Groundwater sustainability plans are detailed road maps for how groundwater basins will achieve long term sustainability.
- Los planes de sostenibilidad de las aguas subterráneas actuan como mapas que detallan la ruta que hay qe seguir para que cuencas de aguas subterráneas logren la sostenibilidad a largo plazo.

TEMESCAL GSA

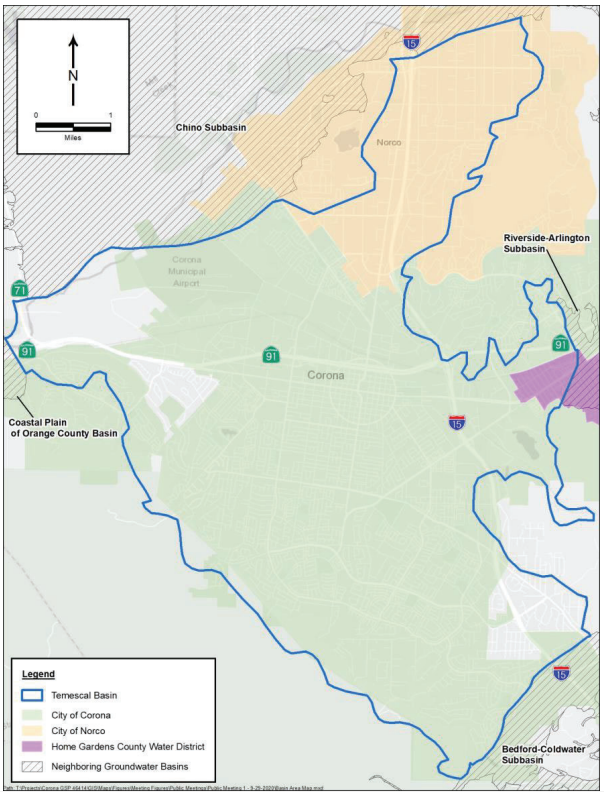
THE TEMESCAL BASIN
LA CUENCA DEL TEMESCAL

- DWR categorized Temescal Basin as a Medium Priority Basin

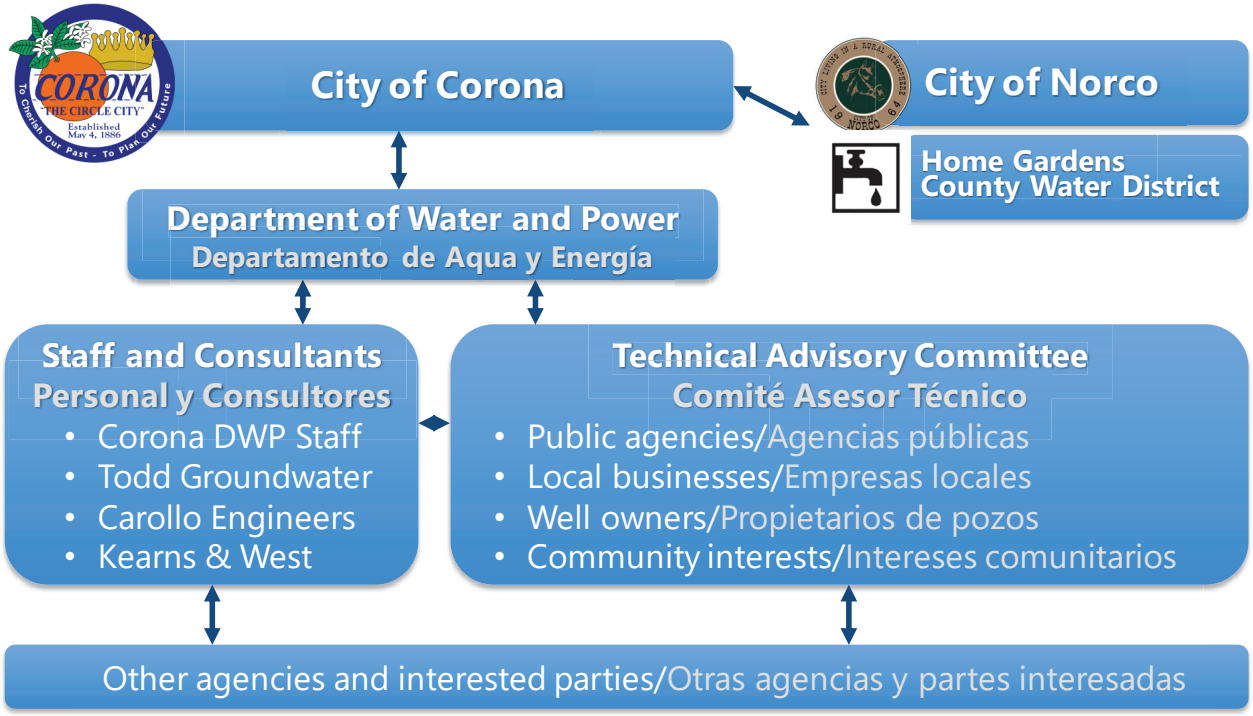
La Cuenca del Temescal fue desginada por DWR como Cuenca de Prioridad Media

- Contiguous and connected

Contigua y conectada



GSA ORGANIZATION / ORGANIZACÍON



TEMESCAL GSA

WARM UP QUESTION

PREGUNTAS DE CALENTAMIENTO

» How many major aquifers are there in the Temescal Basin?

¿Cuántos acuíferos significantes hay en la Cuenca del Temescal?

» Two / Dos
» Three / Tres
» Five / Cinco
» Ten / Diez

HYDROGEOLOGIC CONCEPTUAL MODEL
MODELO CONCEPTUAL HYDROGEOLOGICO

TEMESCAL GSA

HYDROGEOLOGIC CONCEPTUAL MODEL
MODELO CONCEPTUAL HYDROGEOLOGICO

Includes descriptions of:

- Basin boundaries, geology, aquifers and aquitards, aquifer properties, and groundwater use

Maps and Graphics showing:

- Topography, surface water features, geology, soils, aquifer locations, basin thickness, and cross-sections

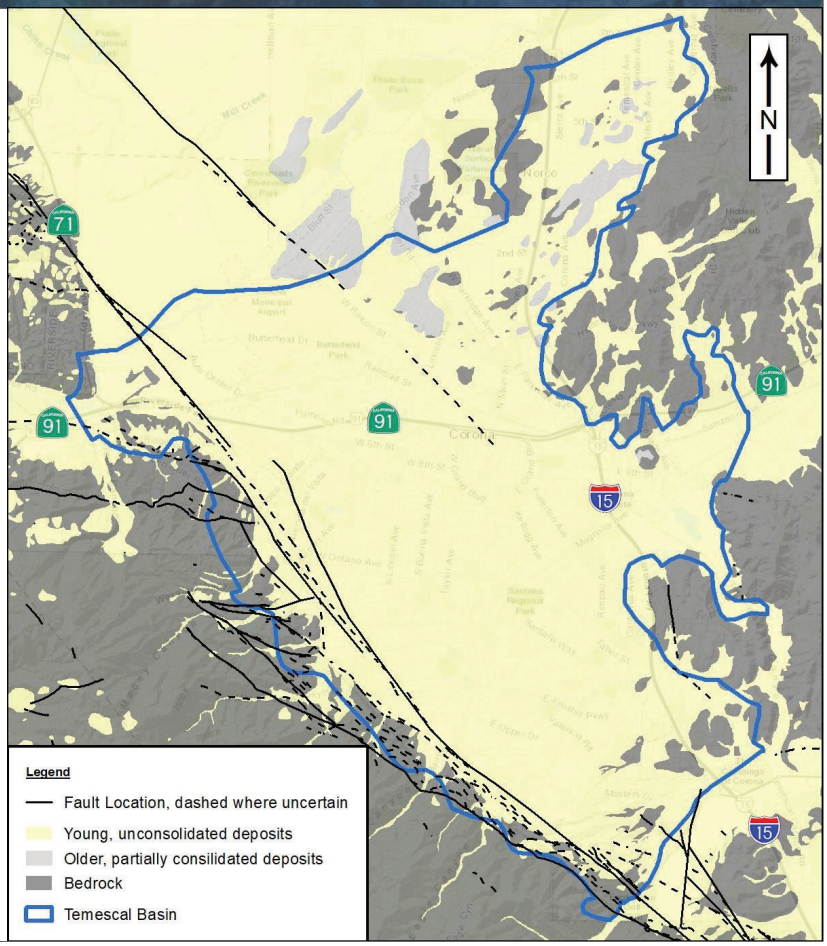
Incluye descripciones de:

- Límites de cuencas, geología, acuíferos y acuitardos, propiedades de acuíferos, y uso de aguas subterráneas

Mapas y gráficos que muestran:

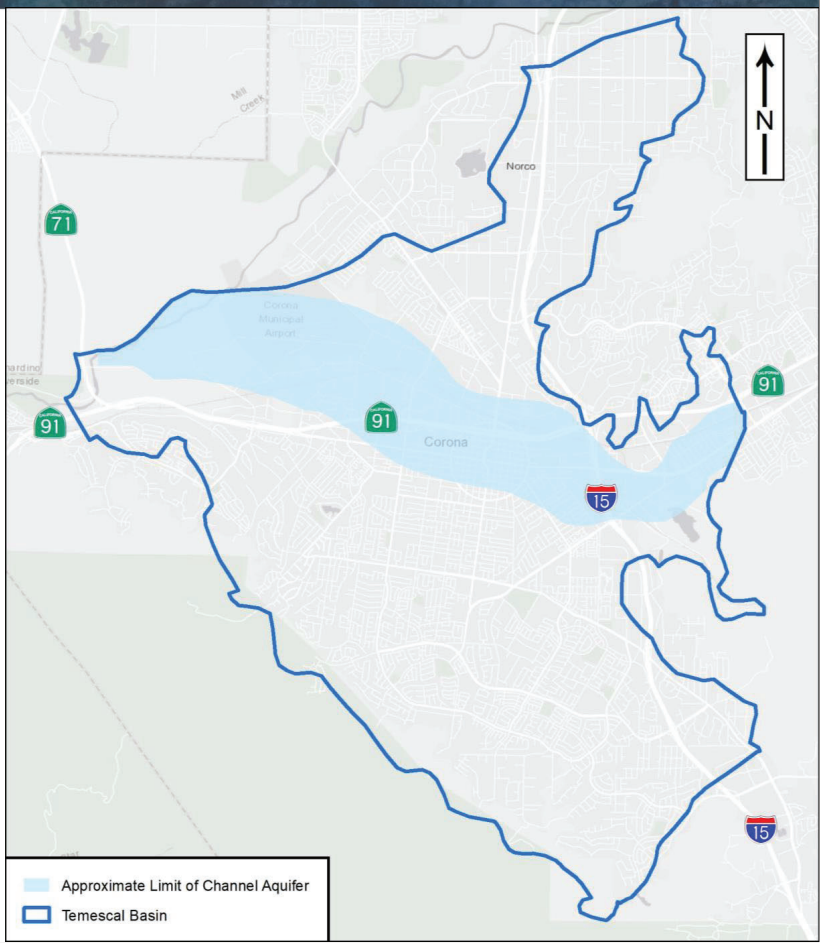
- Topografía, características de aguas superficiales, geología, tipos de tierra, ubicaciones de acuíferos, espesor de cuenca, secciones transversales

SURFICIAL GEOLOGY
GEOLOGÍA SUPERFICIAL

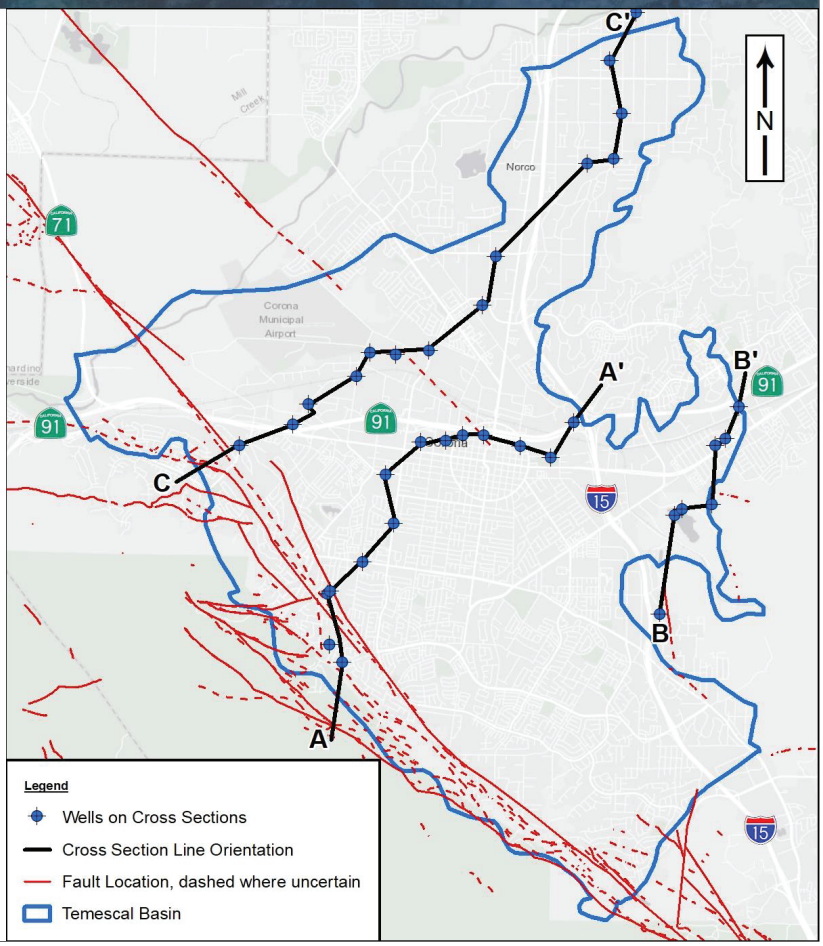


TEMESCAL GSA

CHANNEL AQUIFER
EL ACUÍFERO DEL CANAL



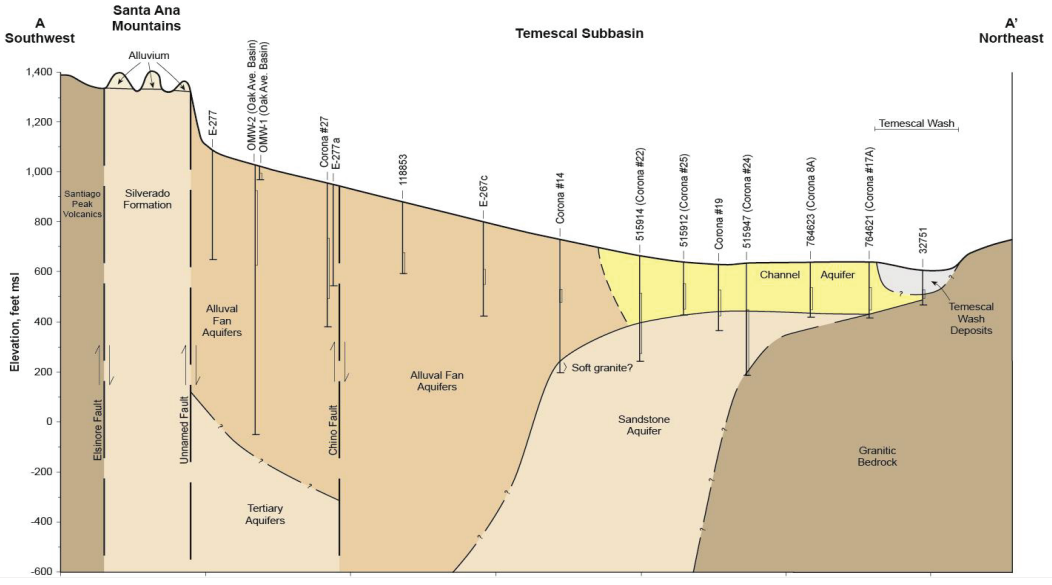
CROSS SECTIONS
SECCIONES TRANSVERSALES



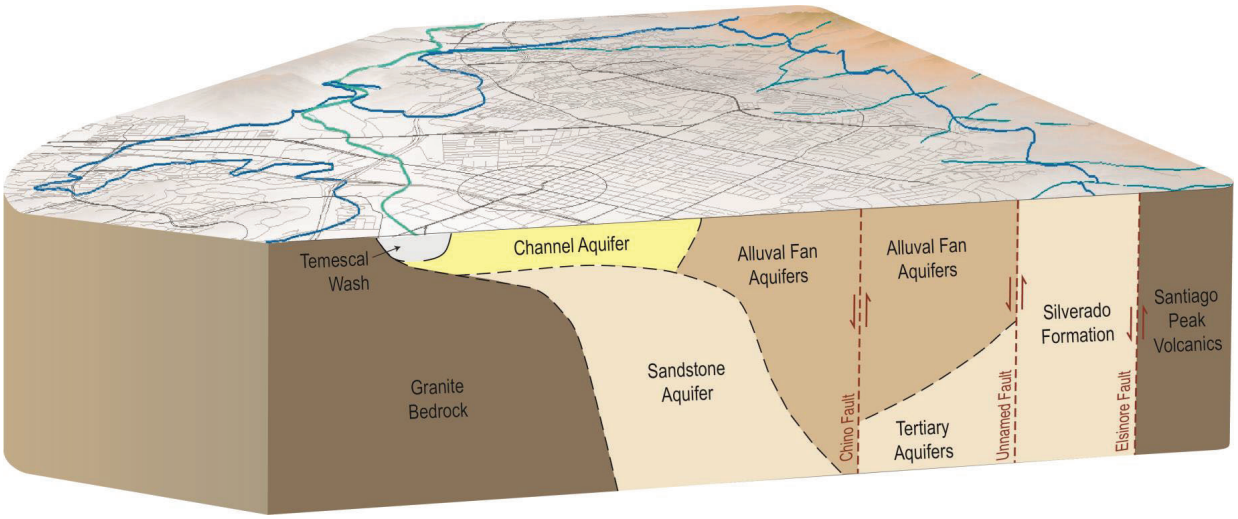
TEMESCAL GSA

CROSS SECTION A
SECCIÓN TRANSVERSAL - A

Channel Aquifer is the principal aquifer
El Acuífero del Canal es el principal acuífero



HYDROGEOLOGIC CONCEPTUAL MODEL
MODELO CONCEPTUAL HYDROGEOLÓGICO



TEMESCAL GSA

DISCUSSION AND Q&A
DISCUSIÓN / PREGUNTAS Y RESPUESTAS

GROUNDWATER CONDITIONS

CONDICIONES DE AGUAS SUBTERRÁNEAS

TEMESCAL GSA

GROUNDWATER CONDITIONS

CONDICIONES DE AGUAS SUBTERRÁNEAS

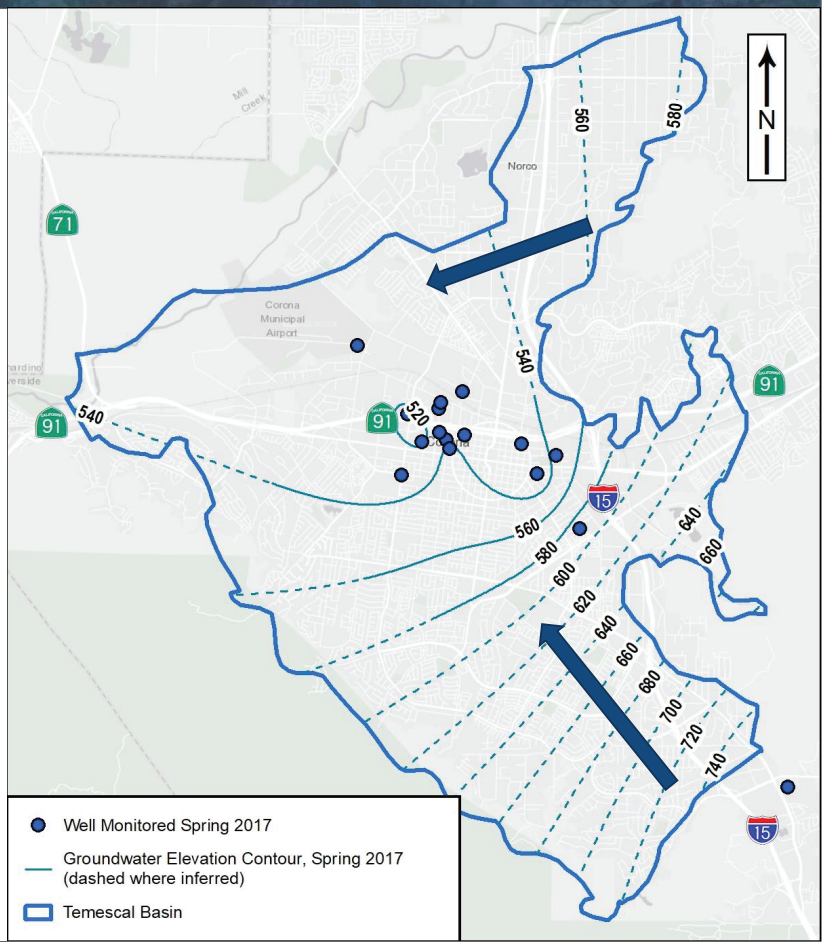
Presentation of current and historical conditions

- » Including groundwater elevations, water quality, interconnected surface water, and subsidence

Presentación de las condiciones actuales e históricas

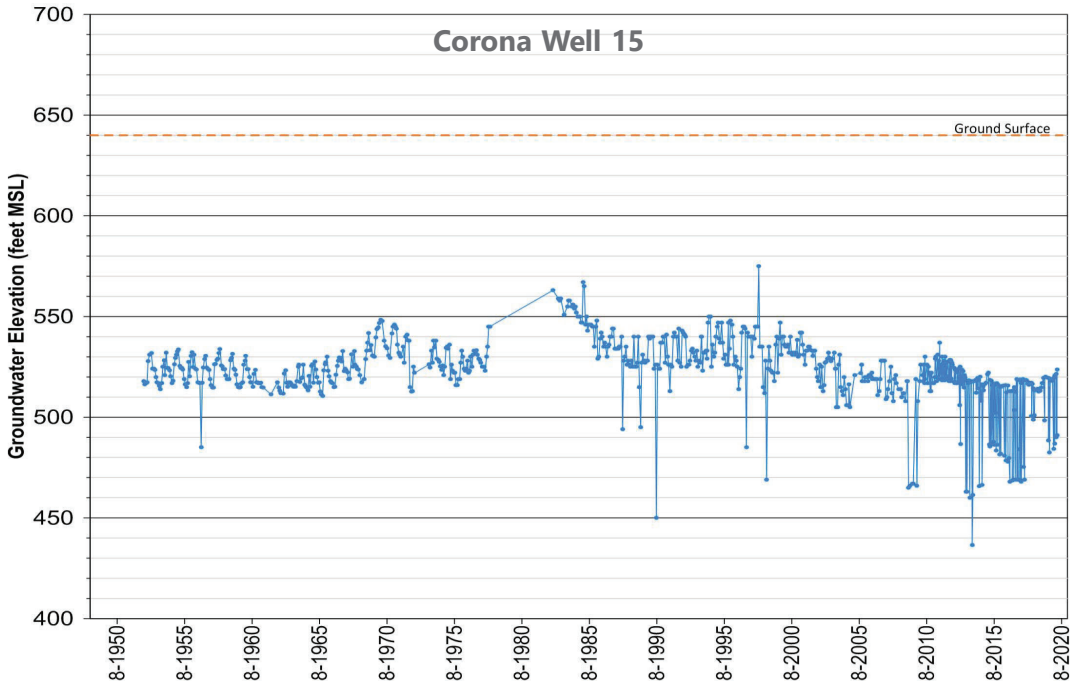
- » Incluyendo las elevaciones de las aguas subterráneas, la calidad del agua, las aguas superficiales interconectadas y el hundimiento

GROUNDWATER ELEVATION CONTOURS
CONTORNOS DE ELEVACIÓN DE AGUA SUBTERRÁNEA

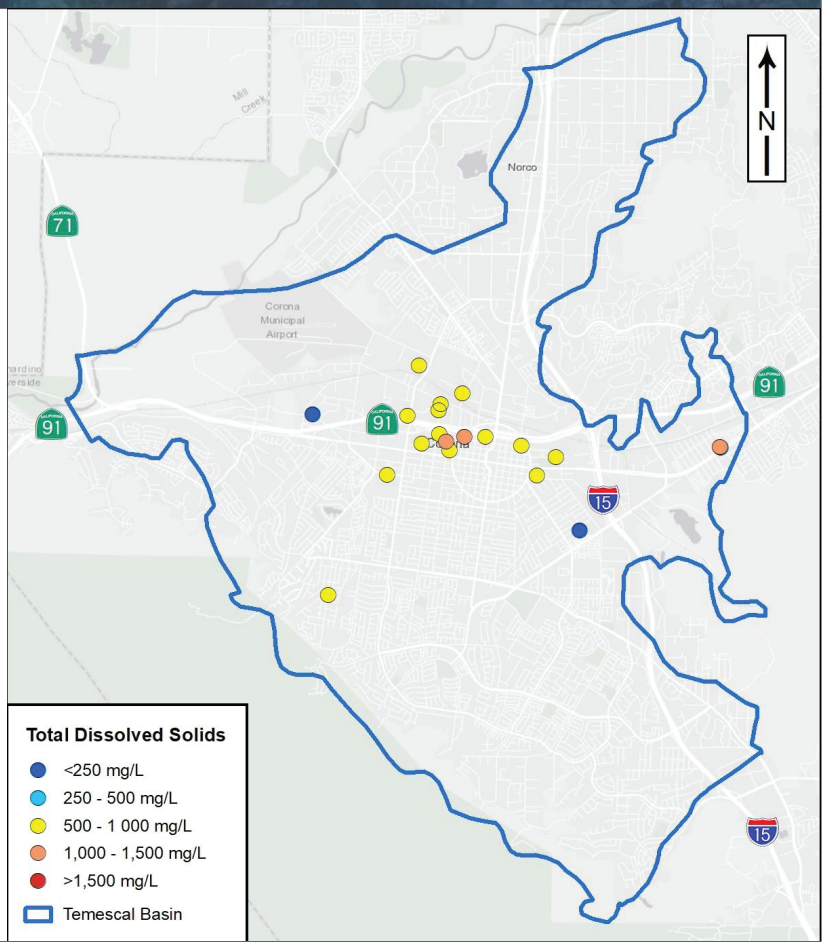


TEMESCAL GSA

HISTORICAL GROUNDWATER ELEVATIONS
ELEVACIONES HISTÓRICAS DE LAS AGUAS SUBTERRÁNEAS

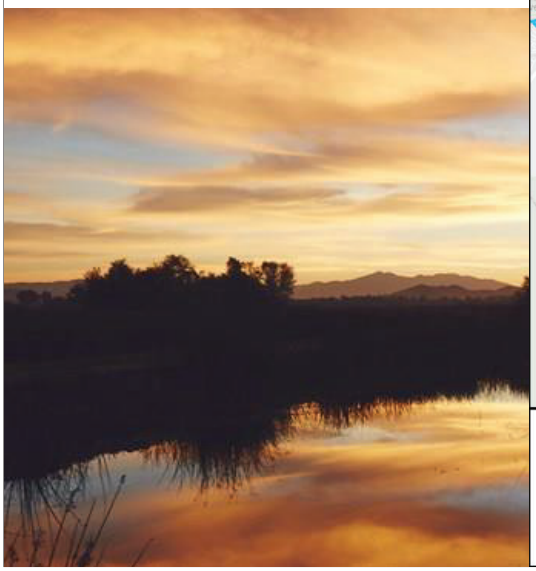


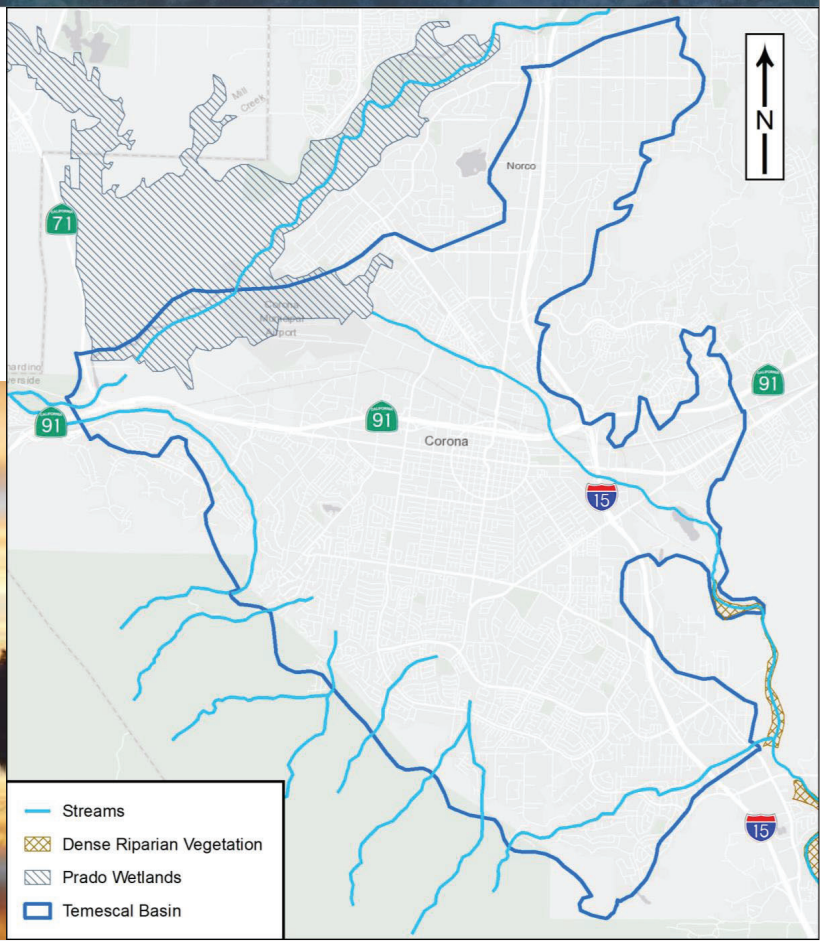
GROUNDWATER QUALITY
CALIDAD DEL AGUA SUBTERRÁNEAS



TEMESCAL GSA

INTERCONNECTED SURFACE WATER
AGUA SUPERFICIAL INTERCONECTADA





DISCUSSION AND Q&A
DISCUSIÓN / PREGUNTAS Y RESPUESTAS

» Do you know of any current or historical problems regarding the use of groundwater in the Temescal Basin?

¿Conoce algún problema actual o histórico sobre el uso de aguas subterráneas en la Cuenca del Temescal?

TEMESCAL GSA

WATER BUDGET
PRESUPUESTOS DE AGUAS

WATER BUDGET PURPOSE
PROPÓSITO DEL PRESUPUESTO DEL AGUA

- A water budget quantifies the inflows and outflows of the Temescal Basin over time

  Un presupuesto hídrico cuantifica los flujos de entrada y salida de la Cuenca del Temescal a lo largo del tiempo

- Both inflows and outflows vary from year to year, depending on hydrology or management

  Tanto los flujos de entrada como los de salida varían de un año a otro, dependiendo de la hidrología o la gestión

TEMESCAL GSA

WATER BUDGET – INFLOWS
PRESUPUESTO DEL AGUA – FLUJO DE ENTRADA

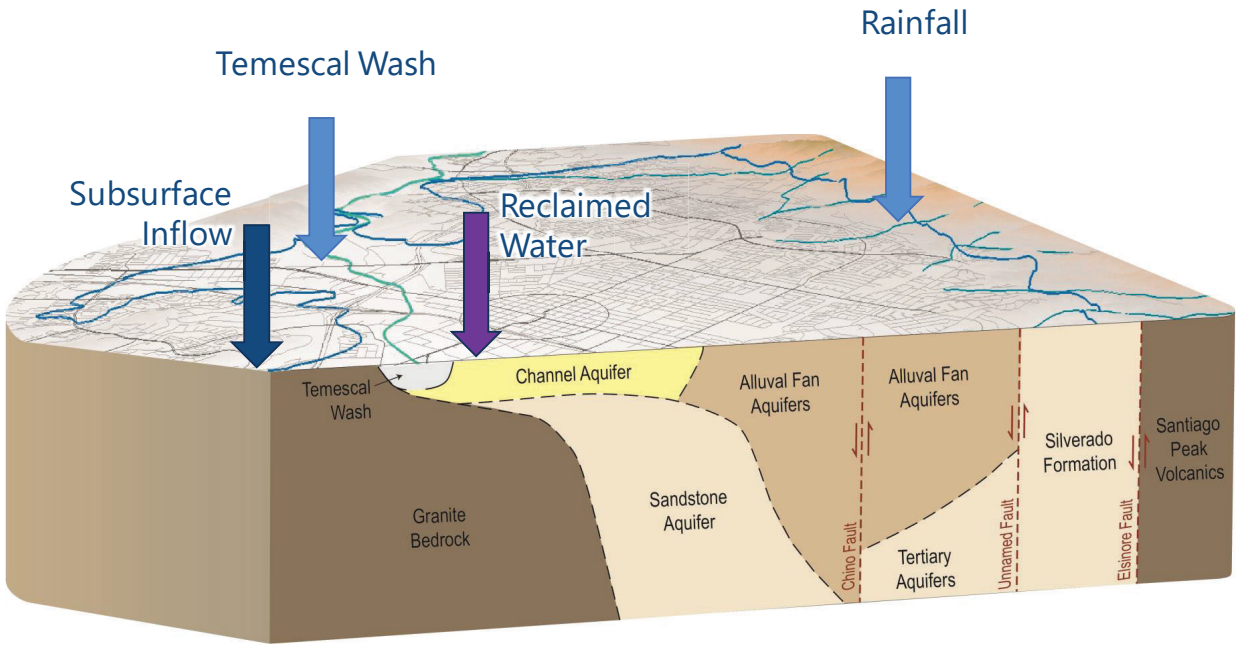
Water enters the groundwater basin through:

- Recharge from rainfall, stormwater, and streamflow
- Reclaimed Water percolation ponds
- Subsurface flow from neighboring basins

El agua entra en la cuenca de aguas subterráneas a través de:

- Recarga natural por lluvias, aguas pluviales y flujo de arroyos
- Estanques de percolación de agua recuperada
- Flujo subterráneo de las cuencas vecinas

WATER BUDGET – INFLOWS
PRESUPUESTO DEL AGUA – FLUJOS DE ENTRADA



TEMESCAL GSA

WATER BUDGET – OUTFLOWS
PRESUPUESTO DEL AGUA – FLUJO DE SALIDA

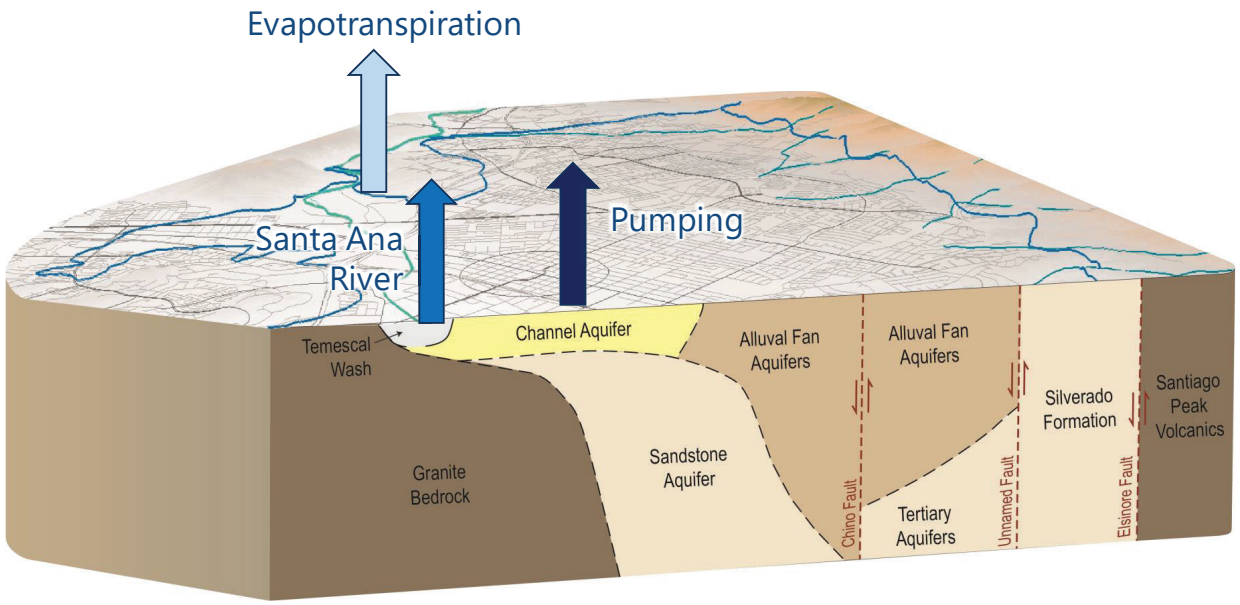
Water leaves the groundwater basin through:

- » Pumping
- » Flow to the Santa Ana River
- » Evapotranspiration

El agua deja la cuenca de agua subterránea a través de:

- » Pozos de Bombeo
- » Flujos al río Santa Ana
- » Evapotranspiración

WATER BUDGET – OUTFLOWS
PRESUPUESTO DEL AGUA – FLUJO DE SALIDA



TEMESCAL GSA

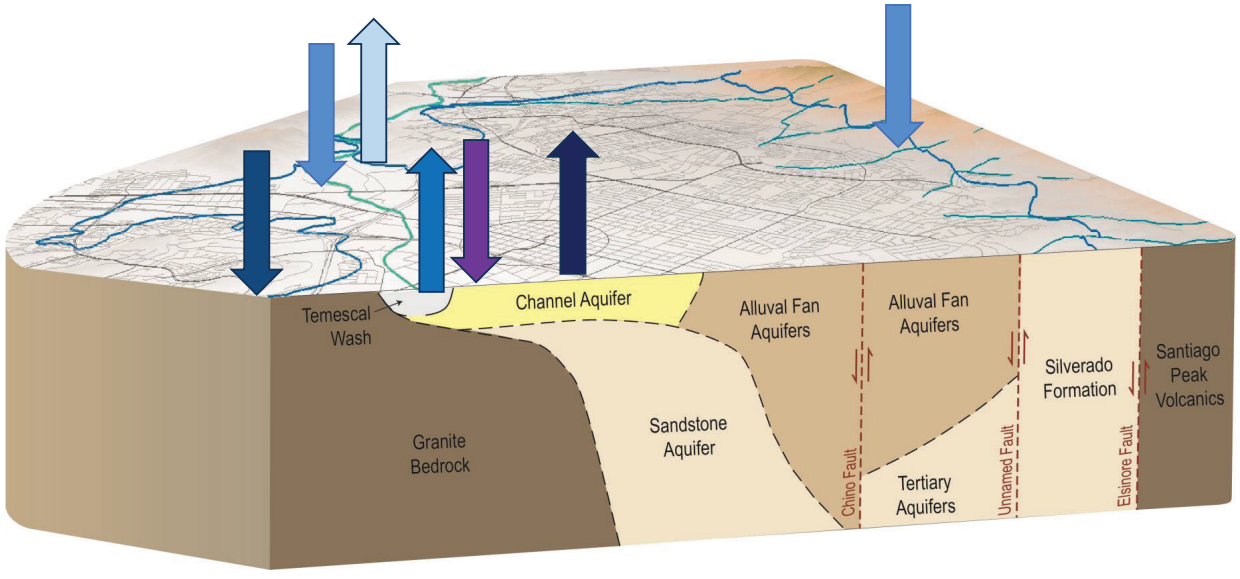
CHANGE IN STORAGE

» Inflows – Outflows = Change in Storage

Flujo de Entrada – Flujo de Salida - Cambio en el almacenamiento

» Numerical model can simulate future conditions

El modelo numérico puede simular condiciones futuras



DISCUSSION AND Q&A
DISCUSIÓN / PREGUNTAS Y RESPUESTAS

TEMESCAL GSA

WHAT DO YOU THINK?
¿QUÉ PIENSAS?

- What do you think are the most important uses of groundwater from the Temescal Basin? (Choose up to three)
  ¿Cuáles cree usted que son los usos más importantes de las aguas subterráneas de la Cuenca del Temescal? (Elija hasta tres)

  - Groundwater Dependent Ecosystems/Ecosistemas dependientes del agua subterránea
  - Industrial Water Supply/ Suministro de agua industrial
  - Municipal Water Supply/Suministro de agua municipal
  - Rural Residential Water Supply/ Suministro de agua residencial en áreas rurales
  - Small Commercial Water Supply/ Suministro de agua para negocios comerciales pequeños
  - Small Community Water Supply/Suministro de agua para comunidades pequeñas

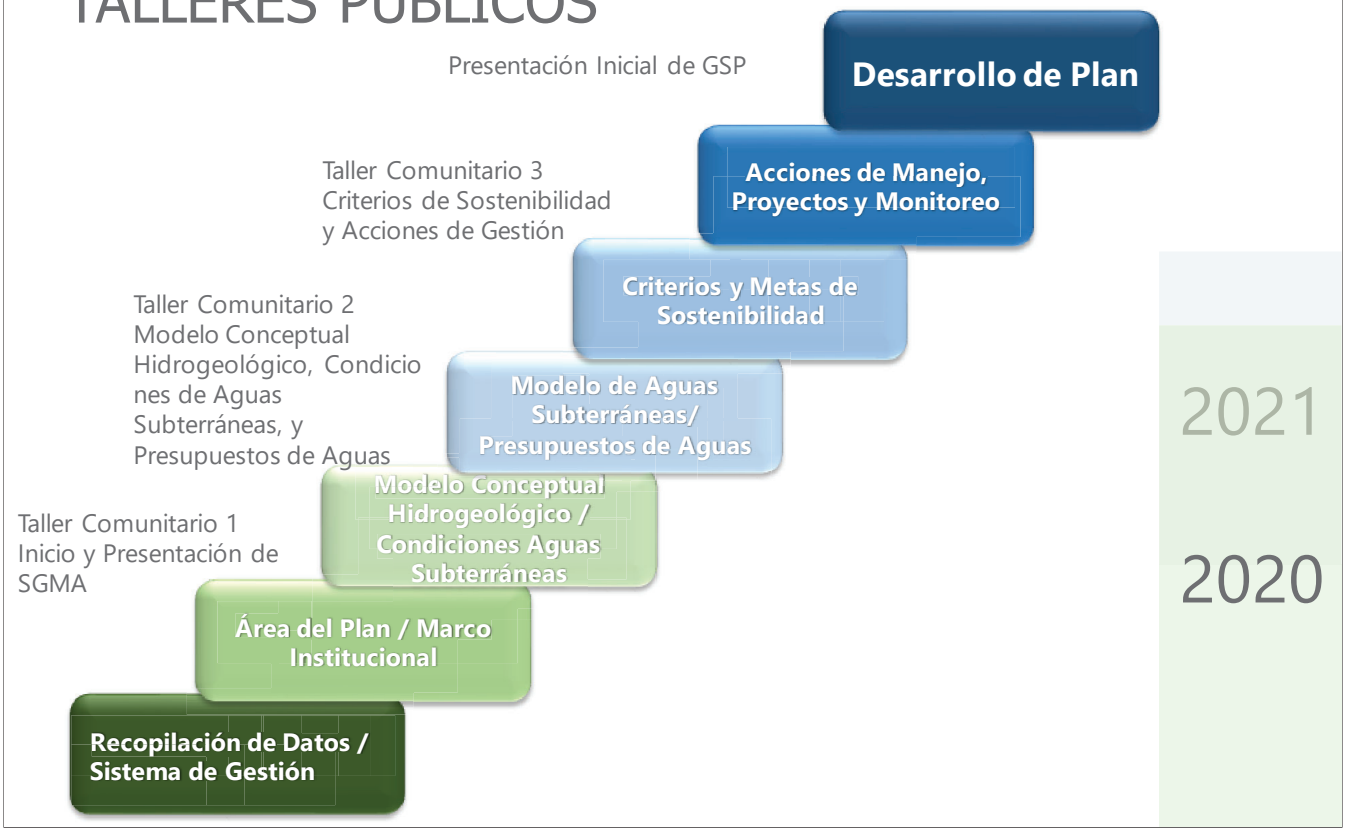
HOW TO STAY INVOLVED
CÓMO MANTENERSE INVOLUCRADO

TEMESCAL GSA

PUBLIC WORKSHOPS
TALLERES PÚBLICOS



PUBLIC WORKSHOPS
TALLERES PÚBLICOS

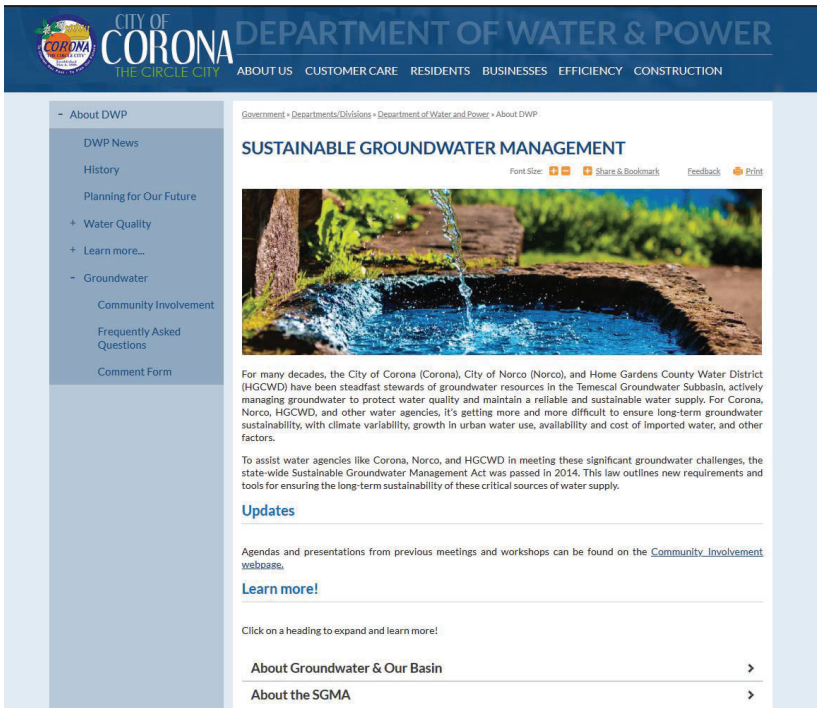


TEMESCAL GSA

OTHER MEETINGS
OTRAS REUNIONES

- Technical Advisory Committee Meetings
  Juntas del Comité Asesor Técnico
- Adoption Hearing for Final GSP
  Audiencia de adopción del GSP final

WEBSITE
SITIO WEB



TEMESCAL GSA

HOW TO KEEP IN TOUCH
CÓMO MANTENERSE EN CONTACTO

- Sign up for the mailing list by emailing groundwater@coronaca.gov
  Regístrese en la lista de correo enviando un correo electrónico a groundwater@coronaca.gov
- Visit the website to view information, review draft chapters and other materials, and to submit comments : www.CoronaCA.gov/Groundwater
  Visite el sitio web para ver información, revisar borradores de capítulos y otros materiales, y enviar comentarios: www.CoronaCA.gov/Groundwater

THANK YOU

GRACIAS

Temescal Basin Public Workshop 3

Workshop Summary

Contents

1. Background 1
2. Pre-Workshop Outreach 2
3. When and Where 2
4. Attendance and Social Media Views 2
5. Summary 2
    Welcome and Introductions 2
    Review of Groundwater Sustainability Plan Development 3
    Groundwater Sustainability Plan Development Update 3
    Sustainable Management Criteria 3
    Projects and Management Actions 6
    Groundwater Sustainability Plan Implementation 7
    How to Stay Involved 8
6. Wrap Up and Closing 8

Appendix

Presentation Slides

1. Background

On September 16, 2014, the Governor of California signed into law a legislative package comprised of three bills: Assembly Bill (AB) 1739, Senate Bill (SB) 1168, and SB 1319. These laws are collectively known as the Sustainable Groundwater Management Act (SGMA). SGMA (pronounced sigma) defines sustainable groundwater management as the "management and use of groundwater in a manner that can be maintained without causing undesirable results." This means keeping balanced levels of pumping and recharge of groundwater while assuring reliable water quality. SGMA provides a comprehensive framework for basin sustainability, additional technical analysis, and quantification of many aspects of basin sustainability and management. This includes extensive and detailed descriptions of the basin setting and conditions and more comprehensive monitoring of groundwater use, quality, and levels, including metering of groundwater usage.

SGMA requires the formation of a locally controlled Groundwater Sustainability Agency (GSA), which is responsible for developing and implementing a Groundwater Sustainability Plan (GSP). The GSP outlines how to achieve groundwater sustainability within 20 years of its adoption. The City of Corona, City of Norco, and Home Gardens County Water District have formed the Temescal Basin Groundwater Sustainability Agency (Temescal GSA) to create a GSP for the Temescal Basin.

GSAs must consider the interests of all beneficial uses and users of groundwater. The GSA must provide opportunities for public engagement and active involvement of diverse social, cultural, and economic elements of the population. The Temescal GSA recognizes that stakeholder and public engagement is critical to ensuring that the full range of interests of all beneficial uses and users of groundwater are represented during GSP development.

To share information and get input from stakeholders and the public, the Temescal GSA has been holding a series of public workshops, of which this is the third. Public Workshop 1, conducted on September 29, 2020, focused on communicating basic information about SGMA, the Temescal Basin, GSP development, and what sustainability means in a GSP. Participants were asked for input about their groundwater interests and what they thought was important for the future of groundwater in the Temescal Basin.

The second Public Workshop, conducted on March 2, 2021, focused on providing updates on the Temescal GSP development and introducing the hydrogeologic conceptual model, groundwater conditions, and water budget. Participants were asked for their input on what they thought the most important uses of groundwater were and if they knew of any current or historical problems regarding the use of groundwater in the Temescal Basin.

Public Workshop 3, conducted on July 8, 2021, focused on providing further updates on the Temescal GSP development and presenting the sustainability management criteria, projects and management actions, and implementation plan. Participants were asked to provide input on the sustainable management criteria, how the volume for groundwater in the Temescal Basin could be increased, and ideas for making groundwater more sustainable.

This summary documents the outreach methods, time and location, attendance, and major topics presented and discussed at this third public workshop.

2. Pre-Workshop Outreach

The Temescal GSA used a variety of methods to inform stakeholders and community members about the workshop and encourage participation, as shown in Table 1.

Table 1: Pre-Workshop Outreach Methods

Method	Description
Social Media Posts	The City of Corona and City of Norco posted information about the workshop on their Facebook pages.
Emails	Invitation emails were sent to those on the interested parties list.
Community Leader Meetings	Two meetings were held on June 29 and July 1. The purpose was to provide information on local water supply to community leaders, learn about needs and perspectives related to the Temescal GSP in vulnerable communities, and get input on what other stakeholders to invite.

3. When and Where

The workshop was held on July 8, 2021 from 4:00 to 6:00 p.m.

The workshop was held virtually on the Zoom platform. People also had the option to view and participate from the City of Corona Council Chambers. The workshop was streamed on the City of Corona's website, Facebook, and YouTube channels and on Corona TV, viewable on Channel 29 on Time Warner Spectrum and Channel 99 on AT&T.

4. Attendance and Social Media Views

Approximately 18 people attended the Zoom virtual meeting, including six stakeholder participants. Spanish interpretation was available for participants to access during the Zoom virtual meeting. Others viewed the workshop on Facebook Live, YouTube, and Corona TV. Post-workshop statistics indicated 18 views on YouTube.

5. Summary

Welcome and Introductions

Jack Hughes, facilitator from Kearns & West, welcomed everyone to the third public workshop for the Temescal GSP. Hughes reviewed the workshop purpose, which was to provide Temescal GSP development updates and present the sustainable management criteria, projects and management actions, and implementation plan. Additionally, the consultant team wanted to hear input from participants on the sustainable management criteria, how the volume for groundwater in the Temescal Basin could be increased, and ideas for making groundwater more sustainable.

Hughes invited the workshop attendees to introduce themselves using the Zoom chat and recognized the Temescal GSA representatives in attendance. Hughes then introduced the additional workshop presenters: Chad Taylor, Principal Hydrogeologist at Todd Groundwater, and Madison Rasmus, Environmental Engineer at Carollo.

Review of Groundwater Sustainability Plan Development

Taylor first reviewed background information on GSP development (see the Appendix for presentation slides for this and the following sections). SGMA is landmark legislation established in 2014 following a long period of statewide drought. SGMA has altered how water is managed in California by providing local agencies with authority and guidance for how to assess sustainability and critical tools to help achieve or maintain sustainability in areas where groundwater is an important water source. Taylor explained that GSPs are detailed road maps for how groundwater basins will achieve or maintain long-term sustainability.

Taylor described the Temescal Basin area, which covers most of the City of Corona, about half of the City of Norco, and the western part of the Home Gardens County Water District. One GSA, the Temescal GSA, was formed for the Temescal Basin because the area is hydrologically connected and has historically been managed as one unit. The California Department of Water Resources has designated the Temescal Basin as a medium priority basin, which required the Temescal GSA to prepare the Temescal GSP.

Taylor next described the organization of the Temescal GSA. The City of Corona, the City of Norco, and Home Gardens County Water District formed the Temescal GSA in 2017 through a memorandum of understanding. The City of Corona is leading the GSP effort with support from Corona Department of Water and Power staff and additional consultants. The Technical Advisory Committee (TAC) has provided input during GSP preparation and includes members that represent public agencies, local businesses, well owners, and community interests. The GSP process is founded on public engagement and stakeholder outreach, which is the purpose of the public workshops.

Groundwater Sustainability Plan Development Update

Taylor provided a status update on the Temescal GSP. The individual chapters that have been prepared are the Introduction, Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, Monitoring Network, Projects and Management Actions, and Implementation Plan chapters. Most of these chapters are available online for public review; some chapters are currently being reviewed by the TAC and will be uploaded to the GSA website shortly for public review. The consultant team is finalizing the Water Budget and Sustainability Management Criteria chapters. A draft of the Temescal GSP will be compiled and prepared for public release later in summer 2021.

Discussion/Q&A

Hughes opened the floor for questions and comments. There were no questions or comments from participants after this presentation.

Sustainable Management Criteria

Taylor presented the draft sustainable management criteria for the Temescal Basin. He first defined sustainable management as the management and use of groundwater without causing undesirable results. Taylor explained that the first part of defining sustainability locally is to establish a sustainability goal. The sustainability goal helps to provide a framework for how the sustainability indicators are assessed. The Temescal GSA and TAC worked together to develop the following goal:

To sustain groundwater resources for the current and future beneficial uses of the Temescal Basin in a manner that is adaptive and responsive to the following objectives:

- Provide a long-term, reliable, and efficient groundwater supply for municipal, industrial, and other uses;
- Provide reliable storage for water supply resilience during droughts and shortages;
- Protect groundwater quality;
- Support beneficial uses of interconnected surface waters; and
- Support integrated and cooperative water resource management.

Taylor provided an overview of the six indicators for evaluating groundwater sustainability in a basin: chronic lowering of groundwater levels, reduction of groundwater storage, degradation of water quality, depletion of interconnected surface water affecting beneficial uses, land subsidence affecting land uses, and seawater intrusion, which is not applicable in the Temescal Basin.

Thresholds need to be developed for the five applicable sustainable management criteria for the Temescal Basin. First, undesirable results, or conditions that should be avoided, are defined for each indicator. Once undesirable results are defined, they are used to develop minimum thresholds for assessing each of the sustainability indicators. Next, measurable objectives are set. Beneficial uses in the Temescal Basin also need to be evaluated and considered for each of the sustainability indicators. These include the following:

- Municipal Water Supply
- Industrial Water Supply
- Small Community Water Supply
- Small Commercial Water Supply
- Groundwater Dependent Ecosystems
- Recreational Surface Water Supply

Taylor next explained how the sustainable management criteria were established for each indicator, starting with chronic lowering of groundwater levels. Since there is no record of wells being dry in the Temescal Basin during the range of historic groundwater levels, the assumption was made that historic low groundwater levels could be repeated in the future. The consultant team established a set of representative key wells in the Temescal Basin. These key wells have a long history for monitoring groundwater levels and will continue to be used for monitoring in the future. Taylor explained that the minimum threshold for defining undesirable results relative to chronic lowering of groundwater levels is defined at each key well by the historic minimum static groundwater elevation (or maximum historical depth to groundwater).

Taylor then presented the sustainable management criteria for reduction of groundwater storage, noting that storage is related to groundwater levels. He explained that GSP regulations allow the use of groundwater level minimum thresholds and measurable objectives as a proxy, and that the historic minimum-based groundwater level threshold is well-suited for use as a proxy for groundwater storage. The minimum threshold for groundwater storage is fulfilled by the minimum threshold for groundwater levels (using the historical minimum).

Taylor presented the sustainable management criteria for degradation of water quality. He explained that the Temescal GSA is not responsible for local groundwater quality problems or degradation caused by others. Groundwater quality is under regulatory oversight by state agencies. However, the Temescal GSA is responsible for undesirable results associated with increased concentrations of water quality

contaminants of concern due to groundwater management, such as through recharge and changes in pumping patterns related to groundwater management. The primary contaminants of concern in the Temescal Basin (historically and currently) are total dissolved solids (TDS) and nitrate. The minimum threshold is defined as a statistically significant increase in the percentage of wells with averages exceeding the maximum contaminant level for TDS and/or nitrate, relative to current conditions. Statistically significant is defined as more than a 10 percent increase in the number of wells in a 5-year period.

Taylor next presented the sustainable management criteria for depletions of interconnected surface water affecting beneficial uses. He explained that groundwater close to the ground surface can interact with vegetation or stream flows. Vegetation that relies on groundwater as its primary source of water is called riparian vegetation. Ecosystems that rely on groundwater are referred to as groundwater dependent. Impacts associated with reductions of stream flow, which affect groundwater dependent ecosystems, and potential impacts to riparian vegetation are assessed. Taylor displayed a map showing the maximum depth to water of wells in the Temescal Basin. Groundwater levels in all the wells in the main portion of the Temescal Basin have never been less than 40 feet deep. Water levels in wells in and near the Prado Basin area have never been deeper than 15 feet. Because riparian vegetation roots typically reach 20 to 30 feet at most, it is unlikely that the main part of the basin supports any riparian vegetation; however, the Prado Basin area likely supports riparian vegetation with its shallow groundwater levels. Depths in all wells around the Prado Basin and trends for groundwater levels, groundwater pumping, river flow, and rainfall were analyzed to determine if the Prado wetlands were supported by groundwater. The conclusion is that the Prado wetlands are more dependent on surface inflows than groundwater inflow. Changes in surface inflows have much more influence than changes in groundwater pumping or levels to the north or south. More monitoring is needed in the southern Prado Basin between the Prado wetlands and pumping centers in the Temescal Basin. Taylor explained that the minimum threshold for depletion of interconnected surface water is the historical maximum depth to water in shallow monitoring wells in the southern Prado area, correlated with Temescal Basin pumping or groundwater levels.

Finally, Taylor presented the sustainable management criteria for land subsidence affecting land uses, explaining that when water is removed from an aquifer, fine-grain materials can compact and the ground surface can decline. Ground surface elevation changes that may be related to subsidence statewide has been estimated by satellite measurements in data provided by the California Department of Water Resources dating from 2015 to 2019. This includes ground surface elevation changes in the Temescal Basin. This method has a margin of error of approximately 0.1 feet. The satellite data estimates show ground surface change in the Temescal Basin ranging between a rise of 0.08 feet to a fall of 0.08 feet. This is very small and within the margin of error. Taylor presented the minimum threshold for subsidence, defined as a rate of decline equal to or greater than 0.2 feet in any 5-year period. This has been considered in terms of a cumulative decline equal to or greater than 1.0 foot of decline since 2015, which represents current conditions and aligns with the SGMA start date.

Discussion/Q&A

Hughes opened the floor for questions and comments. There were no questions or comments from participants after this presentation.

Projects and Management Actions

Rasmus presented the draft projects and management actions for the Temescal GSP. She explained the three groupings of actions: baseline, planned, and potential future. Baseline refers to existing or established commitments to projects or actions. Planned actions are developed and evaluated projects or actions. Potential future actions describe projects or actions to be implemented later to achieve sustainability goals.

Rasmus began by describing the baseline projects. The first is groundwater treatment at the Temescal Desalter to reduce nitrates, total suspended solids (TSS), TDS, and other contaminants of concern for the drinking water supply. The second project is water reclamation facility (WRF) percolation ponds that discharge from City of Corona-owned WRFs to percolation ponds that recharge the Temescal Basin. The third project includes water-level quality assurance and quality control activities that maintain the reliability of ongoing groundwater elevation data. The final project Rasmus presented was the Western Riverside County Regional Authority (WRCRWA) plant that will soon supply recycled water for local irrigation use.

Rasmus next reviewed the baseline management actions. These include Water Shortage Contingency Plans, which are plans that detail the stages of water shortage and conservation response based on an agency's available supply and deficit, and Water Conservation Programs, which include response actions to reduce water use in the stages of a water shortage. Additional management actions include the Western Municipal Water District Integrated Regional Water Management Plan, which is a coordinated, long-range regional water quantity and quality management strategy, and the Temescal GSA's involvement in the Santa Ana Watershed Project, which is a coordinated management group formed to protect the Santa Ana River Basin and associated water resources.

Rasmus then reviewed the three projects included in planned actions. First, the Potable Reuse Feasibility Study will look at the possible use of future reclaimed water supply. Second, the mountain runoff capture investigation would explore options for operational changes allowing for additional benefit of groundwater recharge by using storm event runoff that is collected in Riverside County Flood Control and Water Conservation District basins. This would be at the edges of the basin adjacent to the Santa Ana mountains. Lastly, the interconnected surface water monitoring wells project would include three shallow monitoring wells drilled into the Prado Management Area to allow for groundwater elevation monitoring.

Rasmus provided more information on the interconnected surface water monitoring wells project since its implementation date is within the first year of Temescal GSP adoption. Wells will be sited in the southern area of the Prado Management Area. There is no active groundwater monitoring in this location so drilling wells will allow the Temescal GSA to better understand the relationship between the basin and interconnected water in the Prado Wetlands. The project will consist of three groundwater wells about 40-60 feet deep that will allow for continuous groundwater elevation data collection in the area. The data will be incorporated in the 5-year GSP update and these monitoring wells will inform future management actions in the Santa Ana River Watershed.

Lastly, Rasmus presented potential future actions. Data collected from the Prado Management Area monitoring wells will be used as part of monitoring for undesirable results to interconnected surface water in Prado. If this monitoring identifies potential undesirable results to interconnected surface water

in the Prado Management Area, then coordination will be needed with upstream Santa Ana River partners as a management action. If groundwater levels in the Prado Management Area are falling, this approach will allow for coordinated solutions.

There are two additional future management actions. One is for future groundwater treatment, which would entail implementing advanced treatment for previously detected per- and polyfluoroalkyl substances (PFAS), TDS, nitrate, and trichloropropane (TCP). Other future management actions are for urban stormwater treatment, capture, and recharge, which is an exploration of urban stormwater harvesting to offset water supply and/or provide for groundwater recharge.

Discussion/Q&A

Hughes opened the floor for questions and comments. Participants were encouraged to answer the following question verbally or using the chat:

- Are there other potential groundwater related projects we should consider?
- Do you have ideas for how the volume of groundwater in the Temescal Basin could be increased?
- Do you have ideas for making groundwater more sustainable in the Temescal Basin?

The following are the questions and comments received in the chat box from participants:

- Could you confirm that Western Municipal Water District (WMWD) has an Integrated Regional Water Management Plan (IRWMP)?
- Since the 2008 WMWD IRWMP is a bit dated, I would recommend also citing the 2018 Santa Ana Watershed Project Authority (SAWPA) One Water One Watershed (OWOW) Plan.
- If the GSA is not responsible for impacts to groundwater dependent ecosystems resulting from reductions in surface water flow beyond its control, how does the Temescal GSA intend to determine if reductions in Western Riverside County Regional Wastewater Authority (WRCWRA) flows are impacting groundwater dependent ecosystems in the Prado Basin?
- I would recommend that the groundwater basin planning reflect the storage project called Santa Ana River Conservation and Conjunctive Use Program (SARCCUP) of which WMWD is a member.

Groundwater Sustainability Plan Implementation

Taylor presented for discussion four categories of GSP implementation: monitoring of groundwater conditions and use, annual reports, carrying out of projects and management actions, and periodic evaluations/GSP updates. First, monitoring of groundwater conditions and use will occur often throughout the basin. This includes groundwater levels, water quality, stream flow, subsidence, and water use. Second, the data collected through this monitoring will be compiled into annual reports. Annual reports include groundwater level data, storage change, water use, and sustainability progress. Third, carrying out projects and management actions will be an important part of GSP implementation and will be updated and modified over time. Last, periodic evaluations will occur at least every 5 years and GSP updates can occur based on new information becoming available, new projects being added, or the need to modify sustainable management criteria. All modifications should be made to ensure that the GSP continues to provide a reliable roadmap for sustainability for the groundwater basin.

Discussion/Q&A

Hughes opened the floor for questions and comments. There were no questions or comments from participants after this presentation.

How to Stay Involved

Hughes explained how members of the public could be involved throughout the remainder of the Temescal GSP preparation. Once all chapters are completed later in summer 2021, the draft Temescal GSP will be released for a 90-day period where the public can review and comment on the draft plan. The public will also have the opportunity to attend and make comments at the Adoption Hearing for the final GSP in winter 2021 before the final GSP is sent to the California Department of Water Resources by January 2022.

Draft chapters and other materials such as fact sheets can be found on the project website hosted by the City of Corona Department of Water and Power: CoronaCA.gov/Groundwater. Members of the public can use the form on the website to provide comments. Information on attending the Temescal GSP Adoption Hearing will also be posted on the website. Anyone who wants to be included on the mailing list to receive communication about the Temescal GSP should email Groundwater@CoronaCA.gov.

6. Wrap Up and Closing

Hughes thanked everyone for participating.

Appendix

Presentation Slides

TEMESCAL GSP PUBLIC WORKSHOP 3
TEMESCAL GSP TALLER COMUNITARIO 3

About the Groundwater Sustainability Plan (GSP)

The Sustainable Groundwater Management Act or "SGMA" is a California law that gives local agencies new tools for managing groundwater and planning for the future. The City of Corona, City of Norco, and Home Gardens County Water District have formed the Temescal Groundwater Sustainability Agency (Temescal GSA) in order to make a **Groundwater Sustainability Plan** for the Temescal Basin. Since groundwater is such an important resource for everyone, we need your help!



Un poco sobre el plan de sostenibilidad de las aguas subterráneas (GSP)

La Ley de Gestión Sostenible de Aguas Subterráneas o "SGMA", por sus siglas en inglés, es una ley de California que otorga a las agencias locales nuevas herramientas para gestionar las aguas subterráneas y planificar para el futuro. La Ciudad de Corona, la Ciudad de Norco y el Distrito Hídrico del Condado de Home Gardens han formado la Agencia de Sostenibilidad de Aguas Subterráneas de la Cuenca de Temescal (Temescal Groundwater Sustainability Agency) o Temescal GSA a fin de crear un **Plan de Sostenibilidad de Aguas Subterráneas** para la Cuenca de Temescal. Dado que las aguas subterráneas son un recurso muy importante para todos, ¡necesitamos su ayuda!

TEMESCAL GSA

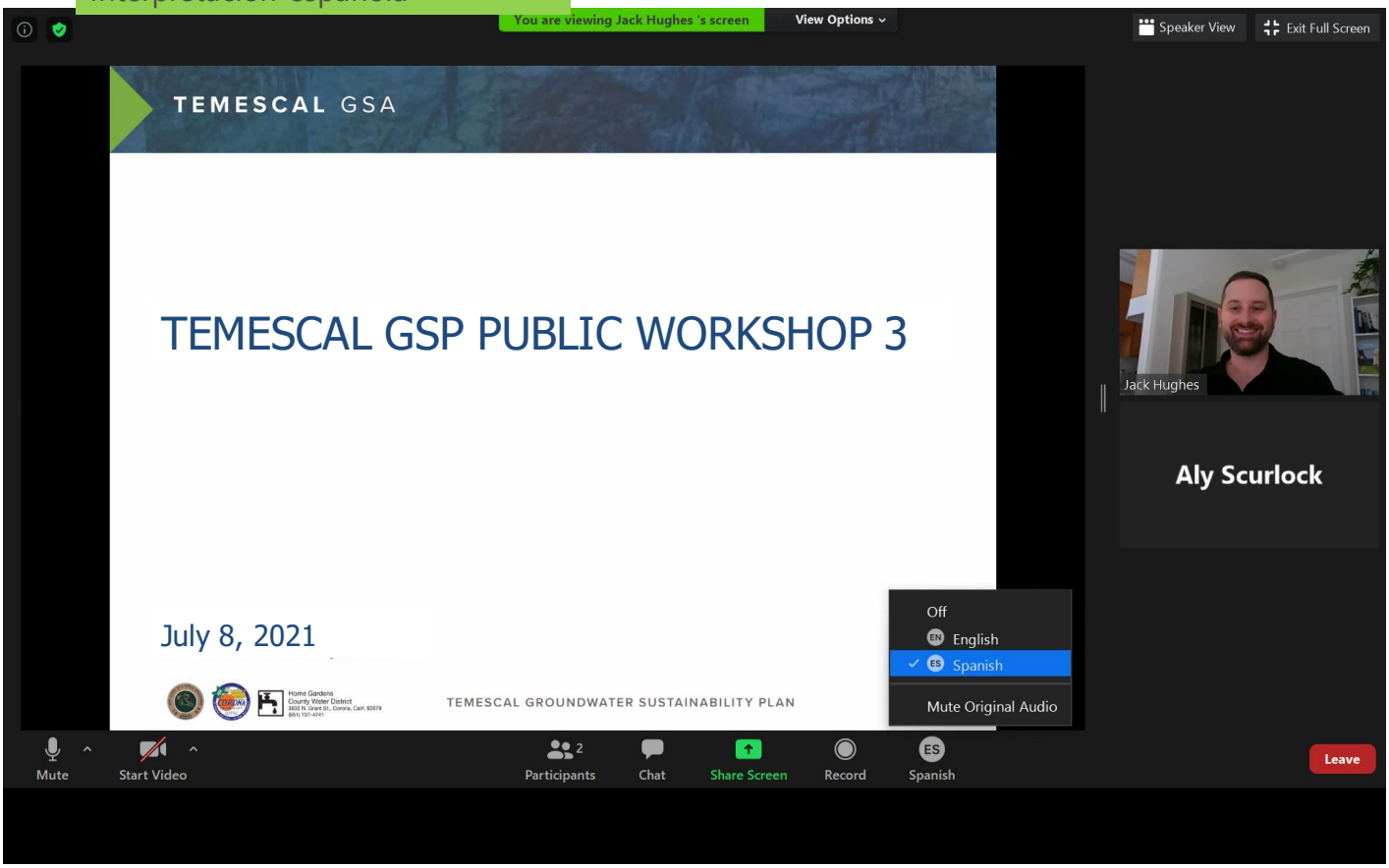
TEMESCAL GROUNDWATER SUSTAINABLY PLAN (GSP) PUBLIC WORKSHOP 3

PLAN DE SOSTENIBILIDAD DE LAS AGUAS SUBTERRÁNEAS (GSP) DE TEMESCAL TALLER COMUNITARIO 3 DE TEMESCAL

JULY 8, 2021 / 8 DE JULIO DE 2021

WELCOME
BIENVENIDOS

Interpretación española



This public workshop is being recorded and will be posted on the website:
www.CoronaCA.gov/Groundwater

Este taller público sera grabado y sera publicado en el sitio web:
www.CoronaCA.gov/Groundwater

TEMESCAL GSA

WORKSHOP PURPOSE
PROPÓSITO DE TALLER COMUNITARIO

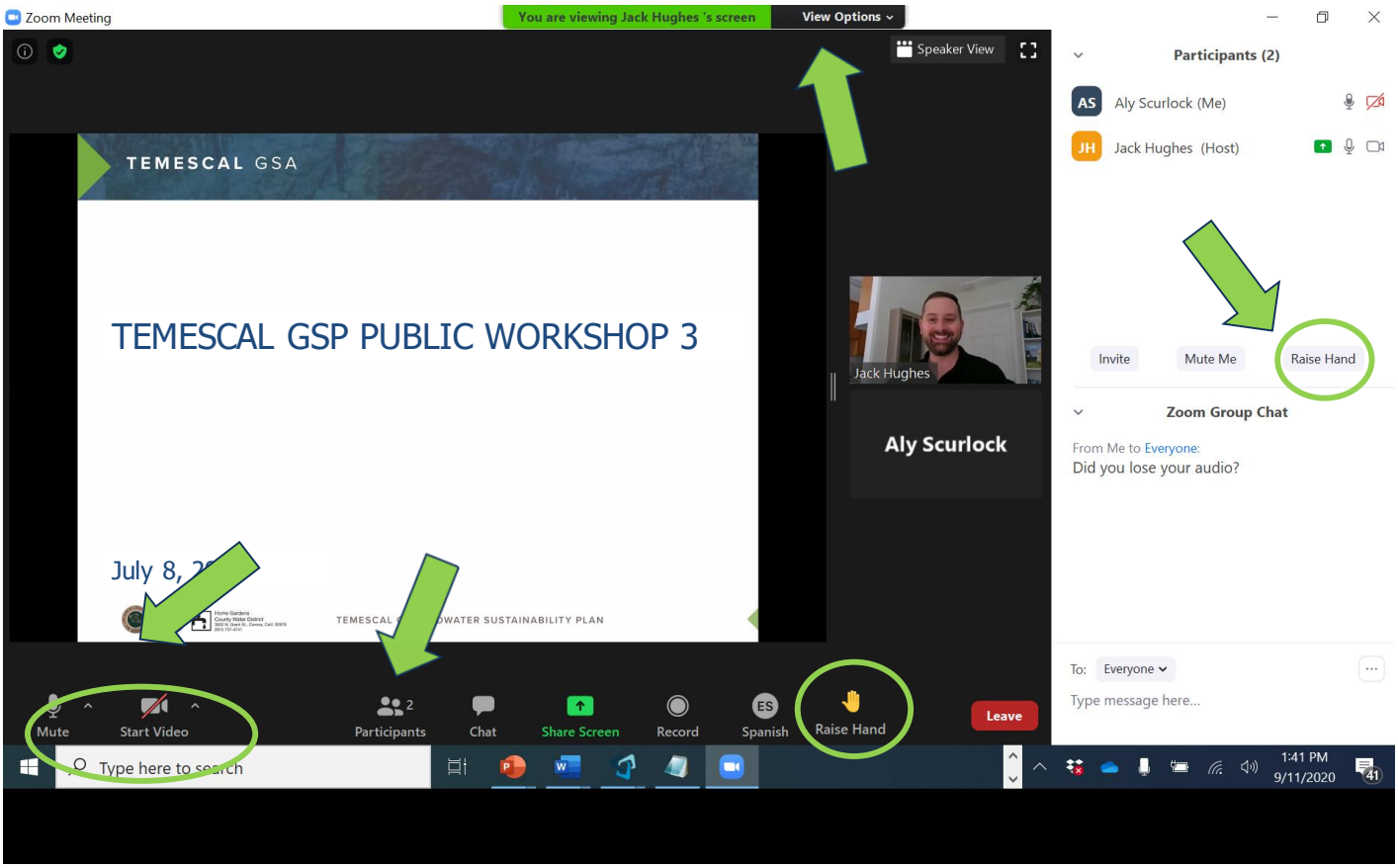
- Give Temescal Groundwater Sustainability Plan development updates.
  Proporcionar actualizaciones del desarrollo del Plan de Sostenibilidad de Aguas Subterráneas de Temescal.
- Present the sustainability criteria, projects and management actions, and implementation plan.
  Presentar los criterios de sostenibilidad, proyectos y acciones de gestión, y plan de implementación.

WORKSHOP PURPOSE
PROPÓSITO DE TALLER COMUNITARIO

» Hear input on sustainability criteria, and how the volume for groundwater in the basin could be increased and ideas for making groundwater more sustainable.
Escuche comentarios sobre criterios de sostenibilidad y cómo se podría aumentar el volumen de agua subterránea en la cuenca e ideas para hacer que el agua subterránea sea más sostenible

TEMESCAL GSA

HOW TO USE ZOOM
CÓMO UTILIZAR ZOOM



TEMESCAL GSA

INTRODUCTIONS
INTRODUCCIONES

TEMESCAL GSA

Home Gardens
County Water District
3832 N. Grant St., Corona, Calif. 92879
(951) 737-4741

TEMESCAL GSA

CONSULTANT TEAM
EQUIPO DE CONSULTORES



Chad Taylor
Todd Groundwater



Madison Rasmus
Carollo Engineers



Jack Hughes
Kearns & West

TIPS FOR A PRODUCTIVE DISCUSSION
CONSEJOS PARA UNA DISCUSIÓN PRODUCTIVA

» One speaker at a time
Solo una persona habla a la vez

» Keep input concise
Sea conciso al hablar

» Actively listen
Escuche activamente

» Offer solutions
Ofrezca soluciones

TEMESCAL GSA

YOUR INPUT MATTERS
SU OPINIÓN ES IMPORTANTE

» The planning team will consider your comments as they prepare the Groundwater Sustainability Plan.
El equipo de planificación considerará sus comentarios mientras preparan el Plan de Sostenibilidad de aguas subterráneas.

» Your input will be recorded, organized thematically, and presented in a workshop summary on the project website.
Sus comentarios serán registrados, organizados temáticamente y presentados en el resumen del taller en el sitio web del proyecto.

REVIEW OF GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT

REPASO DEL PLAN DE SOSTENIBILIDAD DE LAS AGUAS SUBTERRÁNEAS

TEMESCAL GSA

SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)

GESTIÓN SOSTENIBLE DE AGUAS SUBTERRÁNEAS (SGMA)

Landmark legislation in 2014

- » Recognizes that groundwater management in California is best accomplished locally

Legislación histórica en 2014

- » Reconoce que la gestión de las aguas subterráneas en California se logra mejor a nivel local

GROUNDWATER SUSTAINABILITY PLANS
PLANES DE SOSTENIBILIDAD DE LAS AGUAS SUBTERRÁNEAS

» Groundwater sustainability plans are detailed road maps for how groundwater basins will achieve long term sustainability.

» Los planes de sostenibilidad de las aguas subterráneas actuan como mapas que detallan la ruta que hay que seguir para que cuencas de aguas subterráneas logren la sostenibilidad a largo plazo.

TEMESCAL GSA

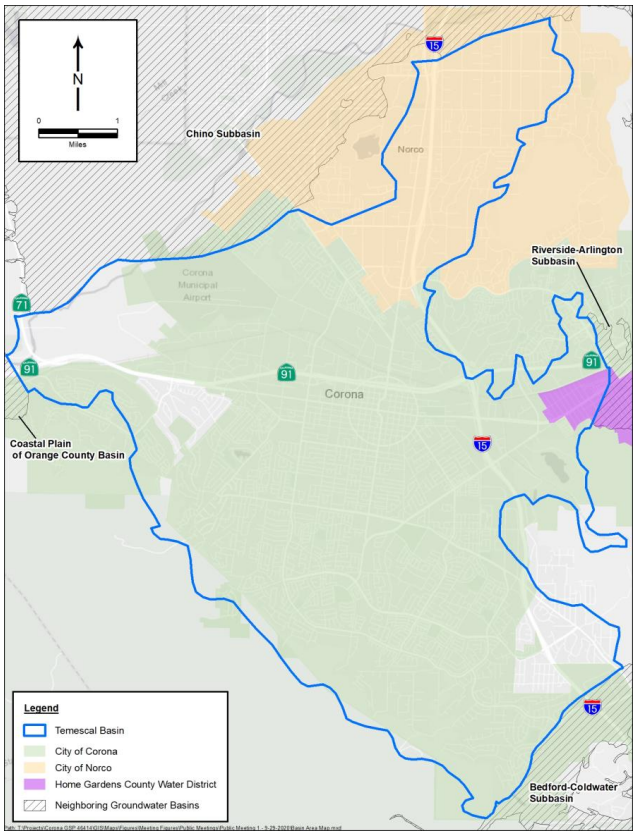
THE TEMESCAL BASIN
LA CUENCA DEL TEMESCAL

» DWR categorized Temescal Basin as a Medium Priority Basin

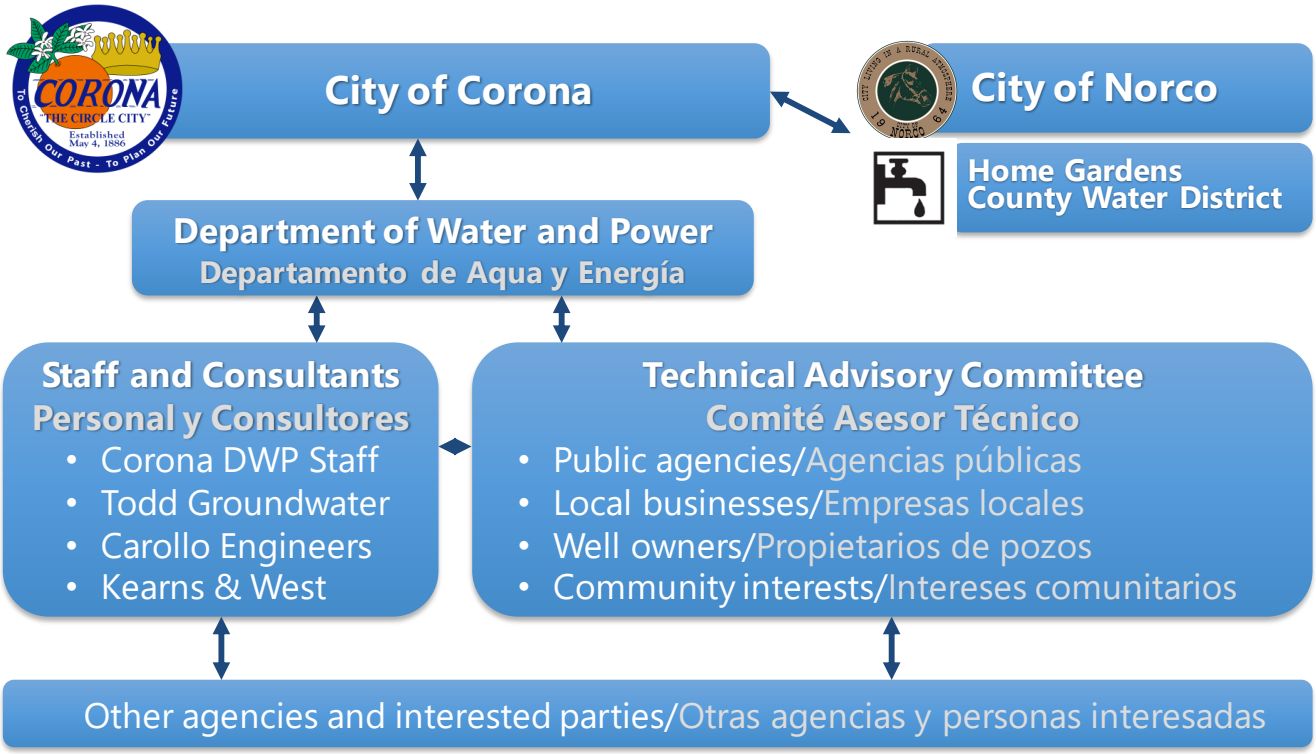
La Cuenca del Temescal fue desginada por DWR como Cuenca de Prioridad Media

» Contiguous and connected

Contigua y conectada



GSA ORGANIZATION / ORGANIZACÍON



TEMESCAL GSA

GSP DEVELOPMENT UPDATE
ACTUALIZACIÓN DE DESARROLLO DEL SGP

GSP STATUS
ESTADO DEL GSP

Individual chapters have been completed:

- Introduction
- Plan Area
- Hydrogeologic Conceptual Model
- Groundwater Conditions
- Monitoring Network
- Projects and Management Actions
- Implementation Plan

Working on finishing drafts of:

- Water Budget
- Sustainability Criteria

Then will be compiling complete GSP for distribution

Se han completado capítulos individuales:

- Introducción
- Área del plan
- Modelo conceptual hidrogeológico
- Condiciones de las aguas subterráneas
- Red de supervisión
- Proyectos y acciones de gestión
- Plan de ejecución

Estamos trabajando en la finalización de borradores de:

- Presupuesto del agua
- Criterios de sostenibilidad

A continuación, se compilará el GSP completo para su distribución

TEMESCAL GSA

DISCUSSION AND Q&A
DISCUSIÓN / PREGUNTAS Y RESPUESTAS

SUSTAINABLE MANAGEMENT CRITERIA

CRITERIOS DE GESTIÓN SOSTENIBLE

TEMESCAL GSA

WHAT IS SUSTAINABLE MANAGEMENT?
¿QUÉ ES LA GESTIÓN SOSTENIBLE?

The management and use of groundwater without causing undesirable results
El gestión y utilización de las aguas subterráneas sin causar resultados indeseables



Chronic lowering of groundwater levels
Reducción crónica de los niveles de aguas subterráneas



Reduction of groundwater storage
Reducción del almacenamiento de aguas subterráneas



Degradation of water quality
Degradación de la calidad del agua



Depletions of interconnected surface water
Agotamiento de aguas superficiales interconectadas



Land subsidence affecting land uses
Hundimiento de tierras que afectan los usos de las tierras



Seawater intrusion (not applicable here)
Inactividad de aguas marinas (no aplicable aquí)

SUSTAINABILITY GOAL
OBJETIVO DE SOSTENIBILIDAD

To sustain groundwater resources for the current and future beneficial uses of the Temescal Basin in a manner that is adaptive and responsive to the following objectives:

- Provide a long-term, reliable and efficient groundwater supply for municipal, industrial, and other uses
- Provide reliable storage for water supply resilience during droughts and shortages
- Protect groundwater quality
- Support beneficial uses of interconnected surface waters, and
- Support integrated and cooperative water resource management.

Sostener los recursos de aguas subterráneas para los usos beneficiosos actuales y futuros de la Cuenca Temescal de manera que sean adaptables y respondan a los siguientes objetivos:

- Proporcionar un suministro de agua subterránea fiable y eficiente a largo plazo para usos municipales, industriales y de otro tipo
- Proporcionar almacenamiento fiable para la resistencia del suministro de agua durante sequías y escaseces
- Proteger la calidad del agua subterránea
- Apoyar los usos beneficiosos de las aguas superficiales interconectadas y
- Apoyar los recursos hídricos integrados y cooperativos

TEMESCAL GSA

HOW DO WE MEASURE SUSTAINABILITY?
¿CÓMO MEDIMOS LA SOSTENIBILIDAD?

Sustainability Criteria
Criterios de sostenibilidad:

- Undesirable results / Resultados no deseados
  - What are undesirable results that we want to avoid?
  - ¿Cuáles son los resultados no deseados que queremos evitar?
- Minimum thresholds (MT) / Umbrales mínimos (MT)
  - How low is too low for water levels?
  - ¿Qué tan bajo es demasiado bajo para los niveles de agua?
- Measurable objectives (MO) / Objetivos mensurables (MO)
  - What is the desired range of water levels?
  - ¿Cuál es el rango deseado de niveles de agua?

BENEFICIAL USES
USOS BENEFICIOSOS

- » Municipal water supply
- » Industrial water supply
- » Small community water systems
- » Small commercial water supply
- » Groundwater dependent ecosystems
- » Recreational surface water use

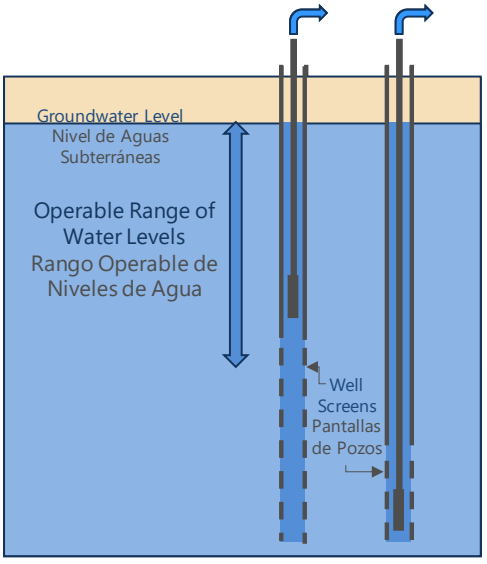
- » Suministro de agua municipal
- » Agua para procesos industriales
- » Sistemas de agua comunitarios pequeños
- » Agua para uso comercial pequeños
- » Ecosistemas dependientes del agua subterránea
- » Uso de aguas superficiales para fines recreativos

TEMESCAL GSA

GROUNDWATER LEVELS
NIVELES DE AGUA SUBTERRÁNEA

- » Define MT as historical low level in Key Wells
  Definir MT como nivel bajo histórico en Key Wells

- » Key Wells are a set of representative monitoring wells that will continue to be monitored
  Los pozos clave son un conjunto representativo de pozos de monitoreo que continuarán siendo monitoreados



REDUCTION OF GROUNDWATER STORAGE
REDUCCIÓN DEL ALMACENAMIENTO DE AGUAS SUBTERRÁNEAS

» Groundwater storage is connected to water levels
El almacenamiento de aguas subterráneas está conectado a los niveles de agua

» GSP regulations allow use of groundwater level Minimum Thresholds and Measurable Objectives as a proxy
Las regulaciones del GSP permiten el uso de umbrales mínimos de nivel de aguas subterráneas y objetivos mensurables como proxy

» Historical minimum-based water level threshold is well suited to use as a proxy
El umbral histórico de nivel de agua basado en el mínimo es adecuado para su uso como proxy

» Minimum Threshold for storage is fulfilled by the minimum threshold for groundwater levels
El umbral mínimo para el almacenamiento se cumple con el umbral mínimo para los niveles de aguas subterráneas

TEMESCAL GSA

WATER QUALITY / CALIDAD DEL AGUA

» GSA is not responsible for local problems or degradation caused by others.
GSA no es responsable por los problemas locales o la degradación causada por otros.

» Groundwater quality is under regulatory oversight by State Agencies.
La calidad de las aguas subterráneas está bajo la supervisión reglamentaria de las agencias estatales.

» The GSA is responsible for increased concentrations in water quality due to management (recharge, pumping, etc.).
La GSA es responsable por el aumento de las concentraciones en la calidad del agua debido a la gestión (recarga, bombeo, etc.).

WATER QUALITY THRESHOLD
UMBRAL DE CALIDAD DEL AGUA

» Minimum Threshold defined as a statistically significant increase in the percentage of wells with averages exceeding the maximum contaminant level (MCL) for total dissolved solids (TDS) and nitrate, relative to current conditions.

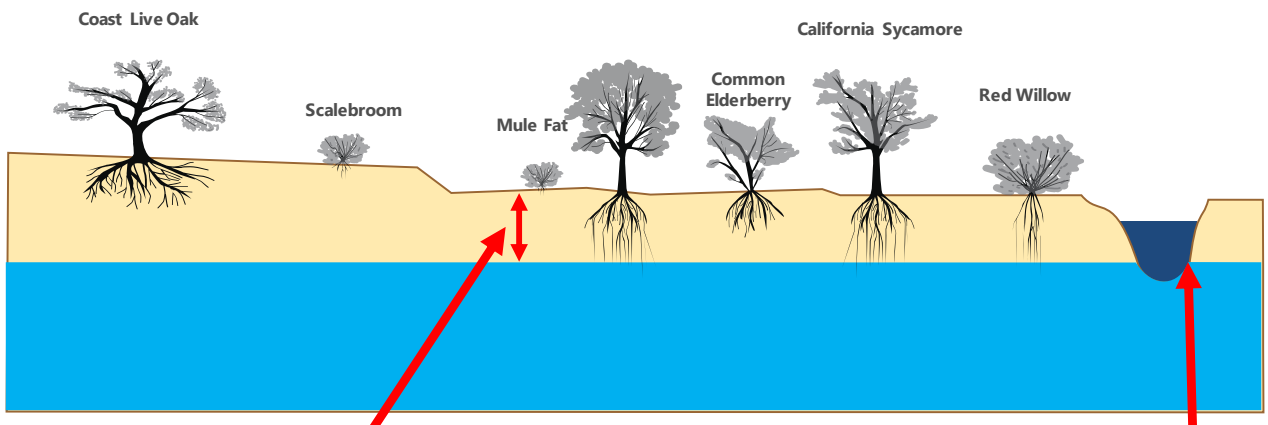
Umbral mínimo definido c omo un aumento estadísticamente significativo en el porcentaje de pocillos con promedios que exceden el nivel máximo de contaminante (MCL) para sólidos disueltos totales (TDS) y nitrato, en relación con las condiciones actuales.

» Statistically significant is defined as more than 10 percent increase in number of wells in 5-year period.

Estadísticamente significativo se define como un aumento de más del 10 por ciento en el número de pozos en un período de 5 años.

TEMESCAL GSA

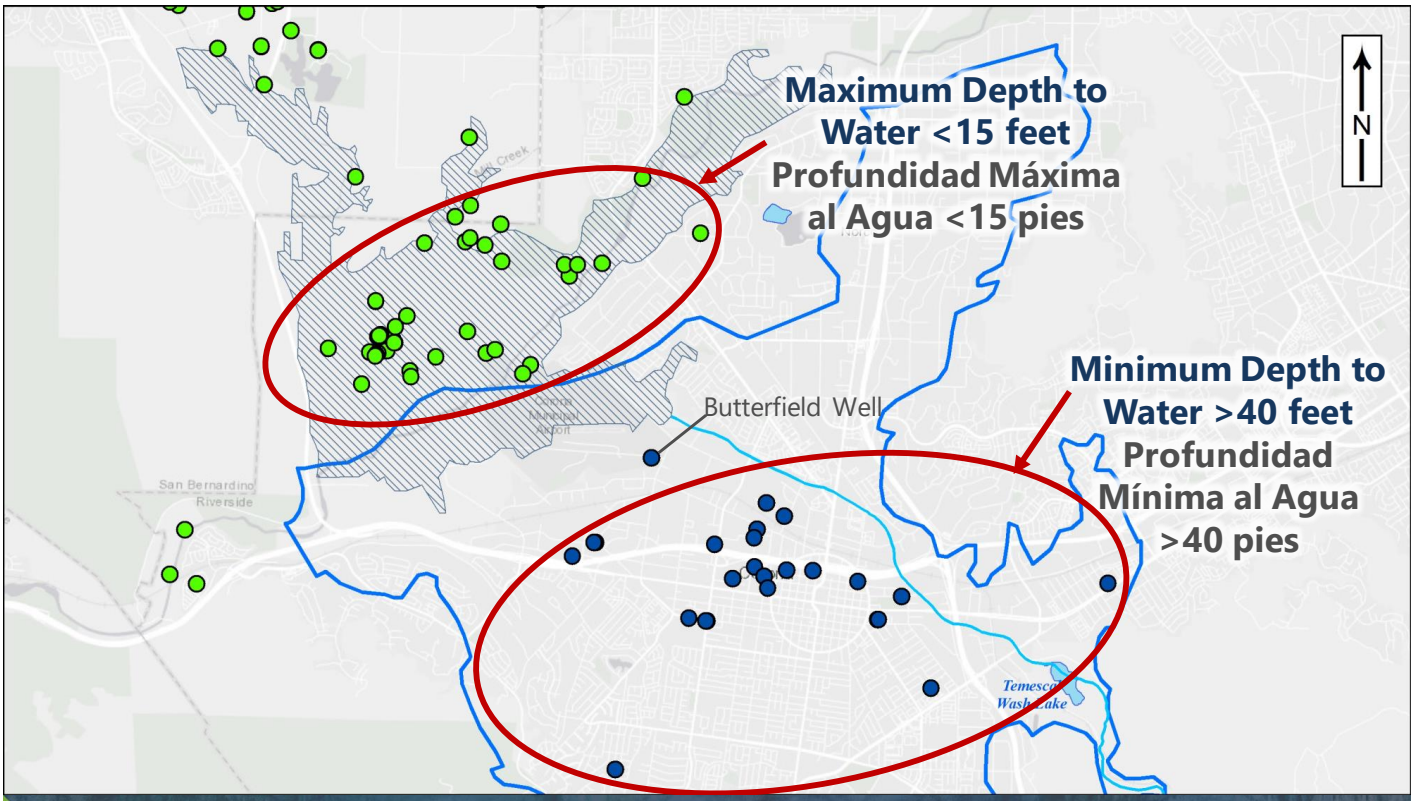
INTERCONNECTED SURFACE WATER
AGUAS SUPERFICIALES INTERCONECTADAS



Riparian Vegetation:
About 20 to 30 feet
Riparian Vegetation:
Cerca de 20 a 30 pies

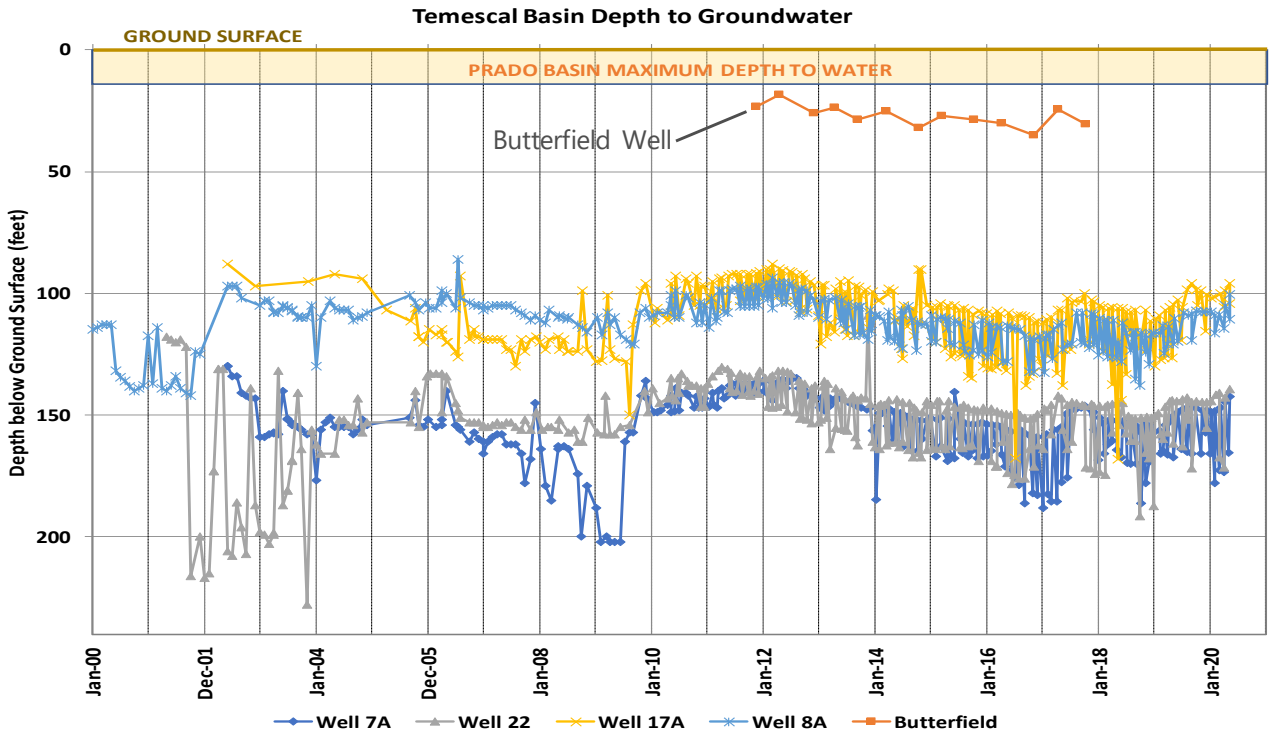
Stream Flow Depletion:
Stream Bed Elevation
Agotamiento del Flujo de la Corriente:
Elevación del Lecho del Arroyo

DEPTH TO GROUNDWATER
PROFUNDIDAD A LAS AGUAS SUBTERRÁNEAS



TEMESCAL GSA

DEPTH TO GROUNDWATER
PROFUNDIDAD A LAS AGUAS SUBTERRÁNEAS



INTERCONNECTED SURFACE WATER CONCLUSIONS
CONCLUSIONES SOBRE LAS AGUAS SUPERFICIALES INTERCONECTADAS

» Prado wetlands are more dependent on surface inflows than groundwater inflow

Los humedales del Prado dependen más de los flujos de entrada superficiales que los flujos de entrada de aguas subterráneas

» Changes in surface inflows have much more influence than changes in groundwater pumping or levels to the north or south

Los cambios en los flujos de entrada superficiales tienen mucha más influencia que los cambios en el bombeo de aguas subterráneas o los niveles hacia el norte o el sur

» More monitoring is needed in the southern Prado between the wetlands and pumping centers in Temescal Basin

Se necesita más vigilancia en el sur del Prado entre los humedales y los centros de bombeo en la cuenca Temescal

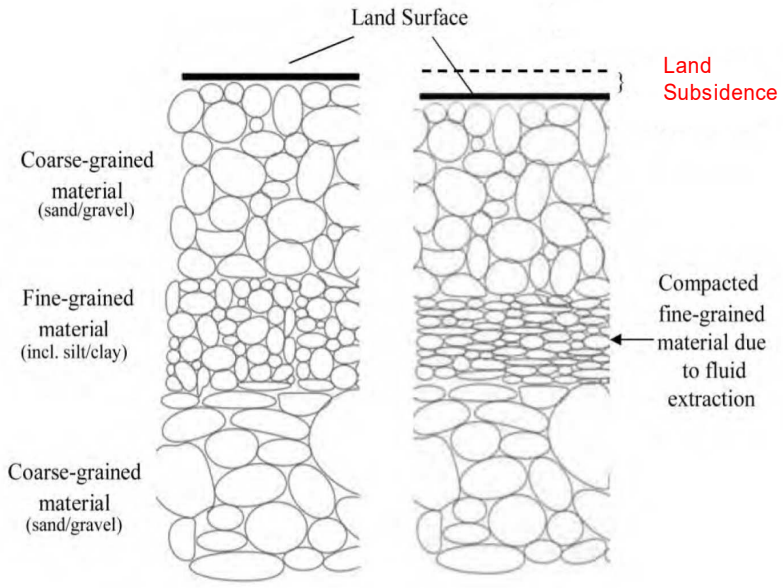
TEMESCAL GSA

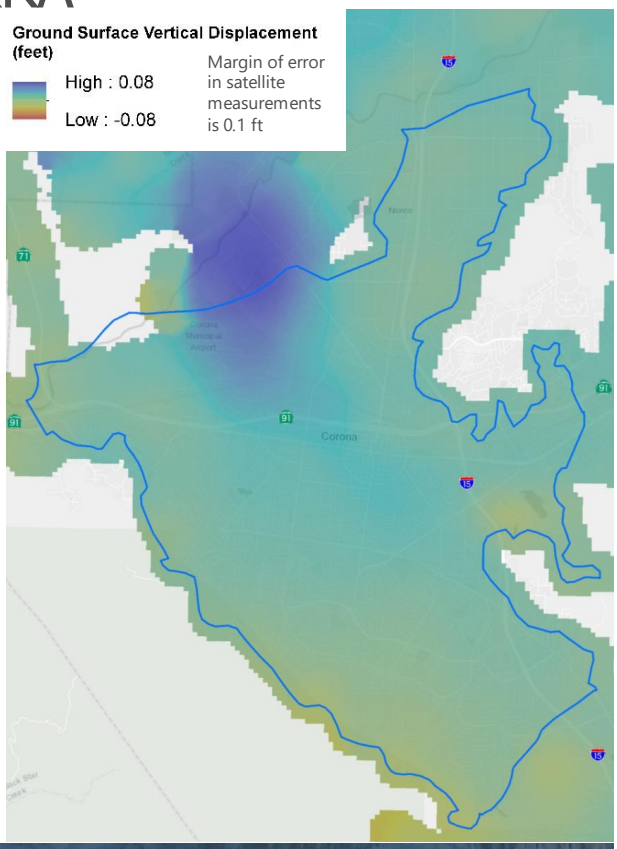
INTERCONNECTED SURFACE WATER THRESHOLD
UMBRAL DE AGUAS SUPERFICIALES INTERCONECTADAS

» Minimum Threshold for depletion of interconnected surface water is historical maximum depth to water in shallow monitoring wells in the southern Prado area, correlated with Temescal Basin pumping or water levels

El umbral mínimo para el agotamiento del agua superficial interconectada es el nivel mínimo histórico del agua (profundidad máxima al agua) en pozos de monitoreo poco profundos en el área sur del Prado, correlacionado con el bombeo de la Cuenca Temescal o los niveles del agua

SUBSIDENCE
HUNDIMIENTO DE LA TIERRA





TEMESCAL GSA

SUBSIDENCE THRESHOLD
UMBRAL DE HUNDIMIENTO DE LA TIERRA

» Defined as rate of decline equal to or greater than 0.2 feet in any five-year period

Definido como una tasa de disminución igual o superior a 0.2 pies en cualquier período de cinco años

» This has been considered in terms of a cumulative decline equal to or greater than one foot of decline since 2015

Esto se ha considerado en términos de una disminución acumulada igual o mayor a un pie de disminución, desde el 2015

DISCUSSION AND Q&A
DISCUSIÓN / PREGUNTAS Y RESPUESTAS

TEMESCAL GSA

PROJECTS AND MANAGEMENT ACTIONS
PROYECTOS Y ACCIONES DE GESTIÓN

PROJECT MANAGEMENT/ACTION GROUPINGS

- Group 1: Baseline Actions

  Grupo 1: Acciones de línea de base
- Group 2: Planned Actions

  Grupo 2: Acciones planeadas
- Group 3: Potential Future Actions

  Grupo 3: Posibles acciones futuras

TEMESCAL GSA

GROUP 1 PROJECTS
PROYECTOS DEL GRUPO 1

- Groundwater Treatment: Treatment at the Temescal desalter to reduce nitrates, TDS, TSS and other contaminants for the City's drinking water supply

  Tratamiento de aguas subterráneas: tratamiento en la desaladora de Temescal para reducir los nitratos, TDS, TSS y otros contaminantes para el suministro de agua potable de la ciudad.
- Water Reclamation Facility Percolation Ponds: Discharge from percolation ponds that recharge the Basin

  Estanques de percolación de instalaciones de recuperación de agua: descarga de estanques de percolación que recargan la cuenca

GROUP 1 PROJECTS
PROYECTOS DEL GRUPO 1

» Water Level QA/QC: Maintaining the reliability of groundwater elevation data

Control de calidad / control de calidad del nivel del agua: mantenimiento de la confiabilidad de los datos de elevación del agua subterránea

» WRCRWA Recycled Water: This plant will soon produce recycled water for local irrigation use

Agua reciclada de WRCRWA: esta planta pronto producirá agua reciclada para uso de riego local.

TEMESCAL GSA

GROUP 1 MANAGEMENT ACTIONS
ACCIONES DE GESTIÓN DEL GRUPO 1

» Water Shortage Contingency Plans: Stages of water shortage and conservation response based on available water supply

Planes de contingencia de escasez de agua: Etapas de escasez de agua y respuesta de conservación en función del suministro de agua disponible

» Water Conservation Programs: Response actions to reduce water use in accordance with water shortage

Programas de conservación de agua: acciones de respuesta para reducir el uso de agua de acuerdo con la escasez de agua

GROUP 1 MANAGEMENT ACTIONS
ACCIONES DE GESTIÓN DEL GRUPO 1

» WMWD IRWMP: Coordinated, long-range regional water quality and management strategy

WMWD IRWMP: Estrategia regional coordinada de gestión y calidad del agua a largo plazo

» Santa Ana Watershed Involvement: Coordinated management group to protect the Santa Ana River basin and associated water resources

Participación de la cuenca de Santa Ana: grupo de gestión coordinado para proteger la cuenca del río Santa Ana y los recursos hídricos asociados

TEMESCAL GSA

GROUP 2 PROJECTS
PROYECTOS DEL GRUPO 2

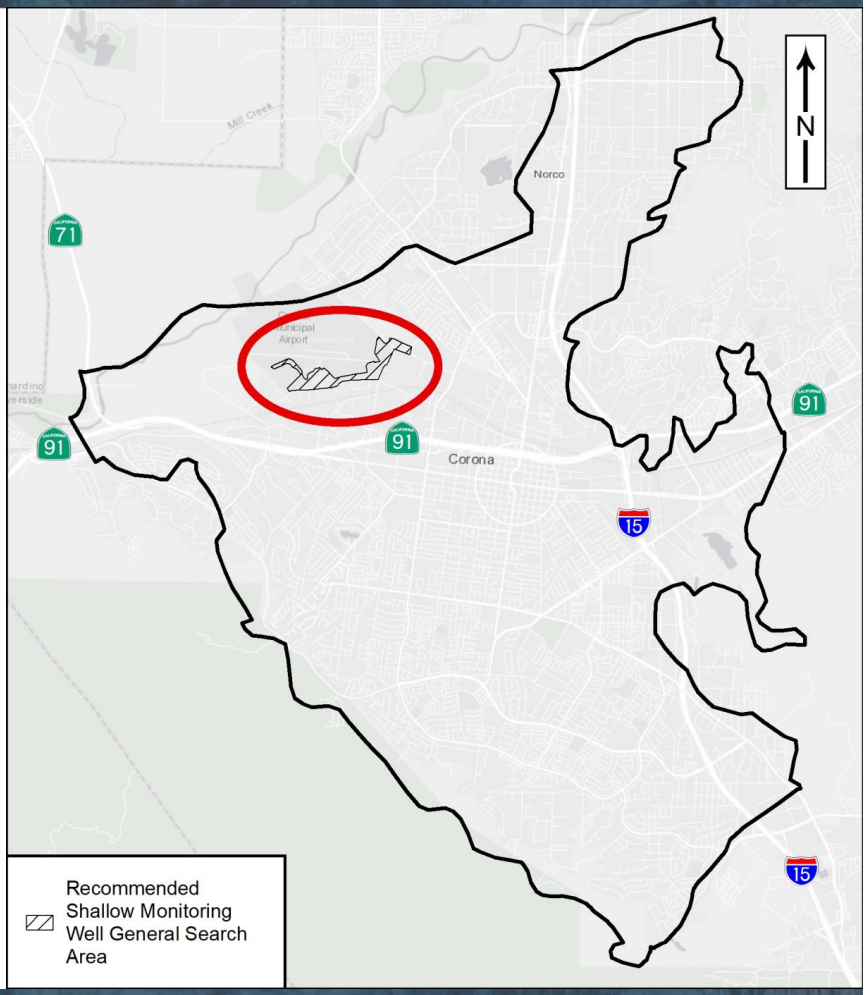
» Potable Reuse Feasibility Study: Study to look at use potential for near to future reclaimed water supply

Estudio de viabilidad de reutilización de agua potable: estudio para analizar el potencial de uso del suministro de agua recuperada en el futuro cercano

» Mountain Runoff Capture Investigation: Runoff during storm events is collected into existing RCFCWCD basins to mitigate flooding. This study would explore options for operational changes to allow for additional benefit of groundwater recharge.

Investigación de captura de escorrentía de montaña: La escorrentía durante tormentas se recolecta en las cuencas RCFCWCD existentes para mitigar las inundaciones. Este estudio exploraría opciones para cambios operativos que permitan un beneficio adicional de la recarga de agua subterránea.

GROUP 2 – MONITORING WELLS PROJECT
GRUPO 2 - PROYECTO DE POZOS DE MONITOREO



TEMESCAL GSA

GROUP 2 – MONITORING WELLS PROJECT
GRUPO 2 - PROYECTO DE POZOS DE MONITOREO

- 3 wells, 40-60 feet deep

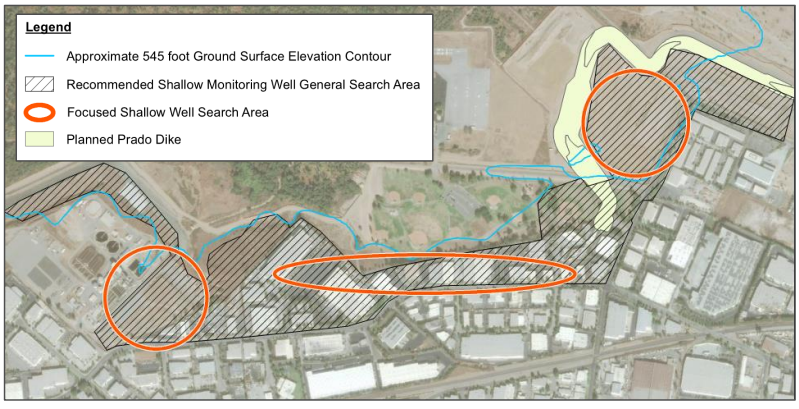
  3 pozos, de 40 a 60 pies de profundidad

- Continuous groundwater elevation data collection to be used in 5-year GSP update

  Recopilación continua de datos de elevación del agua subterránea que se utilizará en la actualización del GSP en 5 años

- Data will inform future management actions

  Los datos informarán las acciones de gestión futuras



GROUP 3 MANAGEMENT ACTIONS
ACCIONES DE GESTIÓN DEL GRUPO 3

» Santa Ana River Wastewater Discharge Coordination for Shallow Groundwater Conditions: Contingent on Prado monitoring well installation. If groundwater levels in Prado are falling, this approach will entail coordination with upstream partners for solutions

Coordinación de descarga de aguas residuales del río Santa Ana para condiciones de aguas subterráneas poco profundas: depende de la instalación del pozo de monitoreo de Prado. Si los niveles de agua subterránea en Prado están cayendo, este enfoque implicará la coordinación con los socios del alrededor para encontrar soluciones

TEMESCAL GSA

GROUP 3 PROJECTS
PROYECTOS DEL GRUPO 3

» Future Groundwater Treatment: Implementation of advanced treatment to treat for PFAS as well as TDS, nitrate, and TCP

Tratamiento de aguas subterraneas en el futuro: Implementacion de tratamiento avanzado para tratar agua de PFAS al mismo tiempo que TDS, nitrato, y TCP

» Urban Stormwater Treatment, Capture, and Recharge: Exploration of urban stormwater harvesting to offset water supply and/or provide for groundwater recharge

Tratamiento, captura y recarga de aguas pluviales urbanas: exploración de la captación de aguas pluviales urbanas para compensar el suministro de agua y / o proporcionar recarga de aguas subterráneas

DISCUSSION AND Q&A
DISCUSIÓN / PREGUNTAS Y RESPUESTAS

» Are there other potential groundwater related projects we should consider?
¿Hay otros proyectos potenciales relacionados con las aguas subterráneas que deberíamos considerar?

» Do you have ideas for how the volume of groundwater in the Basin could be increased?
¿Tiene ideas sobre cómo se podría aumentar el volumen de aguas subterráneas en la cuenca?

» Do you have ideas for making groundwater more sustainable in the Basin?
¿Tiene ideas para hacer que las aguas subterráneas sean más sostenibles en la cuenca?

TEMESCAL GSA

GSP IMPLEMENTATION
IMPLEMENTACIÓN DEL GSP

WHAT IS GSP IMPLEMENTATION?
¿QUÉ ES LA IMPLEMENTACIÓN DEL GSP?

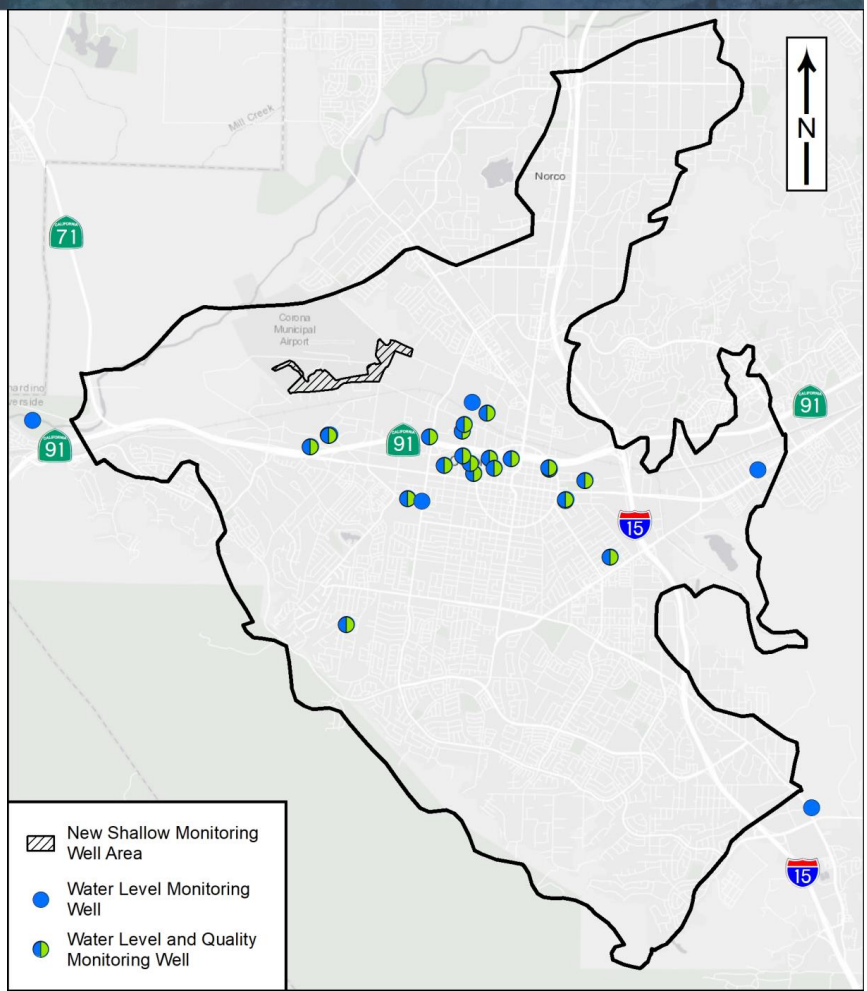
- Monitoring groundwater conditions and use
  Monitoreo de las condiciones y el uso de las aguas subterráneas
- Annual Reports
  Reportes Anuales
- Carrying out projects and management actions
  Realización de proyectos y acciones de gestión
- Periodic Evaluations / GSP Updates
  Evaluaciones Periódicas / Actualizaciones del GSP

TEMESCAL GSA

MONITORING
MONITOREO

Includes:
- water levels,
- water quality,
- streamflow,
- subsidence, and
- water use

Incluye:
- los niveles de agua,
- la calidad del agua,
- el flujo de corrientes,
- el hundimiento y
- el uso del agua



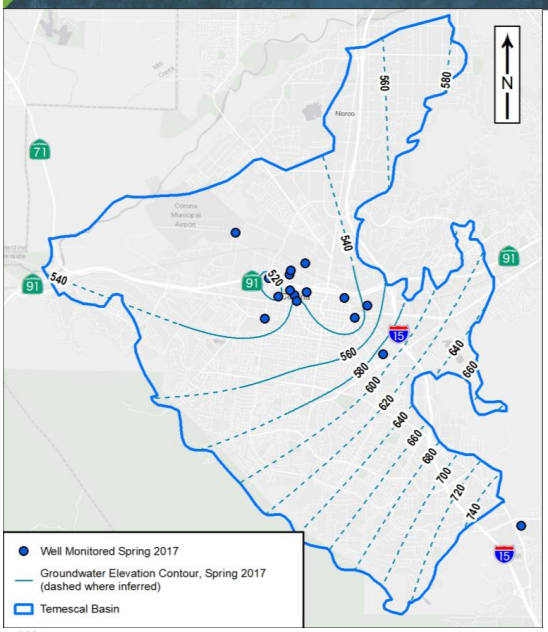
ANNUAL REPORTS
INFORMES ANUALES

Include:
- » water level data,
- » storage change,
- » water use,
- » sustainability progress

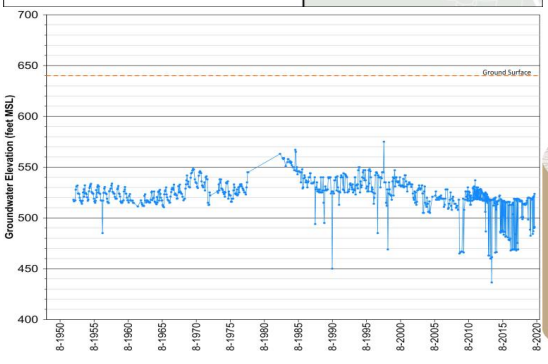
Incluye:
- » dado de nivel de agua,
- » cambio de almacenamiento,
- » el uso agua,
- » progreso de la sostenibilidad

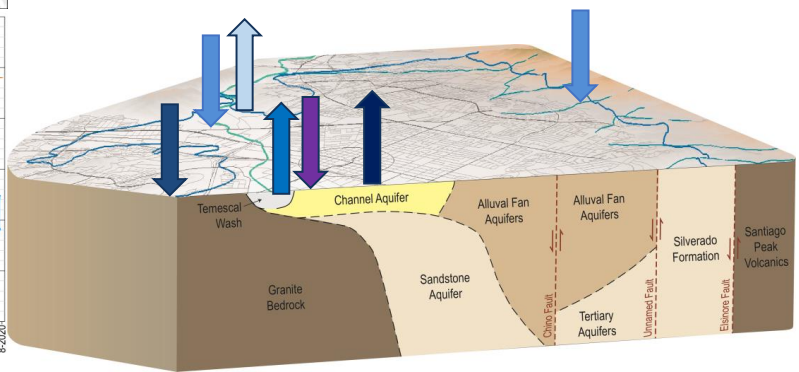


TEMESCAL GSA



PERIODIC EVALUATIONS / GSP UPDATES
EVALUACIONES PERIÓDICAS / ACTUALIZACIONES DEL GSP





DISCUSSION AND Q&A
DISCUSIÓN / PREGUNTAS Y RESPUESTAS

TEMESCAL GSA

HOW TO STAY INVOLVED
CÓMO MANTENERSE INVOLUCRADO

REVIEW AND ADOPTION
REVISIÓN Y ADOPCIÓN

Draft GSP Released

Publicación del borrador del GSP

90 Day Public Review Period

90 Dias Período de revisión pública

Adoption Hearing

Audiencia de adopción

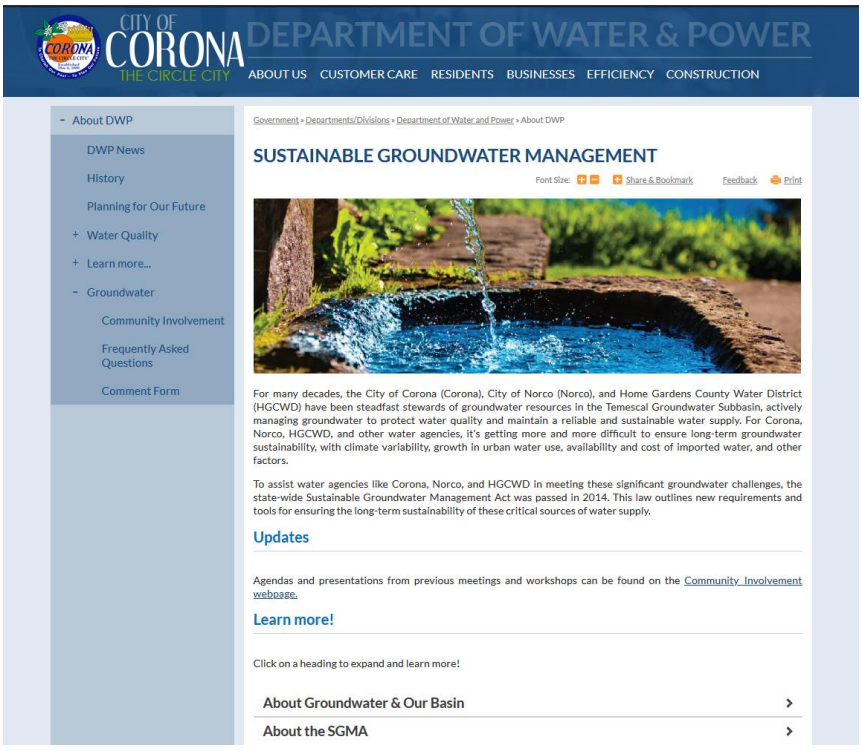
Final GSP Sent to DWR

GSP final enviado a DWR

Late Summer 2021 Finales del verano de 2021	Fall 2021 Otoño 2021	Winter 2021 Invierno 2021	January 2022 Enero 2022

TEMESCAL GSA

WEBSITE
SITIO WEB



HOW TO KEEP IN TOUCH
CÓMO MANTENERSE EN CONTACTO

- Sign up for the mailing list by emailing groundwater@coronaca.gov
  Regístrese en la lista de correo enviando un correo electrónico a groundwater@coronaca.gov
- Visit the website to view information, review draft chapters and other materials, and to submit comments : www.CoronaCA.gov/Groundwater
  Visite el sitio web para ver información, revisar borradores de capítulos y otros materiales, y enviar comentarios: www.CoronaCA.gov/Groundwater

TEMESCAL GSA

THANK YOU
GRACIAS

TEMESCAL GSA

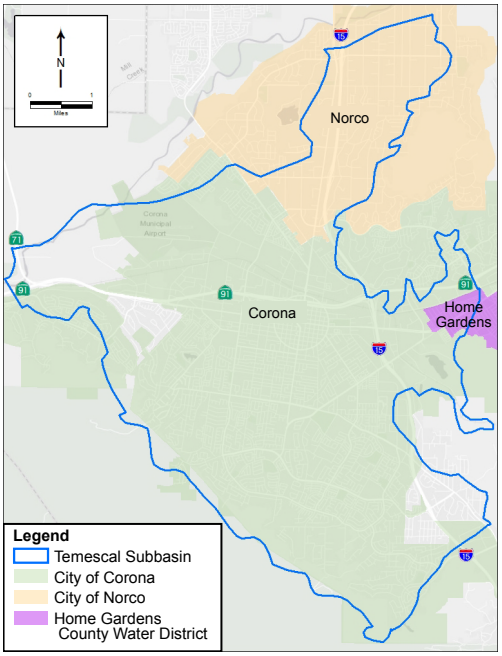
GROUNDWATER FOR PEOPLE, THE ENVIRONMENT, AND THE FUTURE

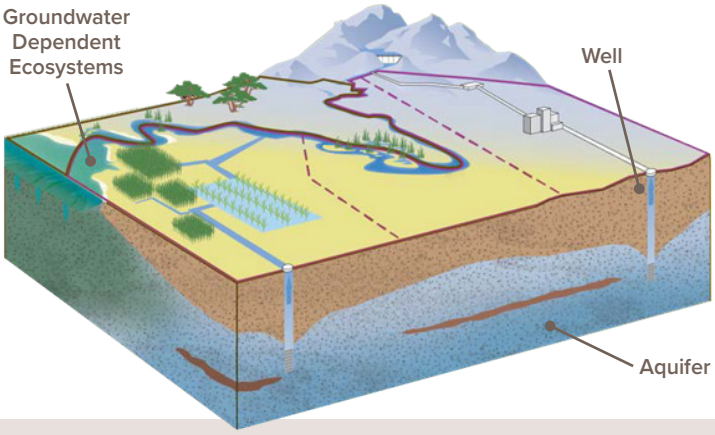
GET INVOLVED! Community input is needed! We want your help to create an effective plan for the future of our groundwater. Visit **CoronaCA.gov/Groundwater** or send an email to **Groundwater@CoronaCA.gov** to attend a workshop or learn more!

THE WATER BENEATH YOUR FEET AND IN YOUR FAUCET

You may not know it, but if you live in Corona, Norco, or Home Gardens, you are likely using groundwater that comes from the **Temescal Basin**. Groundwater from the Temescal Basin and other local groundwater basins, along with water purchased from other areas, is treated and blended together. It then arrives as tap water at your home or business.

The groundwater beneath your feet is an important local resource that will be even more important in the future. On the other side of this factsheet, you can learn more about who manages groundwater in the Temescal Basin and how you can get involved in protecting local groundwater for your community and all who depend on it.





WHAT IS GROUNDWATER?

Groundwater is an important source of water stored in the earth beneath our feet, in spaces between sand, soils, and fractured rock known as an **aquifer**. The areas of the most productive aquifers in California have been defined as **groundwater basins**, which can extend for many miles. The Temescal Basin covers nearly 66 square miles.

WHO USES GROUNDWATER?

Groundwater from aquifers is drawn out by pumps. Cities and water districts pump groundwater from **wells** to supply to businesses and homes. People in rural areas may have their own wells for personal use and/or to water crops. Groundwater also has many uses in manufacturing and industry. It can be used to process, wash, cool, or transport a product.

Groundwater is important to the environment, it flows to and from wetlands, springs, creeks, lakes, and other bodies of water. The plants and animals that live near or in these bodies of water sometimes depend on it for their survival. These areas are called **Groundwater Dependent Ecosystems**.

Home Gardens
County Water District
3832 N. Grant St., Corona, Calif. 92879
(951) 737-4741

TEMESCAL GSA

GROUNDWATER FOR PEOPLE, THE ENVIRONMENT, AND THE FUTURE



GROUNDWATER MANAGEMENT

For many decades, the City of Corona, City of Norco, and Home Gardens County Water District have carefully managed groundwater in the Temescal Basin. They have made sure that there is enough clean and drinkable water for the communities that need it. This has become more of a challenge due to changes in climate, the cost of importing water, and the fact that more water is needed because communities are growing. To help all stewards of groundwater plan for these changes, the state-wide **Sustainable Groundwater Management Act** was passed in 2014.

The Sustainable Groundwater Management Act or "SGMA" is a California law that gives local agencies new tools for managing groundwater and planning for the future. The City of Corona, City of Norco, and Home Gardens County Water District have formed the Temescal Subbasin Groundwater Sustainability Agency (Temescal GSA) in order to make a **Groundwater Sustainability Plan** for the Temescal Basin. Since groundwater is such an important resource for everyone, we need your help!

GROUNDWATER FOR THE FUTURE



Important factors for groundwater basin management can be seen on the right. By creating a Groundwater Sustainability Plan, we will better manage the groundwater in the Temescal Basin and ensure we have enough for current and future generations. We will seek understanding of past groundwater use and plan for the sustainable use of future groundwater. Whether you own your own well, use water from the tap, irrigate your crops, or pump groundwater for your business, **everyone can participate in making this plan a success!** We want to hear your questions, ideas, and concerns about protecting our groundwater supply and quality in the Temescal Basin. To find out how, please visit the website at **CoronaCA.gov/Groundwater**.

To learn more about the TEMESCAL GROUNDWATER SUSTAINABILITY PLAN, including dates of public workshops and other ways to get involved:

Please visit **CoronaCA.gov/Groundwater**

Send an email to **Groundwater@CoronaCA.gov**

Home Gardens
County Water District
3832 N. Grant St., Corona, Calif. 92879
(951) 737-4741

TEMESCAL GSA

GROUNDWATER FOR PEOPLE, THE ENVIRONMENT, AND THE FUTURE

GET INVOLVED! Community input is needed! Visit CoronaCA.gov/Groundwater or send an email to Groundwater@CoronaCA.gov to attend a workshop, review draft chapters, and learn more!

To learn more about the Temescal GSA, GSPs, and groundwater see Fact Sheet 1.

PREPARING TO DEFINE SUSTAINABILITY

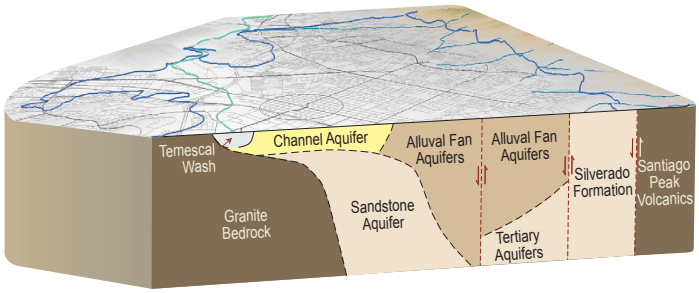
The Temescal GSA is preparing to define groundwater sustainability for the Temescal Basin to ensure we have enough groundwater for current and future generations. First, it is important to understand more about the Basin. This fact sheet explains some important information that will be in the Temescal Groundwater Sustainability Plan to provide that understanding.

HOW WE LEARN ABOUT THE TEMESCAL BASIN

A **hydrogeologic conceptual model** provides a description of the physical features within a groundwater basin. It will summarize information about basin boundaries, soils, geologic structure, and aquifers within the Temescal Basin. It will also illustrate where and how water flows in and through the Basin.

Current and historical groundwater conditions give an understanding of Basin health over time and show patterns of use that are important for understanding current and future sustainability. Groundwater conditions will be described in terms of the six sustainability indicators shown below, which will also be used for planning for sustainability in the Basin.

- Lowering GW Levels
- Reduction of Storage
- Degraded Quality
- Surface Water Depletion
- Land Subsidence
- Saltwater Intrusion



This block diagram shows some important features of the Temescal Basin described in the hydrogeologic conceptual model

A **water budget** quantifies the volumes of ground and surface water moving through a basin. It will also estimate changes in storage, a measure of how much groundwater enters or leaves the Basin in any given period. The water budget and change in storage are important factors in estimating sustainable yield, or how much water can be pumped from the Basin without significant and unreasonable impacts.

This information will provide a framework for defining sustainability in the Temescal Basin in the context of the six sustainability indicators shown to the left. Once sustainability is defined, we will prepare management actions and projects to maintain sustainability into the future.

To learn more about the TEMESCAL GROUNDWATER SUSTAINABILITY PLAN, including dates of public workshops and other ways to get involved:

Please visit **CoronaCA.gov/Groundwater** Send an email to **Groundwater@CoronaCA.gov**

Home Gardens County Water District
3832 N. Grant St., Corona, Calif. 92879
(951) 737-4741

TEMESCAL GSA

AGUAS SUBTERRÁNEAS PARA CONSUMO HUMANO, EL MEDIO AMBIENTE Y EL FUTURO

¡PARTICIPE!

¡Necesitamos la opinión de la comunidad! ¡Visite CoronaCA.gov/Groundwater o envíe un correo electrónico a Groundwater@CoronaCA.gov para asistir a un taller, revisar los borradores de los capítulos y aprender más!

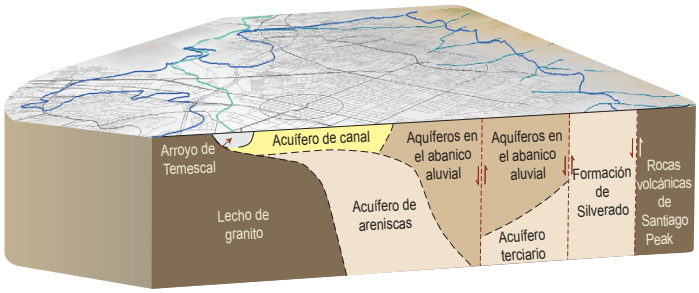
Para obtener más información sobre Temescal GSA, el GSP y el agua subterránea vea la Hoja de datos 1.

PREPARÁNDONOS PARA DEFINIR LA SOSTENIBILIDAD

La Agencia de Sostenibilidad de Aguas Subterráneas de Temescal (Temescal GSA) se está preparando para definir la sostenibilidad de las aguas subterráneas para la cuenca de Temescal a fin de asegurarnos de tener suficiente agua subterránea para las generaciones actuales y futuras. En primer lugar, es importante comprender más sobre la cuenca. Esta hoja de datos explica cierta información importante que se incluirá en el Plan de Sostenibilidad de Aguas Subterráneas de Temescal para ayudar a comprenderla.

CÓMO OBTENEMOS INFORMACIÓN SOBRE LA CUENCA DE TEMESCAL

Un **modelo conceptual hidrogeológico** brindará una descripción de las características físicas en una cuenca de aguas subterráneas. Resumirá la información sobre los límites de la cuenca, los suelos, la estructura geológica y los acuíferos en la cuenca de Temescal. También ilustrará dónde y cómo fluye el agua hacia y a través de la cuenca.



Este diagrama de bloque muestra algunas características importantes de la cuenca de Temescal descritas en el modelo conceptual hidrogeológico

Las condiciones actuales e históricas del agua subterránea ayudan a comprender la salud de la cuenca a lo largo del tiempo y muestran patrones de uso que son importantes para entender la sostenibilidad actual y futura. Las condiciones del agua subterránea se describirán en términos de los seis indicadores de sostenibilidad que se muestran abajo, que también se utilizarán para planificar la sostenibilidad en la cuenca.

- Bajada de los niveles de agua subterránea
- Reducción del almacenamiento
- Degradación de la calidad
- Merma del agua superficial
- Hundimiento de tierras
- Intrusión de agua de mar

Un **balance hídrico** cuantifica los volúmenes de agua subterránea y agua superficial que se desplazan a través de una cuenca. También estima los cambios en el almacenamiento, una medida de cuánta agua subterránea entra a la cuenca o sale de esta en un período determinado. El balance hídrico y el cambio en el almacenamiento son factores importantes en la estimación del rendimiento sostenible, o de cuánta agua se puede bombear desde la cuenca sin producir un impacto significativo y poco razonable.

Esta información proporcionará un marco para definir la sostenibilidad en la cuenca de Temescal en el contexto de los seis indicadores de sostenibilidad que se muestran a la izquierda. Una vez que hayamos definido la sostenibilidad, prepararemos las acciones y los proyectos de gestión para mantener la sostenibilidad en el futuro.

Para obtener más información sobre el PLAN DE SOSTENIBILIDAD DE AGUAS SUBTERRÁNEAS DE TEMESCAL, incluidas las fechas de los talleres públicos y otras formas de participar:

Visite CoronaCA.gov/Groundwater

Envíe un correo electrónico a Groundwater@CoronaCA.gov

Home Gardens County Water District
3832 N. Grant St., Corona, Calif. 92879
(951) 737-4741

TEMESCAL GSA

GROUNDWATER FOR PEOPLE, THE ENVIRONMENT, AND THE FUTURE

GET INVOLVED! Community input is needed! Visit CoronaCA.gov/Groundwater or send an email to Groundwater@CoronaCA.gov to attend a workshop, review draft chapters, and learn more!

To learn more about background information prepared for the GSP see Fact Sheet 2.

DEFINING SUSTAINABILITY AND TAKING ACTION

Now that the background information and modeling is complete, we will define groundwater sustainability for the Temescal Basin. Management actions and projects will keep us on course, so we have enough groundwater for current and future generations. This fact sheet gives more information of these important parts of the Temescal Groundwater Sustainability Plan (GSP).

WHAT IS SUSTAINABILITY IN A GROUNDWATER SUSTAINABILITY PLAN?

The Temescal GSP must include an overall goal that states the desired objectives and conditions for the Temescal Basin. That goal then helps define a sustainability framework to **avoid** lowering groundwater levels, reduction of storage, degraded water quality, surface water depletion, and land subsidence. The framework defines the concepts below, so that we will know if action is needed to maintain sustainability:

1) **Undesirable results** are conditions we want to avoid in the Temescal Basin
2) **Minimum thresholds** set quantifiable measures for undesirable results
3) **Measurable objectives** establish quantifiable goals to maintain or improve groundwater conditions

Groundwater Dependent Ecosystems

GSPs must protect against surface water depletion. This is because surface water that is connected to groundwater is important for groundwater dependent ecosystems (GDEs). GDEs can include plants or animals that depend on groundwater. The Temescal Basin includes GDEs, primarily in the Prado Basin.



HOW CAN WE MAINTAIN SUSTAINABILITY?

With goals defined, the next step is to meet the standards we have set! Management actions and projects help us maintain sustainability by managing the groundwater resource to avoid undesirable results. Some of the actions and projects that will be included in the GSP are already happening, some are planned and will be implemented within the next few years, and others are potential actions that will be taken in response to future changing groundwater conditions in the Temescal Basin.

Examples of Management Actions and Projects

CURRENT	PLANNED	POTENTIAL FUTURE
▸ Groundwater treatment ▸ Water Shortage Contingency Plans ▸ Water Conservation Programs	▸ Interconnected surface water monitoring ▸ Groundwater recharge feasibility studies	▸ Additional groundwater treatment ▸ Stormwater capture, treatment, and recharge

Home Gardens County Water District
3832 N. Grant St., Corona, Calif. 92879
(951) 737-4741

GSA DE TEMESCAL

AGUA SUBTERRÁNEA PARA CONSUMO HUMANO, EL MEDIO AMBIENTE Y EL FUTURO

¡PARTICIPE! ¡Necesitamos la opinión de la comunidad! Visite CoronaCA.gov/Groundwater o envíe un correo electrónico a Groundwater@CoronaCA.gov para asistir a un taller, revisar los borradores de los capítulos, y aprender más!

Para obtener más información sobre la información de antecedentes preparada para el GSP, consulte la Hoja informativa 2.

DEFINIR LA SOSTENIBILIDAD Y TOMAR ACCIÓN

Ahora que la información de antecedentes y el modelado están completos, definiremos la sostenibilidad del agua subterránea para la Cuenca de Temescal. Las acciones y proyectos de gestión nos mantendrán en el rumbo, por lo que tendremos suficiente agua subterránea para las generaciones actuales y futuras. Esta hoja informativa brinda más información sobre estas partes importantes del Plan de Sostenibilidad de Aguas Subterráneas (GSP) de Temescal.

¿QUÉ ES LA SOSTENIBILIDAD EN UN PLAN DE SOSTENIBILIDAD DE AGUAS SUBTERRÁNEAS?

El GSP de Temescal debe incluir una meta general que establezca los objetivos y condiciones deseados para la Cuenca de Temescal. Luego, esa meta ayuda a definir un marco de sostenibilidad para **evitar** la disminución de los niveles de agua subterránea, la reducción del almacenamiento, la degradación de la calidad del agua, el agotamiento de las aguas superficiales y el hundimiento de la tierra. El marco define los conceptos a continuación, de modo que sepamos si es necesario actuar para mantener la sostenibilidad:

1) **Resultados indeseables** son condiciones que queremos evitar en la Cuenca de Temescal
2) **Umbrales mínimos** establecen medidas cuantificables para resultados no deseados
3) **Objetivos medibles** establecen metas cuantificables para mantener o mejorar las condiciones del agua subterránea

¿CÓMO PODEMOS MANTENER LA SOSTENIBILIDAD?

Con las metas definidas, el siguiente paso es cumplir con los estándares que hemos establecido. Las acciones y proyectos de gestión nos ayudan a mantener la sostenibilidad mediante la gestión del recurso hídrico subterráneo para evitar resultados indeseables. Algunas de las acciones y proyectos que se incluirán en el GSP ya están en marcha, algunas están planificadas y se implementarán en los próximos años, y otras son acciones potenciales que se tomarán en respuesta a las futuras condiciones cambiantes de las aguas subterráneas en la Cuenca de Temescal.

Ecosistemas dependientes del agua subterránea

Los GSP deben proteger contra el agotamiento de las aguas superficiales. Esto se debe a que el agua superficial que está conectada al agua subterránea es importante para los ecosistemas dependientes del agua subterránea (GDE, por sus siglas en inglés). Los GDE pueden incluir plantas o animales que dependen del agua subterránea. La Cuenca de Temescal incluye GDE, principalmente en la Cuenca de Prado.

Ejemplos de acciones y proyectos de gestión

ACTUAL	PLANEADO	FUTURO POTENCIAL
▶ Tratamiento de aguas subterráneas ▶ Planes de contingencia de escasez de agua ▶ Programas de conservación de agua	▶ Monitoreo interconectado de aguas superficiales ▶ Estudios de viabilidad de recarga de aguas subterráneas	▶ Tratamiento adicional de aguas subterráneas ▶ Capturar, tratar, y recargar aguas pluviales

Home Gardens County Water District
3832 N. Grant St., Corona, Calif. 92879
(951) 737-4741

APPENDIX H

Summaries of Neighboring Basin Coordination and Community Leader Outreach Meetings

MEETING NOTES

TEMESCAL BASIN GROUNDWATER SUSTAINABILITY PLAN

CITY OF CORONA

DWR PLANNING GRANT NO. 4600012652

Date:	November 30, 2020	**Time:**	1:00 to 2:00 PM
Location:	Teams Web Conference	**Project No.:**	46414
Subject:	Temescal GSP Coordination with Arlington GSA - Meeting 1		
Attendees:	Tom Moody, Katie Hockett, Kristian Alfelor, Melissa Estrada-Maravilla - , Corona DWP, Ryan Shaw – Western / Arlington GSA, Chad Taylor, Gus Yates, and Maureen Reilly – Todd Groundwater		

The City of Corona is preparing a GSP for the Temescal Basin and wants to coordinate with Arlington GSA and the work they are doing to prepare a GSP

- Our coordination will largely focus on the water budget and model for Temescal
- We know there is a model for Arlington that includes estimates of outflow to Temescal
- We want to start the coordination process and plan for requesting data and information from the Arlington GSA

Geoscience is Arlington GSAs consultant preparing GSP

- They are a bit overbudget, but we can request data from them as needed.

They're using the Santa Ana River Integrated Model for the GSP and water budget.

Water budget indicates little flow out of Arlington through the Gap in the current and future periods. The flow has decreased in recent years, but not by an amount that is significant in the context of either basin's water budget.

Willing to coordinate on outflows to some extent, but their water budget is ahead of ours and they have a small basin they feel is well defined.

They have no interconnected surface water or GDE concerns.

- There is a small lake in the basin (Hull Lake) that may have some interconnection, but they don't feel they have any need for criteria to address it.
- Arlington is defining water level SMC's operationally, with respect to well depths, screened intervals, pump settings, etc.

MEETING NOTES

TEMESCAL BASIN GROUNDWATER SUSTAINABILITY PLAN

CITY OF CORONA

DWR PLANNING GRANT NO. 4600012652

Date:	December 9, 2020	**Time:**	11:00 to 12:00
Location:	Teams Web Conference	**Project No.:**	46414
Subject:	Temescal GSP Coordination with Chino GSA - Meeting 1		
Attendees:	Tom Moody, Katie Hockett, Kristian Alfelor, Melissa Estrada-Maravilla - , Corona DWP, Edgar Tellez Foster – Chino Watermaster, Chad Taylor, Gus Yates, and Maureen Reilly – Todd Groundwater		

Introductions

The City of Corona is preparing a GSP for the Temescal Basin and wants to coordinate with Chino Watermaster as a neighboring basin.

- Our coordination will largely focus on the water budget and model for Temescal
- We know Chino has a model that includes some of the Temescal Basin
- We want to start the coordination process and plan for requesting data and information from the Watermaster

Chino has an Optimum Basin Management Plan first prepared in 2000 and updated in 2020.

- This is the equivalent of a GSP for Chino
- Uses material physical injury in place of sustainability indicators
- Available on watermaster website

Chino Valley model includes parts of the Temescal Basin and other neighboring basins as well.

- Needs to talk to consultant (Wildermuth, now West Yost) about how Temescal in represented in their model

Currently no plans to increase capture area or volume in their desalter system above the 40,000 AFY. The desalter wells are intended to function more or less the way ag wells functioned historically in terms of groundwater budget and flow patterns.

How does the Watermaster balance their desalter water quality goals with wetlands and other volumetric considerations?

- They have a monitoring and reporting program that includes groundwater elevation and vegetation monitoring in the Prado Basin Habitat Sustainability reporting, most recent in April 2020
- They also have a State of the Basin report that periodically reports on overall basin conditions
    - The last State of the Basin report was through 2018
    - They are working on the current report through 2020 now

It seems like there is some variability in flow dynamics around the boundary between the two basins, how does the Chino model handle the dynamic flow in this area?

- This is a question for Wildermuth / West Yost

Does the Watermaster have any agreements with OCWD?

- No, but they are bound by the Santa Ana River Watershed agreement that requires a certain outflow past Prado Dam.
- They do coordinate with OCWD in some data collection, but no operations commitments

How can we request data efficiently?

- Submit requests to request email from website and copy Edgar
- They have some data sharing limitations for private well data
- Special model runs can be completed, but there would be a passthrough cost
- Can we request output data from existing/past model runs?
    - Yes, make request through the same channels

Does there desalter capture system capture all the water coming from the north, and do they rely on water coming from the Temescal Basin?

- Their desalter wells create a trough that captures water from both directions
- The intent is to keep high TDS water from the former dairy operations from flowing to and entering the Santa Ana River, simulating historical agricultural pumping

Chino Watermaster is interested in engaging with the preparation of the Temescal GSP.

MEETING NOTES

TEMESCAL BASIN GROUNDWATER SUSTAINABILITY PLAN

CITY OF CORONA

DWR PLANNING GRANT NO. 4600012652

Date:	November 30, 2020	**Time:**	2:00 to 3:00 PM
Location:	Teams Web Conference	**Project No.:**	46414
Subject:	Temescal GSP Coordination with OCWD - Meeting 1		
Attendees:	Tom Moody, Katie Hockett, Kristian Alfelor, Melissa Estrada-Maravilla - , Corona DWP Chad Taylor, Gus Yates, and Maureen Reilly – Todd Groundwater, Adam Hutchinson – OCWD		

The City of Corona is preparing a GSP for the Temescal Basin and wants to coordinate with OCWD in their capacity as the GSA for the neighboring Coastal Plain Basin as a neighboring basin with an approved alternative plan.

- Our coordination will largely focus on the water budget and model for Temescal
- We've looked at the Coastal Plain water budget as presented in the alternative plan and want to coordinate our water budget in this area
- We want to start the coordination process and plan for requesting data and information from OCWD
- We also want to make sure we know if OCWD has questions or concerns about the Temescal

Did we receive the comments on the Plan Area chapter of the Temescal GSP?

- Yes
- Adam wanted to make sure that the Temescal GSP note and incorporate management in the upstream Chino and Riverside-Arlington basins
- Pumping for water quality management in these basins captures a large volume of the outflow that would otherwise come into Temescal and then on to Prado and eventually out to the Coastal Plain of OC basin

Geoscience is working on the Santa Ana River Integrated Model

    - OCWD has been working closely with Geoscience on this model
    - The model needs improvement, and OCWD is working with Geoscience on a version focused on the Prado area
- There is a recently published HCP prepared by Valley District that is watershed-wide and applies to the Basin and Prado
    - It is under review now
    - It is an attempt to combine all the HCPs into one framework

Are you refining water budget, specifically inflow across basin boundary?

- No, that term is relatively static because there is virtually no change between Prado dam and the OCWD rubber dam
- They assume the 1,580 AFY is pretty much all surface water flow

What are OCWD's main concerns relating to the Temescal GSP?

- From a water quality perspective, they are focused on PFOS
    - They sampled in Temescal and see some PFOS in and around Temescal Creek and other waterways
    - This included *first flush* sampling of many streams at the beginning of a significant storm
    - Also sampled one of the new monitoring wells in Prado
    - Temescal Wash showed the highest PFOS surface water concentrations
- OCWD is very concerned about maintaining habitat quantity and quality in the Prado wetlands. OCWD owns about 2,000 acres of the wetlands.
    - Least Bell's vireo is a key management species.
    - OCWD recently installed ten new shallow piezometers to measure water table depth in Prado, supplementing information from drive point piezometers installed previously.
    - Adam is interested in having a multi-depth monitoring well near Prado Dam.
    - Water requirements for sustaining Prado habitat might have a secondary effect of increasing flow past Prado Dam.
- Adam wants the Temescal GSP to include a good and complete description of the entire upper Santa Ana River watershed and groundwater basins.

MEETING NOTES

TEMESCAL SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

CITY OF CORONA

DWR PLANNING GRANT NO. 4600012652

Date:	July 13, 2020	**Time:**	9 to 9:30 AM
Location:	City of Corona Dept. of Water and Power	**Project No.:**	46414
Subject:	Initial Meeting with Eileen Navarro, Community Orgainizer		
Attendees:	Melissa Estrada-Maravilla & Kristian Alfelor – Corona DWP, Jack Hughes– Kearns & West, Chad Taylor– Todd Groundwater, and Eileen Navarro		

1. Brief introduction to SGMA and the GSP process
Chad gives a brief introduction to SGMA legislation

2. Introductions
Eileen recently finished college w/ degree in political science and community outreach. She's recently been working with Vice Mayor Casillas and learning about the Home Gardens community

3. Background information regarding the Home Gardens community
Home Gardens is an unincorporated community with no elected officials or independent governance.

There aren't any formal community groups, but there is active involvement on specific issues and social media engagement.

A large percentage of the community is Latinx with Spanish as their primary language. Lack of Spanish-language outreach has often been an impediment to engagement for the community. There has also been limited engagement due to fear of legal repercussions related to immigration status.

However, the community has come together in the past to lobby for specific items like sidewalks and Policing.

There is a school, Home Gardens Academy, which serves as a local meeting place and information hub and there is also a library where meetings and gatherings are sometimes held

People are currently most engaged in COVID, schools reopening, an increase in car break-ins, policing, and the potential for incorporation.

Active discussion about incorporating into either Corona or Riverside is occurring now.

The Incorporation discussion was started because of policing issues, and Eileen has been involved in information gathering and discussions on this topic.

Melissa asks if there have been any discussions regarding water service from Corona?

> Yes, there has been discussion of water service; approximately half of the community pays to Corona/Home Gardens WD while others pay directly to the City of Riverside. The divide is at McKinley Street.
>
> Eileen is not aware of other water problems or questions from people in Home Gardens.

Melissa asks if Eileen is interested in being involved in the GSP process? And if so, would she like to be on the TAC?

> Eileen indicated that she is interested in being updated during preparation of the GSP as an interested party, but she doesn't think she'll have time to be on the TAC because she is planning to start law school soon.

MEETING AGENDA

TEMESCAL SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

CITY OF CORONA

DWR PLANNING GRANT NO. 4600012652

Date:	August 11, 2020	**Time:**	11AM to 12PM
Location:	Teams Web Conference	**Project No.:**	46414
Subject:	Temescal GSP TAC Outreach Planning with Corona Council Members		
Attendees:	Vice Mayor Jacque Casillas and Council Member Jason Scott – Corona, Katie Hockett, Kristian Alfelor, Melissa Estrada-Maravilla – Corona DWP, Jack Hughes & Joan Isaacson Kearns & West, and Chad Taylor Todd Groundwater		

INTRODUCTIONS

PROJECT OVERVIEW

Chad gives a brief summary of SGMA and the GSP process and an introduction to the outreach requirements and plans

PURPOSE OF THE MEETING

Summary of the outreach and engagement we are planning for and to learn what we should know and consider for outreach in the communities Vice Mayor Casillas and Councilmember Scott work with/represent. Particularly on the areas designated as disadvantaged communities by the State of California and called out for inclusion in outreach and engagement by DWR in GSP preparation.

GSP COMMUNICATIONS AND OUTREACH REQUIREMENT SUMMARY

Jack notes that SGMA calls for consideration of all interests of all beneficial uses and users of groundwater. K&W has developed an Outreach and Involvement Plan that includes multiple avenues for public engagement including public workshops, pre workshop outreach, TACs,

City Council and Board of Directors Meeting Presentations, plus website, fact sheet, translation, etc.

Focused Outreach (Jack/Joan)

Jack notes that there are areas in the Basin designated as Disadvantaged Communities, which are census block groups with less than 80% of the State's median household income or severely disadvantaged communities where (less than 60% of the State's median household income).

Vice Mayor Casillas notes that we should try to meet people where they are. There are multiple Catholic churches (St Edwards and Corpus Christi) that should be included.

Is there a way to incentive people to attend within the grant?

- Hard to move grant funds toward incentives, and reductions in water bills run up on Prop 218 restrictions
- However, we could potentially coordinate with food distribution by providing fact sheets for distribution.

Council member Scott recommends using simple language in communications, reaching out to YMCA and mobile home parks, two work force housing developments 6th street near armory and near City Hall, and American Legion (Joe Domingus).

Vice Mayor Casillas mentions the Corona Norco Parent Teacher Center

Spanish language radio add-buys

Are community members open to shorter content on alternative platforms?

- Yes, especially younger people.
- Should consider packaging items developed for or during public meetings for alternative platform distribution later.

Discussion of character of districts and/or nearby communities (All)

- Do people have any concerns pertaining to water, water quality, and the environment, and if so, what are they?
    - They have not heard of concerns specific to water, except for questions about water bills from municipal providers.

Community Leader Meetings

Draft Notes

Tuesday, June 29, 2021
1:00 p.m. – 2:00 p.m.
Location: Zoom Virtual Meeting

Attendees

- Marven Norman, Center for Community Action and Environmental Justice (CCAEJ)

City of Corona Department of Water and Power Staff

- Katie Hockett
- Kristian Alfelor
- Melissa Estrada-Maravilla

Consultant Team

- Chad Taylor, Todd Groundwater
- Maureen Reilly, Todd Groundwater
- Christian Mendez, Kearns & West
- Jack Hughes, Kearns & West

Notes

As a local leader, does water come up in a conversations with others in the community?

- CCAEJ's big focus is on air quality and other impacts to communities from warehouses and industrial uses. This has not been an issue near the City of Corona as far as CCAEJ knows. Water is not a major focus for CCAEJ, but they have been asked to be involved in a lawsuit pertaining to impacts to groundwater from warehouse runoff.

What questions do you have about water today and tomorrow?

- What happens if we start having more droughts?
- What are the plans if there need to be reduction in water use?

Thursday, July 1, 2021
1:00 p.m. – 2:00 p.m.
Location: Zoom Virtual Meeting

Attendees

- Alma Marquez, Center for Community Action and Environmental Justice (CCAEJ)
- Fauzia Rizvi, Western Municipal Water District
- Elizabeth Toups, IE Works
- Scott Goodell, IE Works
- Diana Meza, City of Corona Planning and Housing

City of Corona Department of Water and Power Staff

- Katie Hockett
- Kristian Alfelor
- Melissa Estrada-Maravilla

Consultant Team

- Chad Taylor, Todd Groundwater
- Maureen Reilly, Todd Groundwater
- Christian Mendez, Kearns & West
- Jack Hughes, Kearns & West

Notes

As a Local Leader, does water come up in a conversations with others in the community?

- CCAEJ is interested in runoff pollution and its impact to groundwater. They would be interested in exploring this in communities outside the City of Corona. They are looking at initiating conversations on education and policy focusing on the impacts of runoff pollution to groundwater.
- Water is not often spoken about in the City of Corona Planning and Housing Commission. There needs to be more education on water conservation and groundwater.
- The only time people speak about water is when there is something wrong.
- There should be an awareness campaign about water issues like costs, drought, and conservation.

Are you aware of any private wells in your community?

- There is a community in Norco on Bluff Street that has a private well (this well appears to be outside the Temescal Basin boundaries).

What other groups/individuals should we invite to the Public Workshop on July 8?

- Outreach to farmers markets, swap meets, and churches
- CCAEJ can support by posting via social media
- Leela Project
- Local group that works with youth: could focus on job mobility
- Outreach material should include: What's in it for me? Why should I care?
- Include higher education and K-12

Other questions and comments from participants:

- What about future job availability?
- Alma Marquez expressed interest in the desalter tour

APPENDIX I

Draft GSP Comments and Responses

December 14, 2021

Temescal GSA
755 Public Safety Way
Corona, CA 92878

Submitted via email: Groundwater@coronaca.gov

Re: Public Comment Letter for Temescal Basin Draft GSP

Dear Melissa Estrada-Maravilla,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Temescal Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Temescal Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,



Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund



J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists



Samantha Arthur
Working Lands Program Director
Audubon California



Danielle V. Dolan
Water Program Director
Local Government Commission



E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy



Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Temescal Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 2-13). However, the GSP fails to clearly state the population of each DAC.

The GSP provides a density map of domestic wells in the basin (Figure 2-5). However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the basin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS

- Provide the population of each identified DAC.
- Include a map showing domestic well locations and average well depth across the basin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of aerial photos to analyze stream reaches and presents analysis of stream gage and groundwater elevation data. The ISW section concludes with the following statement (p. 4-16): *"In spite of these accuracy limitations, contours of depth to water measured in wells—in combination with depth to water data*

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

for the downstream end of the Bedford-Coldwater Subbasin (also shown in Figure 4-20) —indicates that there are only two areas in or near the Basin where depth to water is likely shallow enough to be within the root zone of vegetation or possibly discharge into stream channels or wetlands (Figure 4-20). One of the areas is the 2-mile bedrock reach of Temescal Wash between the Bedford-Coldwater Subbasin and Basin, and the other is the Prado Wetlands, where contouring suggests groundwater discharges into the wetlands. Depth to water in spring of 2017 was less than 20 feet downstream of about North Lincoln Avenue." The spring 2017 depth to water data are the only data discussed when referring to depth to water. However, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. The use of data from one point in time does not reflect the temporal (seasonal and interannual) variability inherent in California's climate.

On the map of stream reaches in the basin (Figure 4.17 Regional Surface Water Features), the reaches are not labeled as interconnected and disconnected, nor are areas with data gaps noted. Therefore, potential ISWs are not being identified, described, nor managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the basin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.
- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.
- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, the GDE section of the GSP could be improved by more clearly describing and mapping the basin's GDEs to show the data sources and areas of data gaps. Figure 4-21(Critical Habitat Areas) shows a map layer called "NCCAG riparian vegetation," however based on the description in the text, it is not clear if this is the entire NC dataset or if any screening criteria were used to modify the mapped potential GDEs. The GSP

text (p. 4-17) discusses the corridor of dense riparian trees and shrubs along the bedrock reach of Temescal Wash between the Bedford-Coldwater Subbasin and the Temescal Basin, but does not explicitly state the data source (i.e., field verification) or whether this vegetation is included in the set of potential GDEs. Data gaps are described in the text, but the areas of data gaps are not clearly labeled on the map.

The GSP discusses trends in groundwater elevations over the period 2010 to 2020 and plots a limited set of hydrographs over this period in Figure 4-23. However, the only depth to groundwater contours show are from Spring 2017. The GSP could be improved by mapping depth to groundwater contours over multiple years and seasons to illustrate the temporal (seasonal and interannual) variability inherent in California's climate.

RECOMMENDATIONS

- Provide a comprehensive set of maps for the basin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps from multiple seasons and water year types (e.g., wet, dry, average, drought), noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included into the water budget.[2,3] The integration of these ecosystems into the water budget is **insufficient**. Appendix I (Temescal Groundwater Sustainability Plan Numerical Groundwater Model Documentation Report) that accompanies the water budget section of the GSP was not included in the published version of the Draft GSP. Without this Appendix of the GSP, which documents the water budgets, we could not evaluate whether the water budget includes the current, historical, and projected demands of native vegetation. Inclusion of the explicit demands for native vegetation is essential so that key environmental uses of groundwater are being accounted for as water supply decisions are made using this budget and considered in project

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Outreach and Stakeholder Involvement Communications Plan (Appendix D).[4]

The GSP documents targeted outreach to DACs, including distribution of SGMA Fact Sheets through local churches and community centers; Spanish translation of materials and interpretation at events; and meetings with community leaders, community action organizations, and elected officials. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSA's Technical Advisory Committee fails to include representation from DACs and environmental stakeholders in the basin.
- Aside from the details of the Technical Advisory Committee, the GSP documents opportunities for public involvement and engagement in general terms. These include communication and engagement through the GSP webpage, outreach materials, communication through social media, websites, and email, and public workshops. The plan lacks specific details of outreach and engagement targeted to environmental stakeholders.
- The plan fails to document the outcome of the outreach and engagement conducted, nor does it document how information obtained from beneficial users was incorporated into the GSP development process.
- The GSP describes plans for Technical Advisory Committee meetings to continue during the implementation phase of the GSP. However, the GSP does not include a detailed plan for continual opportunities for engagement outside of these meetings through the *implementation* phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders within the basin.

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATIONS

- In the Outreach and Stakeholder Involvement Communications Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.
- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the basin.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, minimum thresholds are defined at each representative well as historical groundwater low levels. The GSP discounts private domestic wells when establishing SMC, based on the following rationale (6-6): *"There are very few active private wells in the Basin (see Section 2.3.2.1). The owners and operators of those wells are known and they have not reported any adverse effects to those wells in the past; None of the existing private well owners report that their wells went dry or were otherwise affected during the recent drought. Because of this, some flexibility exists for purposes of analysis; Responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner; there is a reasonable expectation that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts; As discussed below, MTs are initially set at historical groundwater level lows and then adjusted upward to be protective."* No further details are provided regarding the minimum threshold impacts on domestic wells. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or drinking water users when defining undesirable results, nor does it describe how the groundwater levels minimum thresholds are consistent with Human Right to Water policy.[9]

---

[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

For degraded water quality, constituents of concern (COCs) are total dissolved solids (TDS) and nitrate. The minimum threshold for nitrate is defined as the percentage of wells with concentrations exceeding the nitrate MCL (45 mg/L) based on current conditions (2015-2019), which is 50% of wells. The minimum threshold for TDS is defined as the percentage of wells with concentrations exceeding the TDS value of 1,000 mg/L based on current conditions (2015-2019), which is 26 percent of wells. However, according to the state's anti-degradation policy,[10] water quality should be protected and is only allowed to worsen if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made.

The GSP states (p. 6-25): *"Other constituents have been documented (see Groundwater Conditions Section 4.8) but occurrences of these are either under regulation by RWQCB (e.g., perchlorate) or are naturally occurring with no recent exceedances of MCLs and limited potential for mobilization due to management actions (e.g., arsenic, chromium, iron, and manganese)."* However, all COCs in the basin that may be impacted or exacerbated by groundwater use and/or management should be included in the SMC, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users and DACs when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users and DACs within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users and DACs when defining undesirable results for degraded water quality.[11] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users and DACs.

[10] Anti-degradation Policy
https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act
https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Set minimum thresholds and measurable objectives for all water quality constituents within the basin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.

- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC.

For depletion of interconnected surface waters, SMC are only established for the Prado Wetlands area. Our comments above in the ISW section of this letter note that interconnected surface waters have not been sufficiently identified and mapped in the basin. Therefore, SMC for depletion of interconnected surface waters may disregard some of the ISWs in the basin.

For the Prado Wetlands area, SMC are established as follows (p. 6-34): *"The Minimum Threshold for depletion of interconnected surface water is the amount of depletion that occurs when the depth to the water along the southern edge of the Prado Wetlands is greater than 15 feet for a period exceeding one year. This threshold corresponds approximately to the maximum depth to water measured in shallow monitoring wells in the northern part of the Prado Wetlands."* However, if minimum thresholds are set to historic low groundwater levels and the basin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse. No analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the basin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the basin (see Attachment C for a list of environmental users in the basin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Evaluate impacts on GDEs when establishing SMC for chronic lowering of groundwater levels. When defining undesirable results, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be

considered when defining undesirable results in the basin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- Re-evaluate the extent of ISWs in the basin. When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may

[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP appears to integrate climate change into key inputs (e.g., changes in precipitation and evapotranspiration) of the rainfall-runoff-recharge model. However, this could not be confirmed since the details of the described rainfall-runoff-recharge model included in Appendix I were not included for review in the Draft GSP. Furthermore, water is imported into the basin, but these inputs are not quantified and included in the surface water flow volumes of the water budget tables and it is unclear if these inputs are adjusted for climate change.

The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extreme climate scenarios as well as the omission of projected climate change effects on key inputs (e.g., precipitation, evapotranspiration, imported water flows), then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Ensure that Appendix I, including a description of the rainfall-runoff-recharge model, is included in the GSP.
- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Integrate climate change into precipitation and evapotranspiration inputs and include the values in the projected water budget tables.
- Integrate climate change into surface water flow inputs, including imported water, for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around domestic wells, GDEs, and ISWs in the basin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

Figure 7-1 (Groundwater Level Monitoring Wells) shows insufficient representation of GDEs and drinking water users for groundwater elevation monitoring. Figure 7-2 (Water Quality Monitoring Wells) shows

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

insufficient representation of drinking water users for water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP includes plans to install three shallow monitoring wells near the Prado Wetlands to monitor GDEs in this area. However, our comments above note that since this is the only area of the basin where SMC to protect ecosystems have been established, the GSP disregards other areas of the basin where GDEs and ISW may exist. Additional monitoring may be needed to adequately assess the presence of GDEs and ISWs and to monitor the impact of SMC on these ecosystems.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMWs in the shallow aquifer across the basin as needed to map ISWs and adequately monitor all groundwater condition indicators across the basin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMWs.
- Ensure groundwater elevation and water quality RMWs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Further describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the “Multi-Benefit Recharge Project Methodology Guidance Document.”[20]

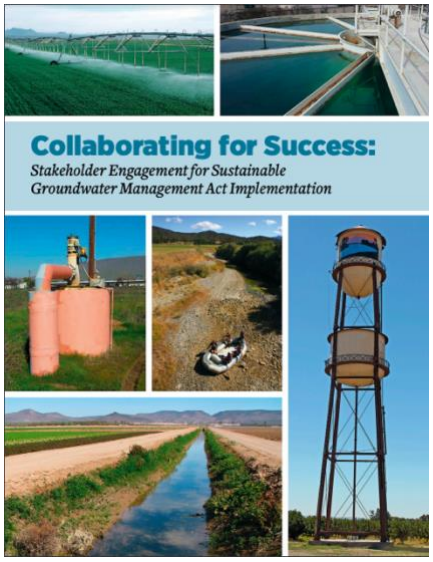
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



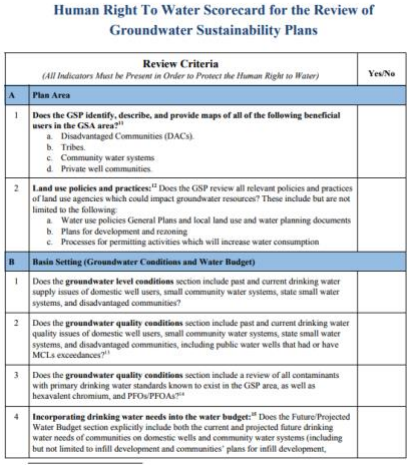
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

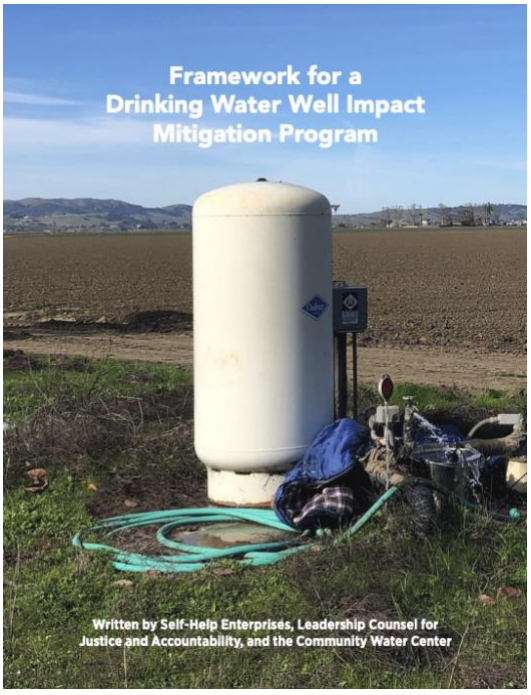


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[43] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems. d. Private well communities.	
2	**Land use policies and practices:**[44] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[45]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[46]	
4	**Incorporating drinking water needs into the water budget:**[48] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

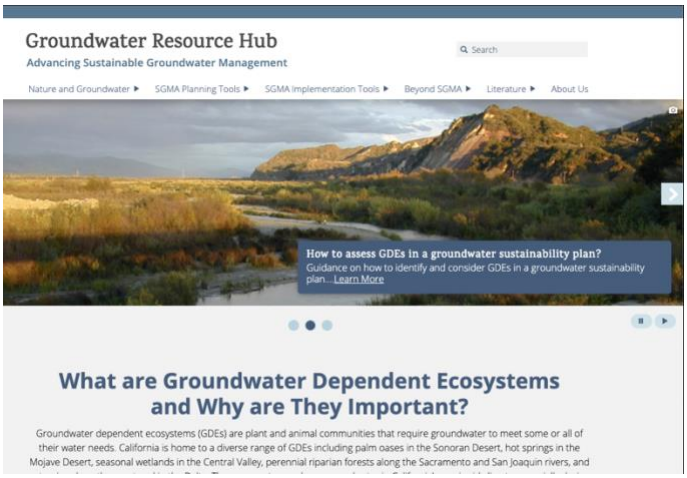
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

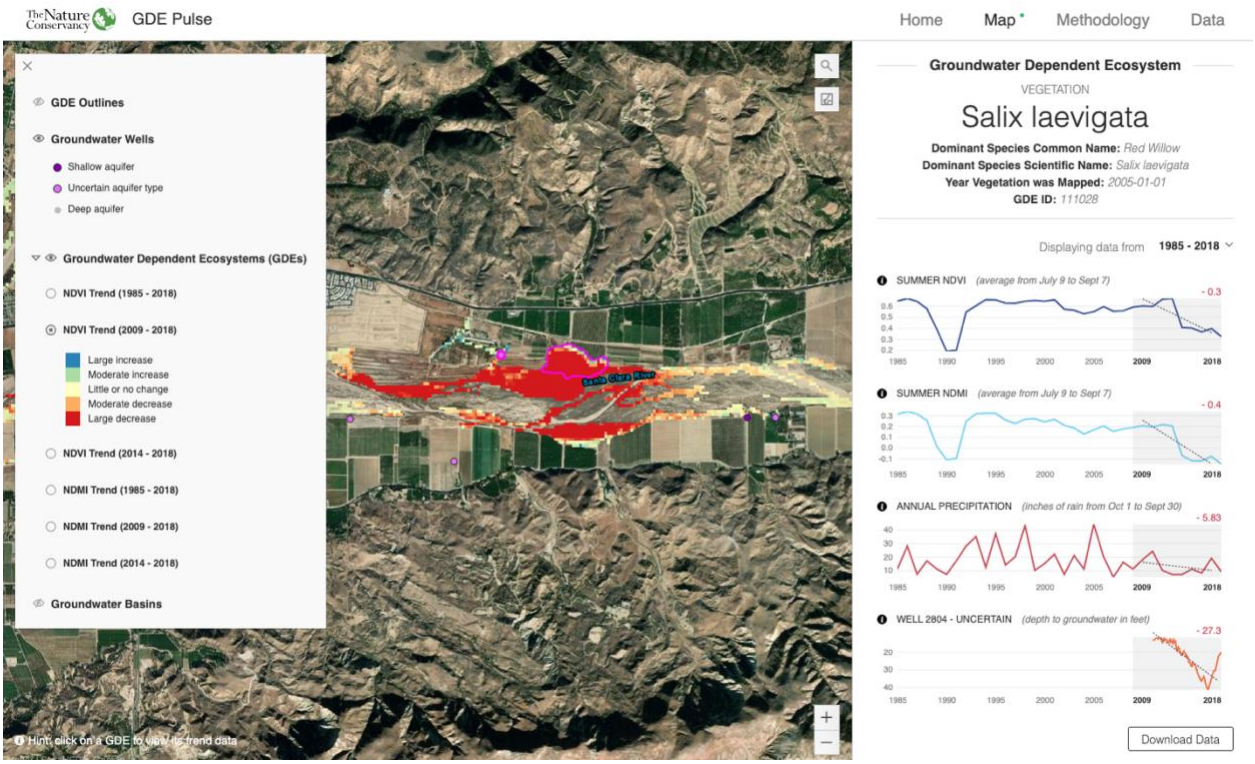
How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

---

[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

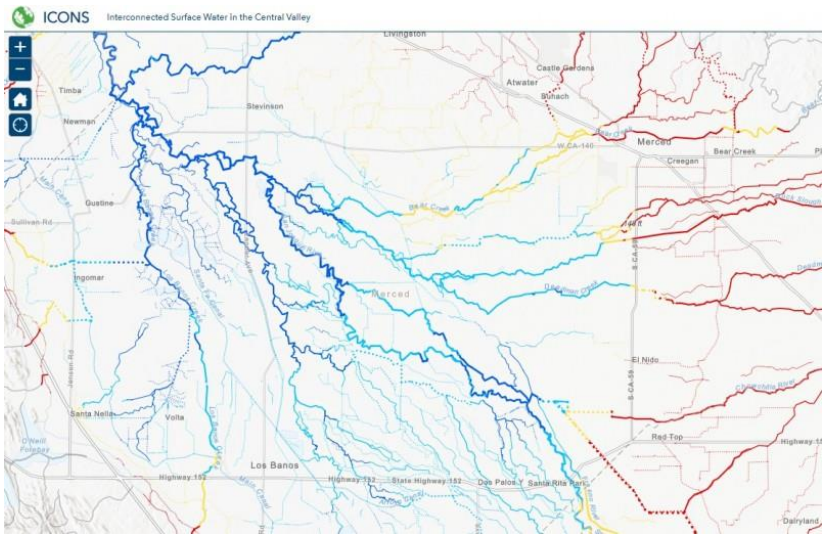
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Temescal Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Temescal Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Aechmophorus clarkii	Clark's Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Megaceryle alcyon	Belted Kingfisher			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
CRUSTACEANS				
Hyalella spp.	Hyalella spp.			
FISH				
Catostomus santaanae	Santa Ana sucker	Threatened	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC

Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Apedilum spp.	Apedilum spp.			
Chaoboridae fam.	Chaoboridae fam.			
Chironomus spp.	Chironomus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Ephydridae fam.	Ephydridae fam.			
Fallceon spp.	Fallceon spp.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Nanocladius spp.	Nanocladius spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Psychodidae fam.	Psychodidae fam.			
Simulium spp.	Simulium spp.			
Thienemannimyia spp.	Thienemannimyia spp.			
MOLLUSKS				
Gyraulus spp.	Gyraulus spp.			
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
PLANTS				
Arundo donax	NA			
Baccharis salicina				Not on any status lists
Marsilea vestita vestita	NA			Not on any status lists

Attachment D

The Nature Conservancy

July 2019



IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

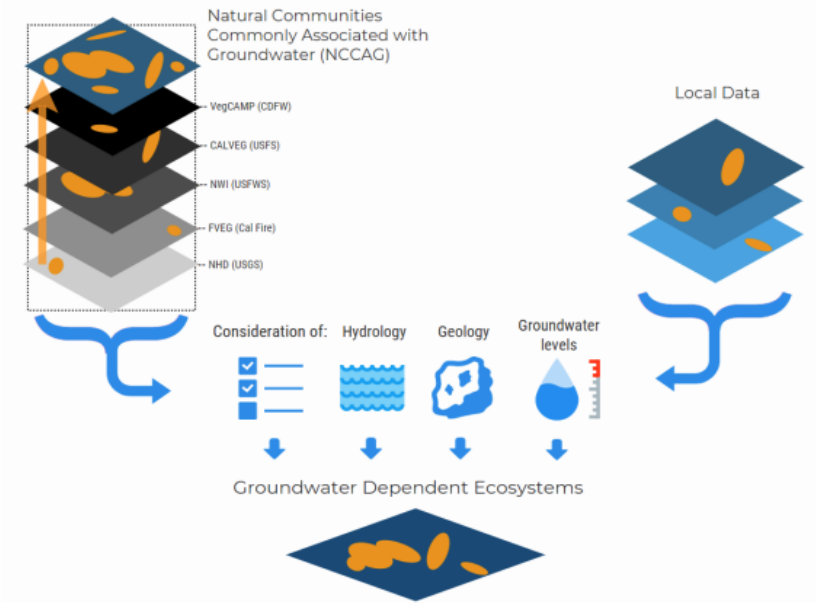


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

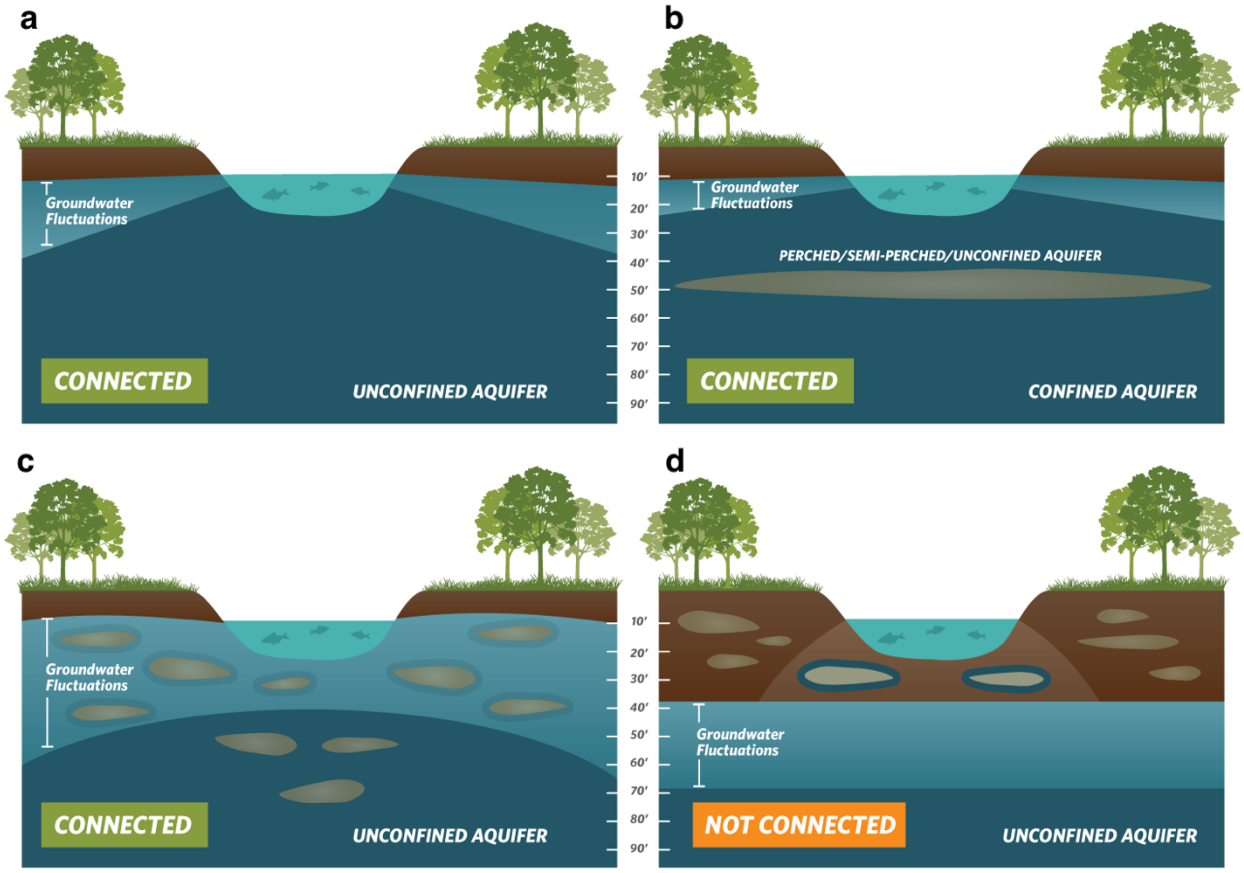


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

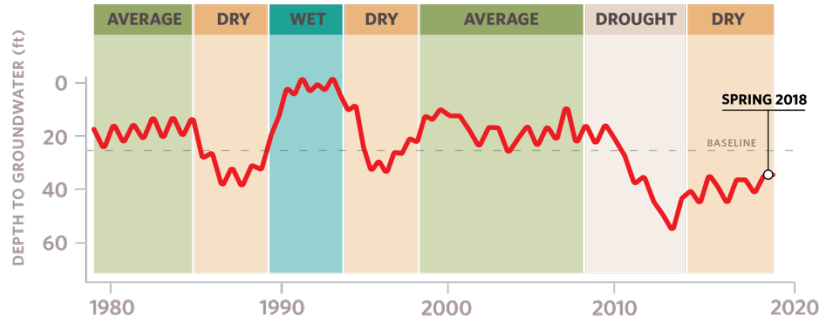


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

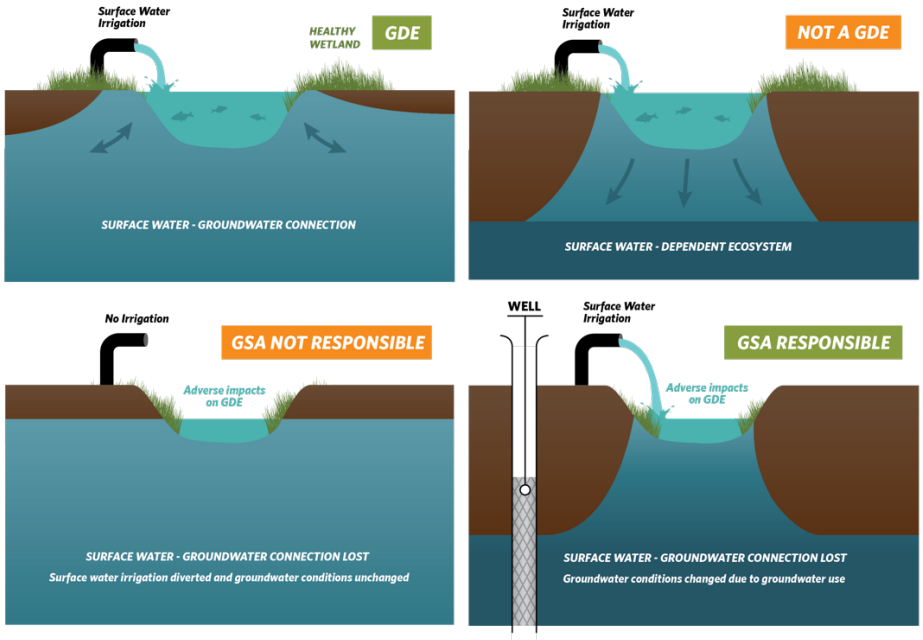


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

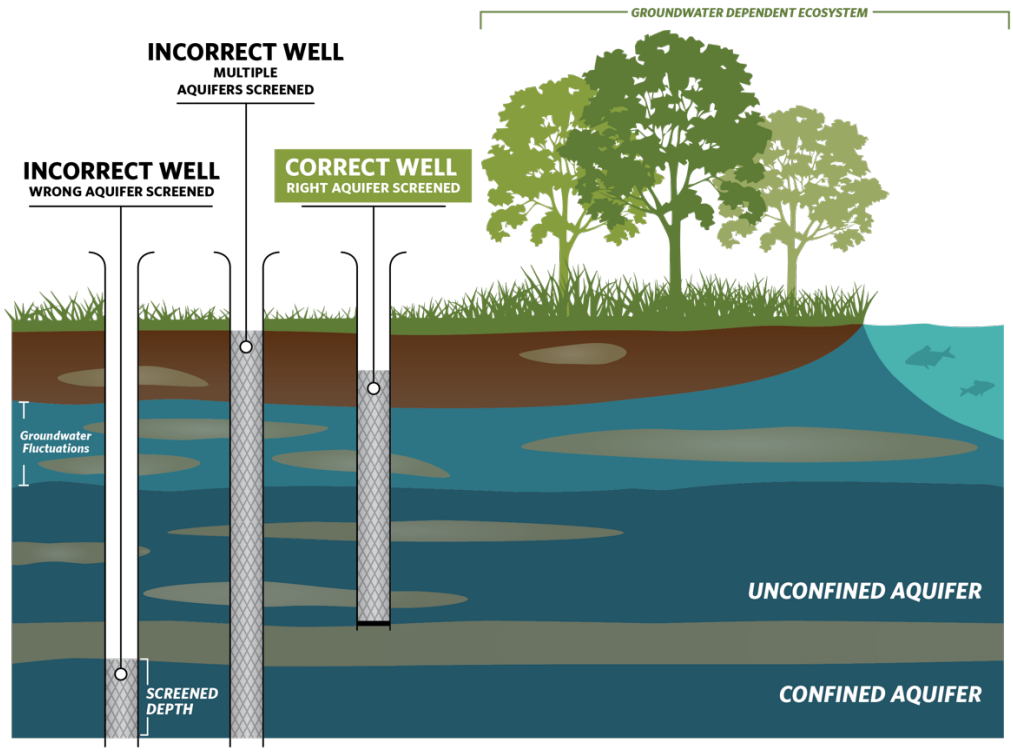


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

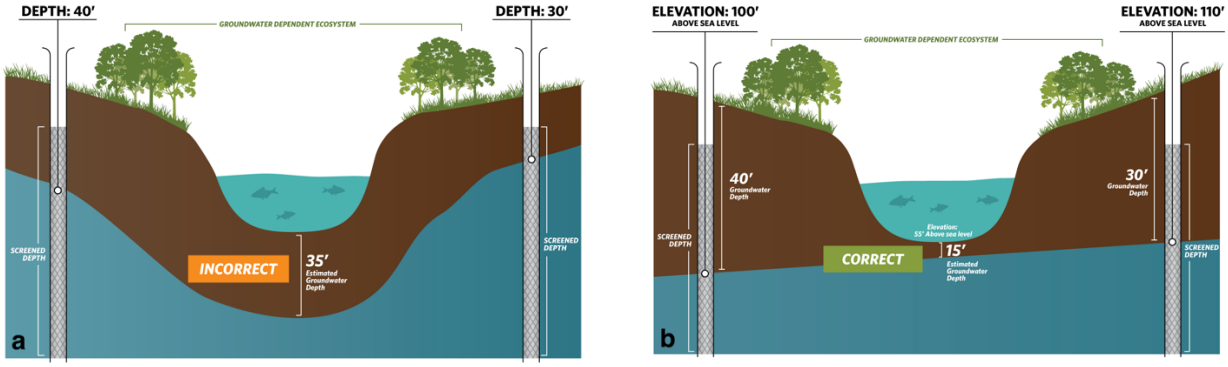


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

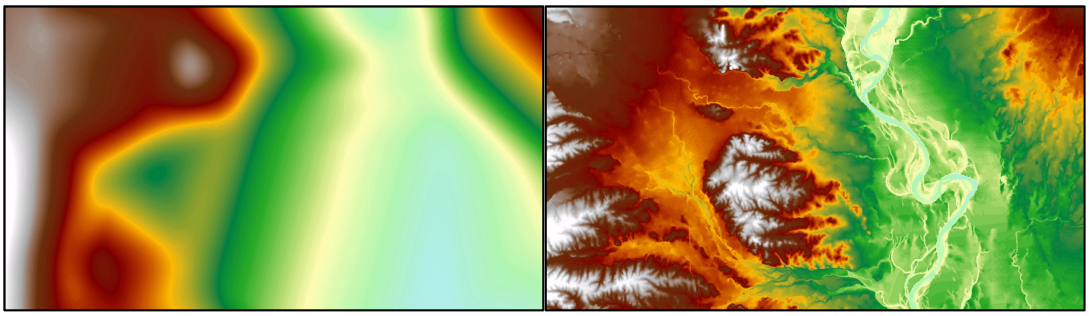


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

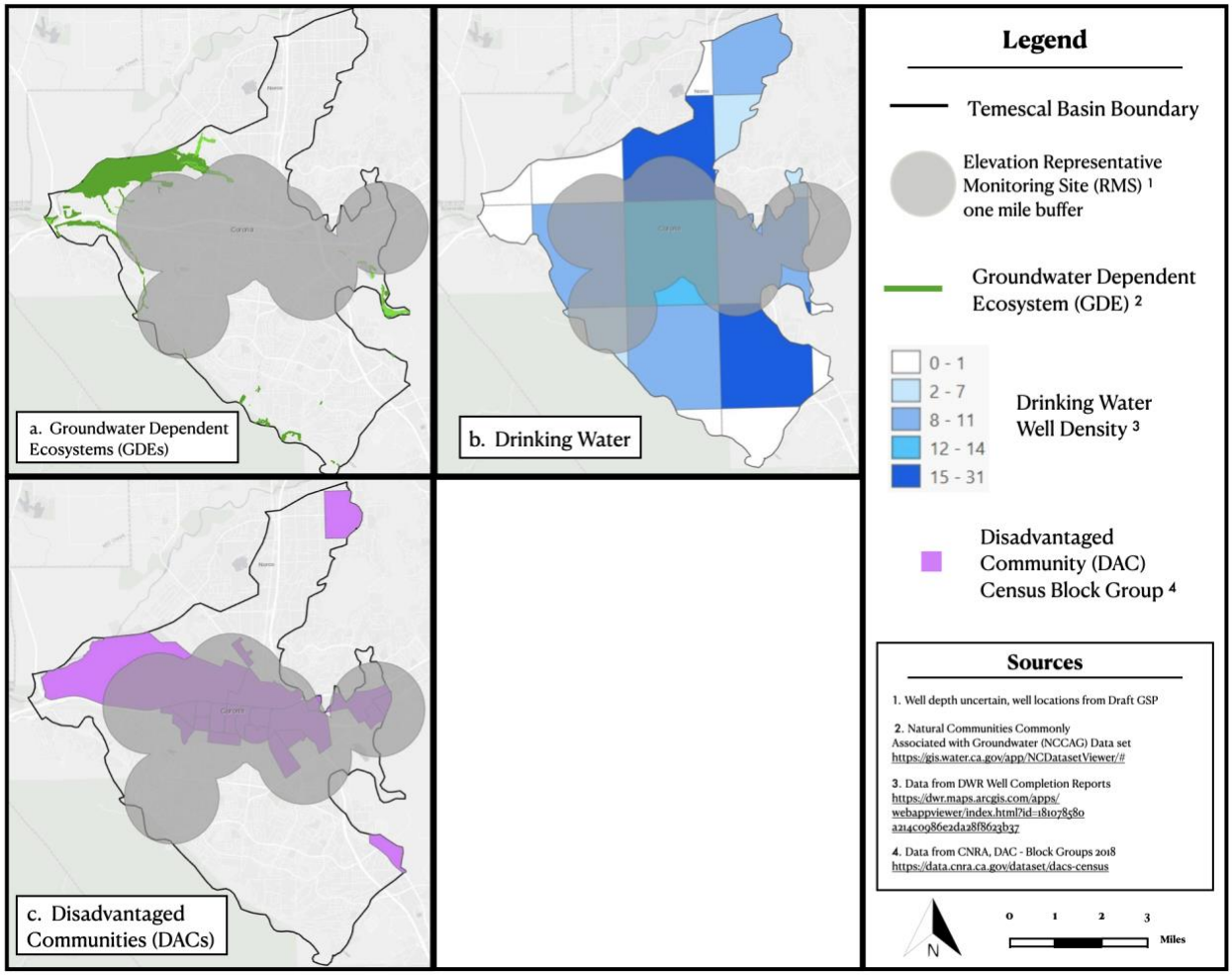


Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

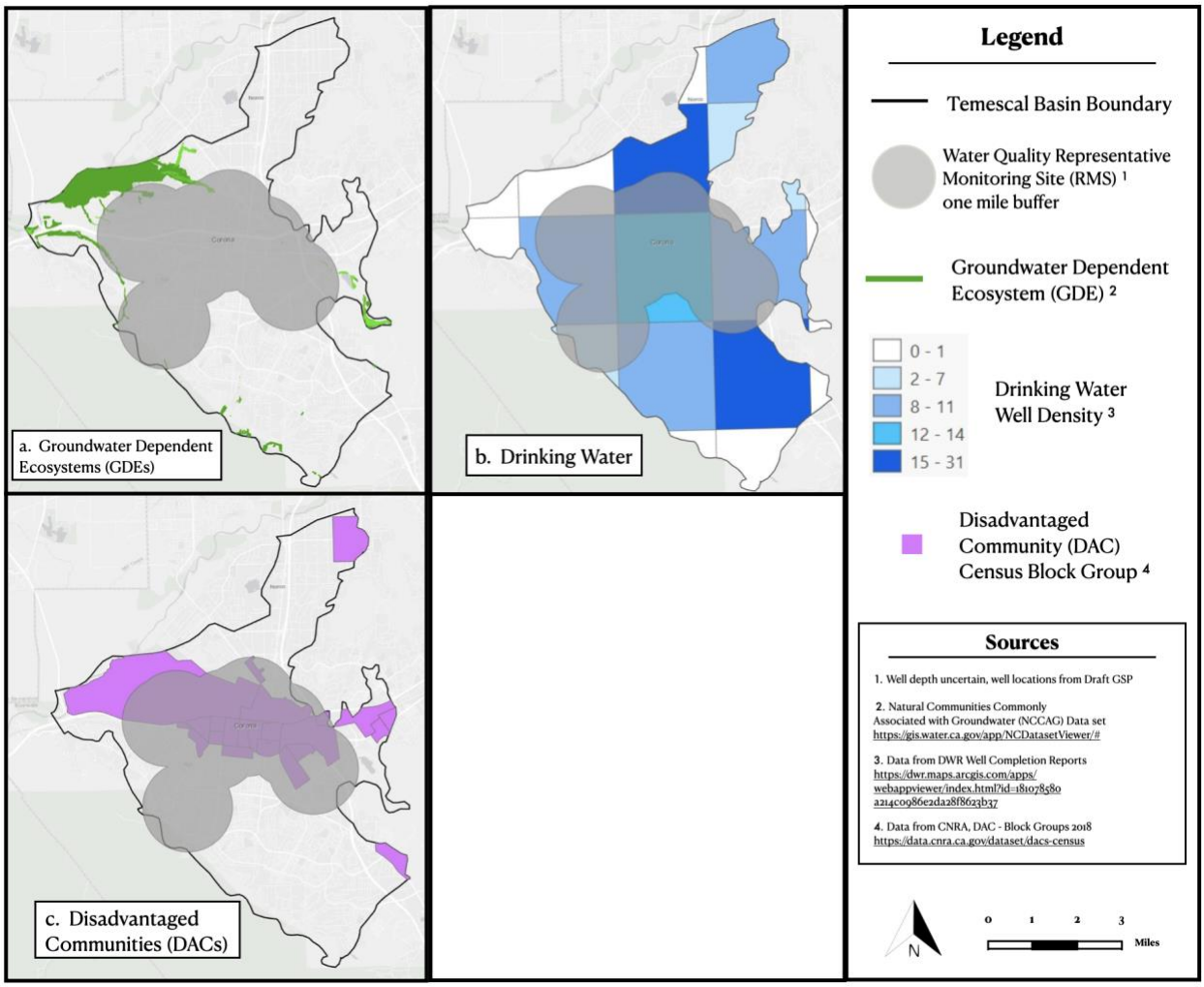


Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

City of Corona
Utilities Department
"Protecting Public Health"

Office: 951.736.2234
Fax: 951.735.3786

755 Public Safety Way
Corona, CA 92878 – www.CoronaCA.gov

January 13, 2021

To: Ngoro Atume – Clean Water Action/Clean Water Fund
Dr. J. Pablo Ortiz-Partida – Union of Concerned Scientists
Samantha Arthur – Audubon California
Danielle V. Dolan – Local Government Commission
E.J. Remson – The Nature Conservancy (TNC)
Melissa M. Rohde – The Nature Conservancy

RE: Public Comment Letter for the Temescal Basin Draft GSP Dated December 4, 2021

The Temescal Groundwater Sustainability Agency (GSA) appreciates your thorough review of our Groundwater Sustainability Plan (GSP). Throughout the process, the Temescal GSA has encouraged and welcomed public input, including the comment letter you submitted on December 14, 2021. We have reviewed your comments. Detailed responses to your comments, including identification of edits to the GSP, are provided below.
Responses are organized according to the Specific Comments in Attachment A of your December 14, 2021 comment letter, which is attached for reference.

COMMENT 1. ***Beneficial uses and users are not sufficiently considered in GSP development.***

COMMENT 1a. ***Human Right to Water considerations are not sufficiently incorporated.***

Multiple topics were included in this comment; these are presented with responses by topic below.

Comment:

The identification of Disadvantaged Communities (DACs) and drinking water users is insufficient.

Response:

The text in Section 2.8.4 discusses DACs within the Basin and the DACs are delineated in Figure 2-13. This section specifically addresses the fact that the DAC and SDAC areas of the Basin are within the service areas of the City of Corona (Corona) and the Home Gardens County Water District (HGCWD) and that there are no active private wells within these areas.

Comment:

The identification of Interconnected Surface Waters (ISWs) is insufficient, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of aerial photos to analyze stream reaches and presents analysis of stream gage and groundwater elevation data. The spring 2017 depth to water data are the only data discussed when referring

to depth to water. However, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. The use of data from one point in time does not reflect the temporal (seasonal and interannual) variability inherent in California's climate.
On the map of stream reaches in the basin (Figure 4.17 Regional Surface Water Features), the reaches are not labeled as interconnected and disconnected, nor are areas with data gaps noted. Therefore, potential ISWs are not being identified, described, nor managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

Response:

We have modified Figure 4-21 so that all stream reaches are designated "mostly interconnected", "mostly not interconnected" or "disconnected". Interconnection can vary over time and over short distances along a stream. The "mostly interconnected" category is one where the water table is shallow enough to allow phreatophytic riparian vegetation to become established and develop tall stature and dense canopy. The "mostly not interconnected" category is assigned to reaches that might have shallow water table conditions or gaining stream flow under wet conditions, but not with enough frequency or duration to develop dense riparian vegetation.

"Disconnected" stream reaches are ones where the water table of the regional groundwater system is almost always 30 or more feet below the stream bed elevation. This can occur where surface flow from tributary watersheds enters the Basin. The regional water table is far below the stream bed at those locations, but persistent base flow in the tributary streams can create enough soil saturation in the stream banks along a short reach of stream to support lush riparian vegetation. Examples include the dense riparian vegetation along Temescal Wash for about 1 mile downstream of the Basin boundary and several NCCAG riparian vegetation polygons along the western margin of the Basin.

The depth to water in the three wells closest to the Temescal Wash vegetation (south of well Corona 13 in Figure 4-1) was historically 50-150 feet below the ground surface. Depth to water increases from the center of the Channel Aquifer area toward the margins of the Basin because the ground slope (0.04-0.13 ft/ft from Figure 3-1) is four or more times steeper than the water table slope (about 0.01 ft/ft from Figures 4-10 and 4-11). Thus, the depth to water at the Temescal Wash riparian vegetation is likely greater than the 50-150 foot range of the three wells farther north. Groundwater elevations at the vegetation location is not considered a data gap because available data indicate that the regional water table could not plausibly be less than 30 ft below the ground surface.

Water level data for the four wells midway along the western margin (see Figure 4-1) are available from the 1930s to 1970s. Depths to water were generally 100-180 feet, and 185-220 feet in the southernmost of those wells. Water levels could not plausibly have risen 70-150 feet in that region in the past 60 years. Thus, there is no data gap with respect to water table elevation at those NCCAG

polygons. The vegetation is clearly disconnected from the regional groundwater system that is the focus of this GSP.

Three wells near the north end of the western Basin margin (near State Highway 91) also have historical water levels from the 1930s to 1960s, which were generally 85-105 feet below the ground surface. The ground elevation at the wells is roughly the same as the bed elevation at the nearest point along Wardlow Wash. Riparian tree cover is fairly dense along much of the Wash, and the NCCAG mapping indicates that cottonwood (an obligate phreatophyte) and sycamore (a facultative phreatophyte) are the most common tree species. Intervening hydrogeology—such as the faults shown in Figure 3-6—could result in a higher water table at Wardlow Wash than at the wells, but by the same token that hydrogeology would block the spread of pumping drawdown from the wells to the wash. Wardlow Wash is conservatively classified as "mostly interconnected" in Figure 4-17.

The comment requests additional contour maps of groundwater elevation, apparently on the assumption that seasonal or annual fluctuations in groundwater elevation change the lengths or locations of interconnected stream reaches. The GSP presents contour maps for two dates (fall 2015 in Figure 4-10 and spring 2017 in Figures 4-11 and 4-21), not just one date as implied by the comment. Transient changes in depth to water are also shown in the hydrographs in Figures 4-2 through 4-9, each of which indicates the ground surface elevation at the well. More importantly, long-term variations in spring groundwater elevation have been on the order of 20 feet even in the heavily pumped Channel Aquifer area (Figures 4-2 through 4-9). Variations are likely smaller in the alluvial aquifer area where pumping stresses are much smaller. That magnitude of variation is not large enough to fundamentally alter the designation of stream interconnection status or riparian vegetation interconnection status.

Comment:

The identification of Groundwater Dependent Ecosystems (GDEs) is incomplete. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, the GDE section of the GSP could be improved by more clearly describing and mapping the basin's GDEs to show the data sources and areas of data gaps. Figure 4-21 (Critical Habitat Areas) shows a map layer called "NCCAG riparian vegetation," however based on the description in the text, it is not clear if this is the entire NC dataset or if any screening criteria were used to modify the mapped potential GDEs. The GSP text (p. 4-17) discusses the corridor of dense riparian trees and shrubs along the bedrock reach of Temescal Wash between the Bedford-Coldwater Subbasin and the Temescal Basin, but does not explicitly state the data source (i.e., field verification) or whether this vegetation is included in the set of potential GDEs. Data gaps are described in the text, but the areas of data gaps are not clearly labeled on the map.

The GSP discusses trends in groundwater elevations over the period 2010 to 2020 and plots a limited set of hydrographs over this period in Figure 4-23. However, the only depth to groundwater contours show are from Spring

2017. The GSP could be improved by mapping depth to groundwater contours over multiple years and seasons to illustrate the temporal (seasonal and interannual) variability inherent in California's climate.

Response:

The comment inquired about the source of the vegetation mapping. The area mapped as "dense riparian vegetation" along Temescal Wash was delineated for this GSP by outlining areas of dense riparian vegetation visible in recent high-resolution aerial photographs (Google Earth©). The riparian vegetation polygons shown in Figure 4- 21 include all of the NCCAG mapped polygons. The Prado Wetlands boundary is from the Prado Basin Habitat Sustainability Program (WEI 2020). The figure does not show NCCAG wetland polygons. Almost all of those polygons are within or immediately adjacent to NCCAG riparian vegetation polygons, and conclusions regarding depth to groundwater and interconnection are consequently the same. One small polygon is mapped where a canyon enters the Basin near the Main Street stormwater detention basin. That polygon is plausibly supported by groundwater leaking from fractured bedrock in the tributary watershed. That source is not affected by Basin management, and the depth of the regional water table at the wetland location is greater than the few feet required by wetland vegetation, for the reasons explained above. A couple of tiny mapped wetland polygons in the middle of the stormwater detention basin are bare dirt in aerial photographs and were at best transient patches of mesic vegetation that appeared after a storm event.

Comment:

Native vegetation and managed wetlands are water use sectors that are required to be included into the water budget. The integration of these ecosystems into the water budget is insufficient. Appendix I (Temescal Groundwater Sustainability Plan Numerical Groundwater Model Documentation Report) that accompanies the water budget section of the GSP was not included in the published version of the Draft GSP. Without this Appendix of the GSP, which documents the water budgets, we could not evaluate whether the water budget includes the current, historical, and projected demands of native vegetation. Inclusion of the explicit demands for native vegetation is essential so that key environmental uses of groundwater are being accounted for as water supply decisions are made using this budget and considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

Response:

The comment stated that the GSP does not discuss managed wetlands. While the exact phrase "management wetlands" was not used, the text clearly indicates that Prado wetlands are managed: "Prado Dam impounds the river to regulate flood flows in winter and sustain a perennial wetland…. Surface water behind the dam is maintained at a specified elevation" (Section 4.10.4). We have inserted the word "managed" in the text for clarity.

COMMENT 1b. ***Public trust resources are not sufficiently considered. Stakeholder engagement during GSP development is insufficient.***

Response:

The Temescal GSA encouraged stakeholder engagement throughout the GSP process. Outreach efforts included website updates, individual phone calls, email, and postal mail. Domestic well owners, environmental stakeholders, and the community at large were invited to participate through these communication mediums, and there was participation in GSP development from private pumpers and other interested parties. Local DAC representatives and environmental stakeholders were contacted early in GSP development and invited to participate, including receiving invitations to attend and participate in Technical Advisory Committee (TAC) meetings. However, these individuals and agencies declined the invitation to be on the TAC and generally did not participate either the well-advertised public workshops or the public TAC meetings. Information regarding targeted outreach to DACs was included in the draft GSP.

The GSP does document the outcome of the outreach and engagement through presentation of notes from all public meetings in Appendices F, G, and H of the draft GSP. Very little feedback was received during these public meetings. However, all feedback was considered in development of the GSP.

The comment criticizes the plan for ongoing engagement in GSP implementation. The draft GSP indicated that TAC meetings will continue during GSP implementation. These are public meetings open to all interested parties, including DACs, domestic well owners, and environmental stakeholders. So, it is the opinion of the GSA that continued TAC meetings does constitute a plan for continual opportunities for engagement for all interested parties.

There are no known tribal lands within the Temescal Basin.

COMMENT 1c. ***Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users are not sufficiently analyzed.***

Multiple topics were included in this comment; these are presented with responses by topic below.

Comment:

For chronic lowering of groundwater levels, minimum thresholds are defined at each representative well as historical groundwater low levels. The GSP discounts private domestic wells when establishing SMC, based on the following rationale (6-6): "There are very few active private wells in the Basin (see Section 2.3.2.1). The owners and operators of those wells are known and they have not reported any adverse effects to those wells in the past; None of the existing private well owners report that their wells went dry or were otherwise affected during the recent drought. Because of this, some flexibility exists for purposes of analysis; Responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner; there is a reasonable expectation that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts; As discussed below, MTs are initially set at historical groundwater level lows and then adjusted upward to be protective." No further details are provided regarding the minimum threshold impacts on domestic wells. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not

protected by the minimum threshold. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or drinking water users when defining undesirable results, nor does it describe how the groundwater levels minimum thresholds are consistent with Human Right to Water policy.

Response:

The quoted text from the GSP specifically addresses all private wells and does not discount domestic wells. The quoted text also references an earlier section of the GSP which states the following:

> *The GSA agencies searched for existing active wells within the Basin. This search included reviewing water use records and contacting owners of large private properties (domestic, commercial, and industrial), inquiring about private wells in discussions with knowledgeable local residents and community leaders, and polling interested parties during public meetings. This effort indicated that the only private pumpers in the Basin are All American Asphalt, Dart Corporation, and 3M. No active private domestic wells were identified in this search.*

The comment ignores these earlier statements that clearly indicate that there are no known active domestic wells in the Basin. The GSA believes that all domestic water use in the Basin is supplied by the municipal water purveyors that make up the GSA (the cities of Corona and Norco and the Home Gardens County Water District). This includes the DAC areas of the Basin. The known private wells in the Basin are operated by industrial water users who have reported no previous problems with water shortages. Additionally, no private wells have been reported to have water shortages for the Basin in the DWR led *Household Water Supply Shortage Reporting System*. Therefore, it is the opinion of the GSA that the use of historical minimum groundwater elevations as the minimum threshold for water levels is protective of all groundwater users.

Comment:

For degraded water quality, constituents of concern (COCs) are total dissolved solids (TDS) and nitrate. The minimum threshold for nitrate is defined as the percentage of wells with concentrations exceeding the nitrate MCL (45 mg/L) based on current conditions (2015-2019), which is 50% of wells. The minimum threshold for TDS is defined as the percentage of wells with concentrations exceeding the TDS value of 1,000 mg/L based on current conditions (2015-2019), which is 26 percent of wells. However, according to the state's anti-degradation policy, water quality should be protected and is only allowed to worsen if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made.

Response:

There is no indication that water quality will worsen in the Basin due to groundwater management. The minimum thresholds for water quality are designed to recognize baseline conditions and monitor the Basin for potential changes related to groundwater management. The minimum threshold would be exceeded If water quality is significantly degraded and additional projects and

management actions would be triggered. In addition, groundwater in the Temescal Basin is treated before being delivered to municipal customers, there are no known domestic wells that use untreated groundwater for drinking water or any other potable uses.

Comment:

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC.

Response:

The comment correctly notes that the short paragraph on impacts of the water-level minimum threshold on beneficial (Section 6.2.4) uses does not mention interconnected surface water or GDEs at all. We have added a sentence directing the reader to the interconnected surface water sustainable management criteria section (specifically section 6.7.6.1), where the consistency of the interconnected surface water minimum threshold and water-level minimum threshold is explicitly discussed, and to Sections 4.10.4 and 6.7.4 which lay out the evidence that changes in Prado Wetlands vegetation have not historically correlated with changes in water levels in production wells north or south of the Wetlands. Noticeable vegetation die-back along Temescal Wash where it enters the Prado Wetlands started around 2009 and has been attributed to decreased base flows in Temescal Wash (McMichael 2021). No shallow water table information is available for that area and time period. This is an important data gap that will be filled by installing shallow monitoring wells in the southern Prado Wetlands area.

COMMENT 2. ***Climate change is not sufficiently considered.***

Response:

The comment states that “the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget.” The comment appears to be referring to two alternative sets of monthly climate multipliers provided in the files of climate change factors downloadable from the SGMA Data Portal. Those sets of factors are labeled Drier/Extreme-Warming (DEW) and Wetter/Moderate-Warming (WMW). There is no requirement to use anything but the expected factors. The California Department of Water Resources (DWR) document “Guidance for Climate Change Data Use during Groundwater Sustainability Plan Development” does not even mention the alternative data sets. Rather, Section 4.5 of the guidance document states that uncertainty in climate change predictions is represented by inter-annual variability in the 50-year future simulations. It also states that the evaluation of sustainability will be based on the “central tendency” of the climate change factors, which is represented by the primary climate factor data set. The

DEW and WMW data sets are for optional research purposes. Therefore, the climate change analysis in the GSP is adequate.

COMMENT 3. ***Data gaps are not sufficiently identified and the GSP does not have a plan to eliminate them.***

Response:

In the context of SGMA, a data gap is "a lack of information that significantly affects the understanding of basin setting or evaluation of the efficacy of the Plan implementation and could limit the ability to assess whether a basin is being sustainably managed." Data gaps were identified in the monitoring network (Chapter 7), and construction of new shallow monitoring wells for interconnected surface water monitoring are included in a project in Chapter 8 of the draft GSP. The comment asserts that the wells in the monitoring network do not adequately represent GDEs and drinking water users. The new shallow monitoring well project is specifically designed to represent GDE and interconnected surface water conditions, and as noted in previous responses, drinking water users in the Basin receive water supply directly from the agencies that make up the GSA. The wells these agencies use are adequately monitored in the existing monitoring network. The comment also asserts that the monitoring network does not adequately identify data gaps in the shallow aquifer. However, there is not a shallow aquifer in the Temescal Basin that is separate from either the principal or secondary aquifer, as described in Chapter 3.

COMMENT 4. ***Projects and Management Actions do not sufficiently consider potential impacts or benefits to beneficial uses and users.***

Response:

The comment claims that the projects and management actions in the GSP do not completely identify benefits or impacts to all beneficial users. The projects and management actions in the GSP do assess effects on beneficial uses and users consistent with SGMA. The recommendations related to this comment specifically request the addition of discussion and mitigation for DAC and domestic well owners. As noted in previous responses, there are no known domestic well users within the Basin. The agencies that make up the GSA are municipal water purveyors who provide service to domestic, municipal, commercial, and industrial users throughout the Basin, including the DAC areas. Climate and water delivery uncertainties have been included in the water budget analysis (Chapter 5).

OCWD Comments on: Draft Temescal Basin Groundwater Sustainability Plan, September 2021.

The Orange County Water District (OCWD) is responsible for managing the Orange County Groundwater Basin, which is part of the Coastal Plain of Orange County Groundwater Basin (DWR Basin 8-1). In 2017, OCWD, along with partner agencies, submitted an Alternative to a Groundwater Sustainability Plan (Alternative) to the Department of Water Resources (DWR) to show that Basin 8-1 had been sustainably managed over the last 10 years. DWR approved the Alternative on July 17, 2019.

OCWD thanks the Temescal Basin Groundwater Sustainability Agency (GSA) for reaching out and including OCWD in the public participation process of developing the Temescal Basin Groundwater Sustainability Plan (GSP or Plan). Not only is the Temescal Basin adjacent to Basin 8-1, Coastal Plain of Orange County Groundwater Basin, OCWD owns and manages wetlands and a large area of riparian habitat behind Prado Dam that is within the Temescal Basin. The health of this riparian habitat is dependent on surface flows of the Santa Ana River (SAR) and its tributaries as well as rising groundwater. There are data gaps within this area that need to be filled, particularly with respect to interconnected surface water. A number of studies are ongoing by multiple agencies to better understand the impacts of increased recycling of SAR water and groundwater pumping on SAR flows and rising groundwater and their potential impacts to interconnected surface water and riparian vegetation.

Our detailed comments are presented below, but in general, our comments can be summarized as follows:

1. Additional data needs to be obtained in the north end of the Temescal Basin and Prado Basin to adequately characterize the interconnection of surface water and groundwater and establish the appropriate sustainability criteria and minimum thresholds.
2. The Temescal Basin GSA needs to closely coordinate with adjacent upstream groundwater basins, such as the Chino Basin, to ensure that their groundwater management activities do not create undesirable results in the Temescal Basin, particularly in the area of interconnected surface water and groundwater.

OCWD provided prior comments on the Temescal Basin GSP, Draft Plan Area, Sept. 2020. These comments are presented in Attachment A for completeness.

OCWD is providing initial comments on the Draft GSP in this letter and may follow up with additional comments during the public review period after the GSP is submitted to DWR.

The Regional Water Quality Control Board's Basin Plan defines the 'Prado Basin Management Zone'. It is defined as follows in the Regional Board's Basin Plan:

> The Prado Basin Management Zone is generally defined by the 566-foot elevation above mean sea level. It extends from Prado Dam up Chino Creek, Reach 1A and 1B to the concrete lined portion near the road crossing at Old Central Avenue, up the channel of Mill Creek (Prado Area) to where Mill Creek becomes named as Cucamonga Creek and the concrete-lined portion near the crossing at Hellman Road, up what was formerly identified as Temescal Creek, Reach 1A (from the confluence with the Santa Ana River upstream of Lincoln Avenue) (this area is indistinguishable because of shifting topography and is now considered a part of the Prado Basin Management Zone), and up the Santa Ana River, Reach 3 to the 566-foot elevation (just west of Hamner Avenue). The Prado Basin Management Zone encompasses the Prado Flood Control

Basin, which is a created wetlands as defined in this Plan (see the discussion of wetlands elsewhere in this Chapter). Orange County Water District's wetlands ponds are also located within the Prado Basin Management Zone.

OCWD, the Army Corps of Engineers and the United States Fish and Wildlife Service commonly refer to the reservoir area behind Prado Dam, up to elevation 566 feet, as 'Prado Basin'. In these comments, we will refer to the area using the terminology in the Regional Board's Basin Plan – as the 'Prado Basin Management Zone' or PBMZ.

Page ES-8, Sustainable Management Criteria. In this section, "The Minimum Threshold for depletion of interconnected surface water is the amount of depletion that occurs when the depth to the water along the southern edge of the Prado Wetlands is greater than 15 feet for a period exceeding one year." Later in the GSP, it is stated that this is an initial value subject to change as more data is collected. Based on the limited data available, this should be considered a starting point to be refined as the large existing data gaps in the northern part of the Temescal Basin and the PBMZ are filled. Additionally, the minimum threshold should be linked to impacts on interconnected surface water and groundwater, such as adverse impacts on riparian vegetation.

Page 2-25, Section 2.8.5, Neighboring Basin Coordination. We are glad to see that Chino Basin is included in coordination and data sharing. The Chino Basin is adjacent to the Temescal Basin, and thus it is important that the Temescal Basin GSA monitor conditions in the Chino Basin to ensure they do not cause undesirable results in the Temescal Basin, particularly with respect to the interconnection of surface water and groundwater. OCWD provided comments on this issue and others during the public participation process, which are documented on pages 627-628.

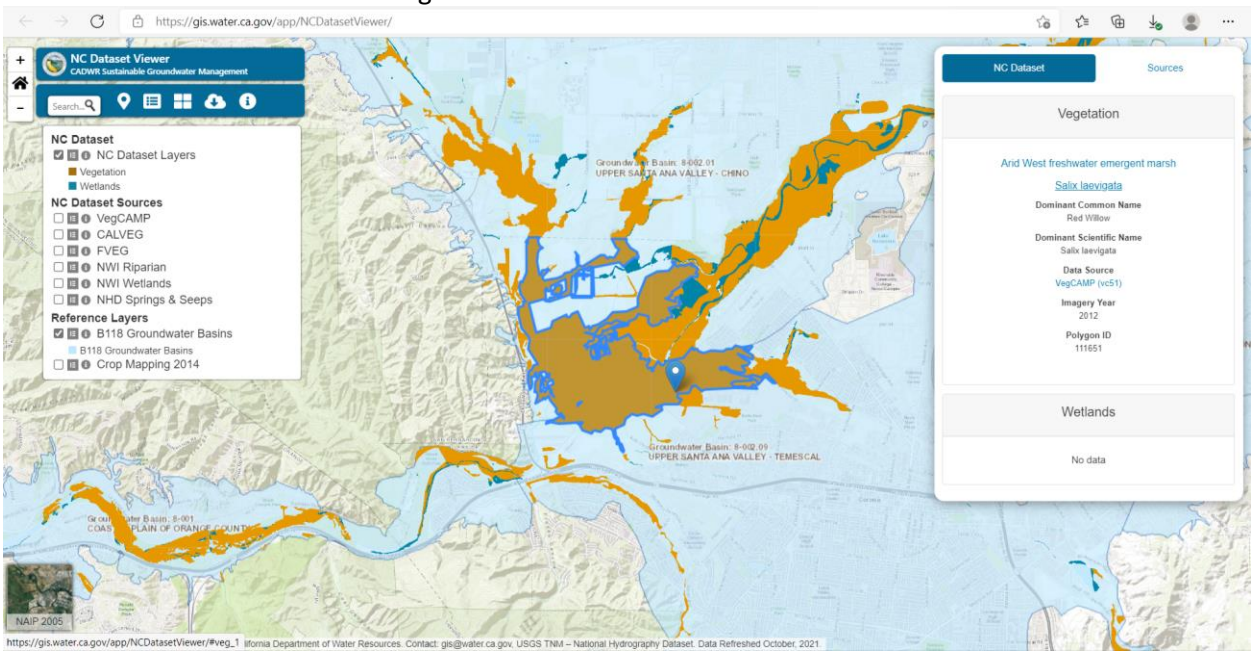
Page 4-12. Section 4.6.4 Monitoring Networks. We suggest that OCWD and other agency wells are included in the PBMZ to the Monitoring Network. OCWD is in the process of installing more than a dozen shallow monitoring wells in the PBMZ to provide more information on shallow groundwater conditions. These wells will be critical in understanding how groundwater management of the Chino and Temescal Basins impacts interconnected surface water and groundwater dependent ecosystems in the PBMZ.

Page 4-15. Section 4.10.1, Stream Flow Measurements. In the discussion of stream flow measurements on Temescal Creek as measured by the USGS gage at Main Street in Corona, CA (Gage No. 11072100), only recent data from 2012 to present is shown (Figure 4-18). In contrast, historical data for the outflow from Prado Dam from 1949 to present is shown. All available historical data from 1980 to present for the Temescal Gage at Main Street is shown in Figure 21 in Attachment B. It is important to note that a noticeable decline in minimum flows is noted in the mid-2000s and has been very low over the past decade. These reductions in flow are due to reduced discharges of treated wastewater and perhaps other factors and has adversely impacted the quantity and quality of riparian habitat in Temescal Creek. OCWD staff biologists reviewed historical aerial photographs and have prepared a summary of the changes noted since 1939, which is presented in Attachment B. This historical summary indicates that the quantity and quality of habitat in the lower reaches of Temescal Creek rapidly declined starting in approximately the mid-2000s. This area remains a good candidate to restore habitat and ecological health provided there was sufficient water supplies.

Page 4-15. Section 4.10.2, Depth to Groundwater. In this section, it is acknowledged that "available data are of limited use for this purpose due to insufficient vertical and geographic coverage." As mentioned above, OCWD has installed multiple new shallow monitoring wells and is the process of constructing additional monitoring wells in the PBMZ that will be critical to understanding interconnected surface water and groundwater in the north end of the Temescal Basin. We look forward to further development by the Temescal Basin GSA of the understanding of the interconnection of surface water and groundwater using data from OCWD wells, wells installed by the Temescal Basin GSA, and well installed by other agencies.

Page 4-17. Section 4.10.3, Riparian Vegetation. This section contains little information about the lower reach of Temescal Creek. This lower reach was very productive until the mid-2000s, when surface flows were reduced. See comments on Section 4.10.1, Stream Flow Measurements and Attachment B for more information on the history of vegetation in the lower reach of Temescal Creek. Section 4.10.3 also needs additional discussion of riparian vegetation in the PBMZ, in the area in and around the Corona Airport. Section 4.10.3 should identify the number of acres of riparian vegetation within the PBMZ (generally speaking the area below ground elevation 566 feet above mean sea level). A key source of data that should be included and shown below (Figure 1) is data from a joint effort of CA DWR and the Nature Conservancy to map areas referred to by DWR as 'natural communities commonly associated with groundwater (NC Dataset Viewer (ca.gov)).

Figure 1. NC Dataset Viewer for PMBZ



Page 4-18 to-21. Section 4.10.4, Wetlands and Interconnected Surface Water. Surface water can now be temporarily impounded behind Prado Dam up to elevation 505 ft msl during the flood and non-flood seasons. This change was approved by the US Army Corps of Engineers in April 2021. Please make the appropriate changes to the text of this section.

This section addresses the wetlands/riparian habitat and interconnected surface water in the PBMZ and the north end of the Temescal Basin. Within this section, multiple indirect lines of evidence are

presented in an attempt to show that the wetlands are sustained by surface flows and not groundwater. Clearly there are critical data gaps that need to be filled to adequately understand the interconnection of surface water and groundwater in the north end of the Temescal Basin and the PBMZ. The additional monitoring wells OCWD has and is installing will provide key data and should be utilized by the Temescal Basin GSA as it becomes available. In addition, the Integrated Santa Ana River Model (ISARM), that was used as part of the Habitat Conservation Plan (HCP), cannot be relied on in its current configuration within the PBMZ. Although the ISARM is a useful tool to evaluate watershed wide conditions, there are data gaps within the PBMZ that need to be filled in order to adequately calibrate the model to make it useful in understanding interconnected surface water and groundwater in the area. This may require the development of a PBMZ Sub-model that would include portions of the Temescal Basin

The draft GSP states:

> "The correlation of precipitation and river flow with Prado groundwater levels and the lack of correlation with groundwater pumping north and south of the wetlands indicates that the wetlands are primarily sustained by surface inflows."

Additionally, the draft GSP states:

> "The low importance of groundwater as a factor in managing Prado Wetlands is also implicit in the Upper Santa Ana River Habitat Conservation Plan (HCP) (ICF 2020)."

OCWD disagrees with these statements. The statement about the perceived lack of correlation with Prado groundwater levels and groundwater pumping north and south of the wetlands should be revised to account for the following factors:

- Historical pumping north of the PBMZ in the Chino Basin may not be of sufficient magnitude to induce observable historic changes in groundwater elevation in the PBMZ. This is particularly the case since there have been some changes in overall pumping in the southern portion of the Chino Basin as agricultural-related groundwater production has declined (see for example the report '2013 Chino Basin Groundwater Model Update and Recalculation of Safe Yield Pursuant to the Peace Agreement', prepared by Wildermuth Environmental Inc for Chino Basin Watermaster, October 2015).
- The ability to observe changes in groundwater elevations in the PBMZ and relate changes to a particular factor like pumping can be obscured or made more complicated to detect due to recharge of groundwater from surface water.
- There is an overall lack of sufficient historical groundwater elevation data on the eastern side of the PBMZ, such as near the Corona Airport; this lack of sufficient data restricts or limits the ability to reach definitive conclusions regarding the impacts of pumping on groundwater levels.
- Surface water and groundwater are connected in the PBMZ and also along the Santa Ana River upstream of the PBMZ. Surface water flow in the SAR and its tributaries upstream of the PBMZ and surface flow into the PBMZ help support groundwater levels as surface water flows recharge the shallow groundwater system.
- The flow rate in the Santa Ana River and its tributaries such as Temescal Creek and Chino Creek are projected to decline in the future due to water recycling, stormwater capture, and other factors. As described in the Draft EIR for the Upper Santa Ana Habitat Conservation Plan (HCP), flows in the SAR reaching the PBMZ are estimated to decline in the low flow period (summer to early Fall) to approximately 35 to 40 cubic feet per second. With decreased flow in the Santa

> Ana River and its tributaries, groundwater levels in the PBMZ are anticipated to decline in the future. Under these future conditions, groundwater pumping may have a greater impact on groundwater levels in the PBMZ.

Regarding the state perceived low importance of groundwater as a factor in managing Prado Wetlands and information in the Upper Santa Ana River HCP, OCWD submitted extensive comments on the draft EIR for the HCP. These comments have not yet been addressed in writing and the EIR for the Upper Santa Ana HCP has not been certified. OCWD's comments on the draft EIR included several issues related to groundwater levels and riparian vegetation in the PBMZ. Additionally, the Upper SAR HCP public review draft document (May 2021) states:

> "The Upper Santa Ana River Sustainable Resources Alliance (Alliance) would create an account within SARCCUP, or other conjunctive use program, to purchase water that would be used to supply environmental flow. Alternatively, additional discharge from the aforementioned WWTPs could be purchased by the Alliance to provide supplemental flow."

Provision for supplemental flows to sustain environmental resources is included in the proposed HCP to account for uncertainty in model projections and potential impacts that may occur. The supplemental flows, if needed, would help recharge groundwater and support groundwater levels. It is not appropriate to state or imply that the HCP contains evidence that groundwater is of low importance in managing environmental resources such as riparian vegetation in the PBMZ.

A portion of the PBMZ is within the Temescal Basin. The GSP should identify the number of acres of the PBMZ that are within the Temescal Basin.

Page 5-19. Section 5.7.2.4, Riparian Evapotranspiration. The draft report says, "These calculations are applied at model cells within the Prado Wetlands where aerial photographs indicate the presence of potential riparian vegetation." The word 'potential' should be removed from this sentence. The number of acres of riparian habitat should be identified. There is clear evidence of riparian habitat in the portion of Temescal Basin within the PBMZ and there is also evidence that the riparian vegetation is dependent on interconnected surface water and groundwater. Attachment B discusses how riparian vegetation was negatively impacted when surface flows declined in the lower portion of Temescal Creek, within the PBMZ.

Page 6-4. Section 6.1, Summary of Sustainable Management Criteria. In this section, "The minimum threshold for depletion of interconnected surface water is defined as the historical minimum water levels (maximum depth to water) in shallow monitoring wells in the southern Prado area, where these shallow water level declines are correlated with Temescal Basin pumping and/or water levels."

First of all, this minimum threshold does not meet the definition established in Section 354.28(c)(6) of the Regulations, which states that "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results" (CCR, 2016). Minimum thresholds only apply to the interconnected stream reaches.

The PBMZ has Beneficial Uses identified in the Regional Water Quality Control Board's Basin Plan. The Beneficial Uses identified for the PBMZ include 'WILD' and 'RARE'. 'WILD' is defined in the Regional Board's Basin Plan as:

> Wildlife Habitat (**WILD**) waters support wildlife habitats that may include, but are not limited to, the preservation and enhancement of vegetation and prey species used by waterfowl and other wildlife.

'RARE' is defined as:

> Rare, Threatened or Endangered Species (**RARE**) waters support the habitats necessary for the survival and successful maintenance of plant or animal species designated under state or federal law as rare, threatened or endangered.

The PBMZ contains wildlife habitat for the least Bell's vireo, which is an endangered species identified by the US Fish and Wildlife Service. The US Fish and Wildlife Service has also identified critical habitat for the least Bell's vireo, and the PBMZ includes area with this designated critical habitat. Additionally, the RARE beneficial use occurs in the PBMZ by virtue of nest locations of the least Bell's vireo occurring in the PBMZ. As a result, the minimum threshold needs to consider not only the potential changes in surface water depletions caused by groundwater pumping and or management actions, but also impacts to the beneficial uses in the PBMZ.

Secondly, no data are presented to document what the "historical minimum levels" are. As noted in prior comments, there are data gaps in the northern Temescal Basin and PBMZ that need to be filled. As such, it is not possible to establish a minimum threshold until these data gaps are filled.

Finally, because the Temescal Basin is hydrologically connected to the Chino Basin and other basins, it is not possible to isolate the impacts of pumping in adjacent basins from those in the Temescal Basin. This is why it is critical that the Temescal Basin GSA monitor and coordinate with adjacent basins to ensure that their actions do not cause or contribute to undesirable results in the Temescal Basin.

Page 6-31. Section 6.6.6.1, Description of Measurable Objectives. Measurable objectives are presented for TDS and Nitrate. While we appreciate that the TDS of basin outflows is included, other constituents of concern should also be included. There are some constituents of concern that may have Maximum Contaminant Levels (MCLs) established in the future that may require additional actions to reduce concentrations in outflow to the Orange County Groundwater Basin, including stormwater.

Page 6-32 to 6-33. Section 6.6.2.1, Surface Water Users. Similar to Section 4.10.4, multiple lines of indirect evidence are used to imply that groundwater discharge to the PBMZ is not significant and not expected to decrease significantly in the future. As stated above, additional data needs to be collected and the ISARM needs to be further developed to better understand interconnected surface and groundwater interactions in the north end of the Temescal Basin and the PBMZ.

Page 6-33, Section 6.7.2.3, Riparian Vegetation. The conclusion that the wetlands are primarily sustained by surface water and not groundwater is based on Section 6.6.2.1. See comments on this section above.

Page 6-33. Section 6.7.3, Definition of Undesirable Results. This definition should include potential impacts to groundwater dependent ecosystems or natural communities commonly associated with groundwater. OCWD has been managing riparian vegetation in the PBMZ for many years to support the endangered least Bell's Vireo. Through these actions, the PBMZ has become one of the most heavily

populated areas of least Bell's Vireo in California. Any reduction in the quality of riparian habitat caused by impacts to surface/groundwater interactions could also affect least Bell's Vireo habitat.

Page 6-34. Section 6.7.6, Minimum Threshold. We are glad to see that it is acknowledged that there are data gaps and uncertainties regarding establishing the minimum threshold of depth to water exceeding 15 feet for more than one year. This threshold should be refined based on Section 354.28(c)(6) of the Regulations and OCWD comments on Section 6.1 above.

Page 6-35. Section 6.7.6.2, Effect of Minimum Threshold on Sustainability of Adjacent Areas. A key source of water supplies to the Coastal Plain of Orange County Groundwater Basin (Basin 8-1) is the baseflow of the Santa Ana River (SAR). SAR baseflow is a combination of surface flow and rising groundwater within the PBMZ. Any reduction in rising groundwater will result in reduced baseflow to Basin 8-1. It is unclear what evidence would be used to quantify the "historical minimum" of groundwater discharge to the SAR in the PBMZ. As mentioned in prior comments, there are significant data gaps with respect to the interconnection surface water and groundwater that need to be filled.

Page 6-36. Section 6.7.6.5, How the Minimum Threshold will be Monitored. OCWD supports the installation of additional wells and filling data gaps. We look forward to coordinating with the Temescal Basin GSA in this effort and further refining the Minimum Threshold for the interconnection of surface water and groundwater (see prior comments).

Attachment A

OCWD Comments on: Temescal Subbasin Groundwater Sustainability Plan, Draft Plan Area, September 2020.

OCWD Comments on: Temescal Subbasin Groundwater Sustainability Plan, Draft Plan Area, September 2020.

The Orange County Water District (OCWD) is responsible for managing the Orange County Groundwater Basin, which is part of the Coastal Plain of Orange County Groundwater Basin (DWR Basin 8-1). In 2017, OCWD, along with partner agencies, submitted an Alternative to a Groundwater Sustainability Plan (Alternative) to the Department of Water Resources (DWR) to show that Basin 8-1 had been sustainably managed over the last 10 years. DWR approved the Alternative on July 17, 2019.

OCWD thanks the City of Corona for reaching out and including OCWD in the process of developing the Temescal Subbasin Groundwater Sustainability Plan (GSP or Plan). Not only is the Temescal Subbasin adjacent to Basin 8-1, Coastal Plain of Orange County Groundwater Basin, OCWD owns and manages wetlands and a large area of riparian habitat behind Prado Dam. The health of this riparian habitat is dependent on surface flows of the Santa Ana River (SAR) and its tributaries as well as rising groundwater. A number of studies are ongoing by multiple agencies to better understand the impacts of increased recycling of SAR water and groundwater pumping on SAR flows and rising groundwater with respect to potential impacts upon riparian vegetation. We have listed some of these studies in our comments.

Specific Comments on the Temescal Subbasin GSP, Draft Plan Area, Sept. 2020 are as follows:

Page 2-3, Section 2.2.6. Please add a description of the Chino Basin Watermaster and other agencies that manage groundwater in adjacent groundwater basins. Even though they do not have jurisdiction within the Temescal Subbasin, the Chino Basin (Upper Santa Ana Valley Basin 8-002.01) is adjacent and upgradient of the Temescal Subbasin. Groundwater management actions taken by the Chino Basin Watermaster and other agencies upgradient of the Temescal Subbasin can affect groundwater conditions within the subbasin. Although a formal coordination agreement is not required, it is important that these agencies know that they must carefully consider any actions that could affect groundwater conditions in the Temescal Subbasin.

Page 2-6, Table 2-1. It is good to see that native vegetation is shown as a significant user of groundwater (18%). Please include a description of this water use and location as a separate subsection in Section 2.4. Also provide information on how the 18% figure was calculated, including assumptions, acreages, etc.

Page 2-8, Section 2.4, Water Resources Monitoring Programs.

Given the significant water use by native vegetation and significant natural resources present in the Prado Basin, we suggest that you add Natural Resources to the list of water resources monitoring categories.

We suggest that you add the following monitoring programs in the appropriate category. We have put a suggested category (or categories) in parentheses.

1. Groundwater Monitoring in Prado Basin by Western Riverside County Regional Wastewater Authority. (Groundwater Levels)
2. Natural resources and groundwater monitoring in Prado Basin by OCWD. (Groundwater Levels, Groundwater Quality, Surface Water Quality, Natural Resources (new category))

3. Chino Basin Watermaster/Inland Empire Utilities Agency Monitoring as part of Prado Basin Habitat Sustainability Committee. (Groundwater Levels, Groundwater Quality, Natural Resources (new category))
4. Upper Santa Ana River Habitat Conservation Plan (HCP) and associated monitoring plans being managed by the San Bernardino Valley Municipal Water District (Valley District) with participation from multiple other agencies including OCWD. (Groundwater Levels, Surface Water Flow, Surface Water Quality, Natural Resources (new category)). Please note that to support the HCP, an Integrated Santa Ana River Model (ISARM) has been developed.

Page 2-24, Table 2-5. Under L), There is a significant amount of information to indicate there are groundwater dependent ecosystems present in Prado Basin and the Santa Ana River and tributaries to the SAR upstream of Prado Basin. Prado Basin is generally defined as the area behind Prado Dam up to elevation 566 feet mean sea level. The groundwater dependent ecosystems present within Prado Basin and Santa Ana River and its tributaries need to be carefully considered in the Plan.

Attachment B

Temescal Creek Riparian Habitat Timeline

Prepared by David McMichael, Biologist

Orange County Water District

December 2021

Temescal Creek Riparian Habitat Timeline

Prepared by David McMichael, Biologist

Orange County Water District

December 2021

Temescal Creek has long shown a tendency to grow a riparian belt especially as it nears its confluence with the Santa Ana River. Temescal Creek was protected from the scouring effect of the river hidden behind the Norco bluffs, which means riparian habitat would have been allowed to mature creating a perennial haven for wildlife. Aerials taken in 1939 and 1953 clearly show riparian trees growing thick along Temescal Creeks (Figures 1-2).

Figure 1. Temescal Creek and the Prado Basin in 1939



Figure 2. Temescal Creek and the Prado Basin 1953



This timelapse habitat study focuses on a portion of Temescal Creek that is not channelized. This natural setting is confined to a roughly 2 mile stretch from Lincoln Ave. downstream past to where it meets the Santa Ana River. Upstream of Lincoln Ave the creek is channelized. This concrete channel originates at Temescal Canyon Lake in the city of Corona. Two segments will be studied using aerial imaging, and observations from the ground. The first segment begins at Lincoln Ave. and continues down to Auburndale Street. The next segment will be area of the creek immediately upstream and downstream of Rincon St.

The segment immediately downstream of Auburndale St. will not be looked at due to the proximity of an earthen dike project which involved the removal of habitat. Multiple fires in this area also made habitat comparisons difficult. It should be noted that the habitat along this stretch has not regrown following the completion of this project and no recruitment has been noted here.

The area of Temescal Creek which joins with the Santa Ana River flood plain will also not be discussed due to the proximity of water from the river as well as several fire events. The Willow Forest in this area seems to be in optimum health and any alteration of species composition seems to be from the shifting nature of the river. When the river moves away (west) from the creek it's possible to find more Mulefat recruitment, but when the river flows south its common for there to be wetland species' such as Cattails. Water will often form ponds near the end of the Corona Airport runway.

1994

Habitat along Temescal Creek was generally good where water was available. Figure 3 indicates that creek bottom between Lincoln Ave. and Auburndale St. was lined with riparian trees with clumps of Mulefat immediately upslope of the creek. Ground observations from this period indicate that the Mulefat was established right up to the farmed fields on the south side of the creek. The darker clumps were Black Willows, Cottonwoods, and Arroyo Willows. There were and still are a few clumps of Eucalyptus on the site and Arundo donax is also present during this time mixed in the riparian.

The aerial at figure 4 indicates that the thick Willow Forest seen behind the Prado Dam has creeped up to Rincon Street an extended into the Corydon St. corner. Mulefat was common in the upland areas adjacent to and well away from the creek bed. Besides seasonal invasives such as Black Mustard other perennial non-natives such as Tamarisk and Arundo were seen only sporadically. They were not abundant along this segment of the creek.

Figure 3. 1994 Temescal Creek – Lincoln Ave. to Auburndale St.



Figure 4. 1994 Temescal Creek at Rincon St.



2003

Habitat conditions remain relatively unchanged in these 2003 aerials but key invasives such as Tamarisk are beginning to spread in Temescal as well as the entire Prado Basin (Figures 5-6). Tamarisk is a more xeric riparian species with deep root systems able to tap into deeper ground water sources. Mulefat is also becoming more common along the banks of the creek. Mulefat is a transitional riparian species which can exist at different elevational zones often growing alongside sage scrub patches upslope of riparian settings. Mulefat is more tolerant of dry conditions as it can monopolize lower ground water levels than Black Willows.

Figure 5. 2003 Temescal Creek – Lincoln Ave to Auburndale St.



Figure 6. 2003 Temescal Creek at Rincon St.

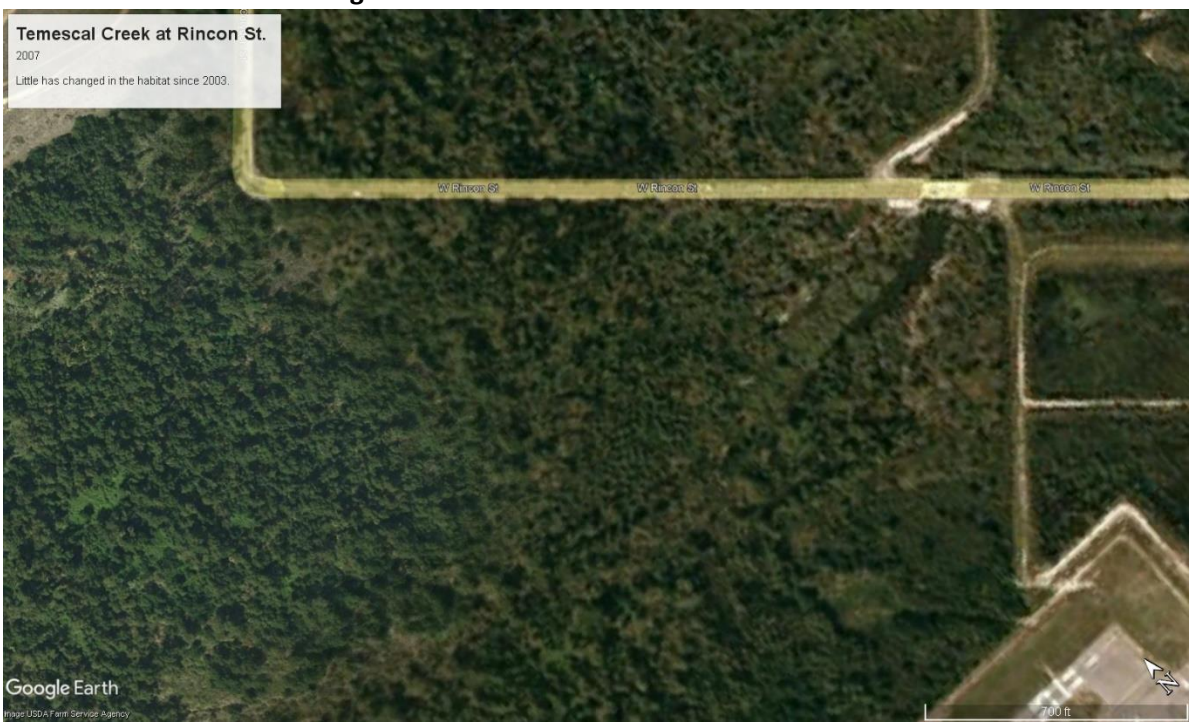


2007

Figure 7 shows that little changed along Temescal from 2003 to the end of 2007. There were some significant weather events in the basin such as the historic flood in 2004-2005 where 33.94" of rain fell over a relatively short period of time. This event caused destructive flooding in Prado Basin and resulted

in a long pool retention time behind the dam. The rain year of 2005-2006 was a relatively average rain year with 11.53" of rain but the bulk of this came late in the season resulting in another long inundation period behind the dam. These subsequent inundation events should have had little impact on the habitat along Temescal Creek except in the lowest portion of the creek near the Santa Ana River. The final important weather impact happened in 2006-2007 when the area saw historic low rainfall at 3.37". Drought conditions can be very damaging to riparian habitat but any sort of impactful damage to the habitat was not seen until 2009.

Figure 7. 2007 Temescal Creek at Rincon St.



2009

The aerials taken in 2009 showed a drastic shift in the disposition of the riparian habitat along Temescal Creek. The segment of Temescal Creek from Lincoln Ave. down to Auburndale St. showed significant loss of both Willow and Mulefat habitat (Figure 8). Much of the creek bottom banks still shows some Black Willows stands but many of the historic patches are now gone. Upslope of the creek where the Mulefat used to reside was also vacant save for some weedy annual species.

Figure 9 indicates that the Rincon St. segment of Temescal Creek is dramatically altered from previous aerials. The Black Willow Forest has retreated downstream and in its place non-native such as Perennial Pepperweed, and Tamarisk has begun to form monocultural stands. Mulefat is still present but competing with pepperweed in the upland sites. Channel scouring is evident as well which could have removed some of the riparian habitat during the previous year's big rain events.

Figure 8. 2009 Temescal Creek- Lincoln Ave. to Auburndale St.



Figure 9. 2009 Temescal Creek at Rincon St.



2009-2021 Temescal Creek (Lincoln Ave.-Auburndale St.)

These aerials indicated that the habitat downstream of Lincoln Ave. further degraded during the 2009-2021 period. Further Black Willows disappeared and Mulefat continued to be uncommon over the entire site. No recruitment of native riparian species was noted during this period. Some Eucalyptus continue to reside at this site but most of the non-native species' seen further downstream are also absent from this stretch.

Figure 10. 2012 Temescal Creek – Lincoln Ave. to Auburndale St.

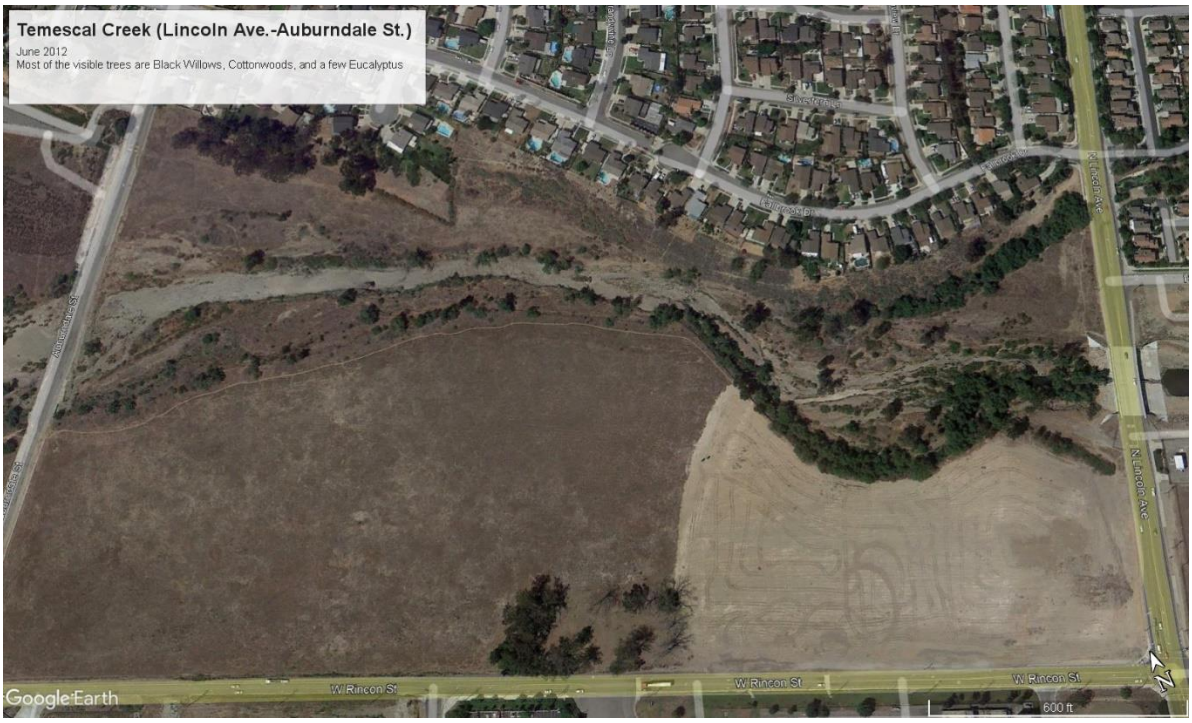


Figure 11. 2018 Temescal Creek – Lincoln to Auburndale St.

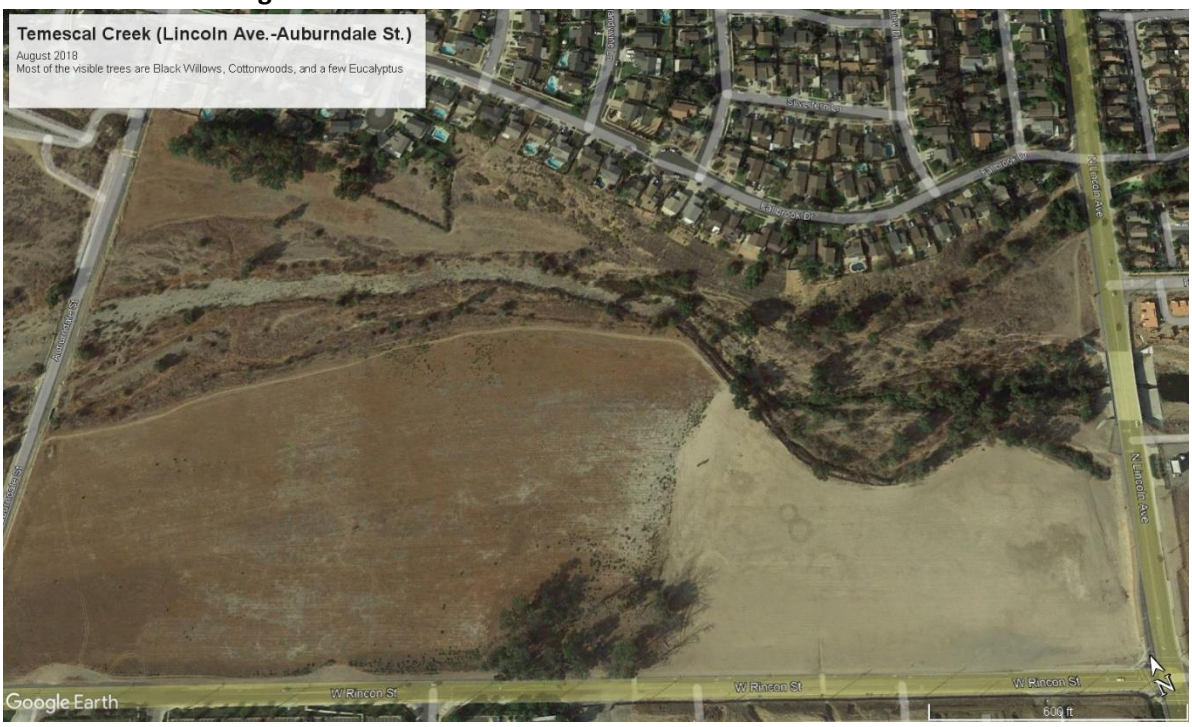


Figure 12. 2020 Temescal Creek – Lincoln Ave. to Auburndale St.



2014 Temescal Creek at Rincon St.

Figure 13 shows the continual retreat of Black Willows away from the Rincon St. area. Some patches continue to remain around the Corydon -Rincon curve but it's clear the Willows are disappearing from the area. Perennial Pepperweed and Tamarisk continue to plague the site and some of the upland patches of Mulefat appear to be in decline.

Figure 13. 2014 Temescal Creek at Rincon St.



2016-2017 Temescal Creek at Rincon St.

The invasive species were removed from the Rincon St. area in 2015-2016 and treatment continued until 2019. This included the physical removal of Arundo and Tamarisk but also the spraying of Perennial Pepperweed. The removal of the exotics facilitated the recruitment of Mulefat into this area Recruitment was primarily in those areas where Perennial Pepperweed was treated (Figures 14-15). There was little evidence of lasting recruitment by young Willows even during average rainfall years. Mulefat recruitment and habit transition to more xeric riparian species has been seen in other parts of the basin where drought stress and low ground water levels create conditions unfavorable to Black Willow growth. Mulefat have deeper root structure than Black Willows and other water dependent species. Mulefat continued to thin out in those areas that do not get flood irrigated during the winter.

Figure 14. 2016 Temescal Creek at Rincon St.



Figure 15. 2017 Temescal Creek at Rincon St.



<u>2020-2021 Temescal Creek at Rincon St.</u>

During 2020 and 2021 the encouraging growth and recruitment of Mulefat in the Rincon St. area has been halted and instead the evidence suggests that many Mulefat plants have begun disappearing and those that remain appear stunted and sporadic. The remaining mature Black Willow trees are persisting but there is still no recruitment of young willows and very little recruitment of Mulefat plants (Figures 16-17). There appears to be an influence from the Santa Ana River on the remaining Willow Forest where the constantly shifting course of the river often favors the Temescal creek area. The larger willows must be able to tap into ground water replenished by the river.

Figure 16. 2020 Temescal Creek at Rincon St.



Figure 17. 2021 Temescal Creek at Rincon St.



Least Bell's Vireo Distribution

Figure 18 suggests that least Bell's Vireo were previously widely distributed below Lincoln Ave, but Figure 19 suggests that in recent years Vireo have not stayed in those areas where the habitat is unsuitable for nesting success. Figure 20 shows the distribution of least Bell's Vireo in 2021. least Bell's Vireo is currently completely absent along Temescal Creek from Lincoln Ave. to Auburndale St.

Figure 18. Least Bell's Vireo Distribution 2007-2021



Figure 19. Least Bell's Vireo Territories 2019-2021



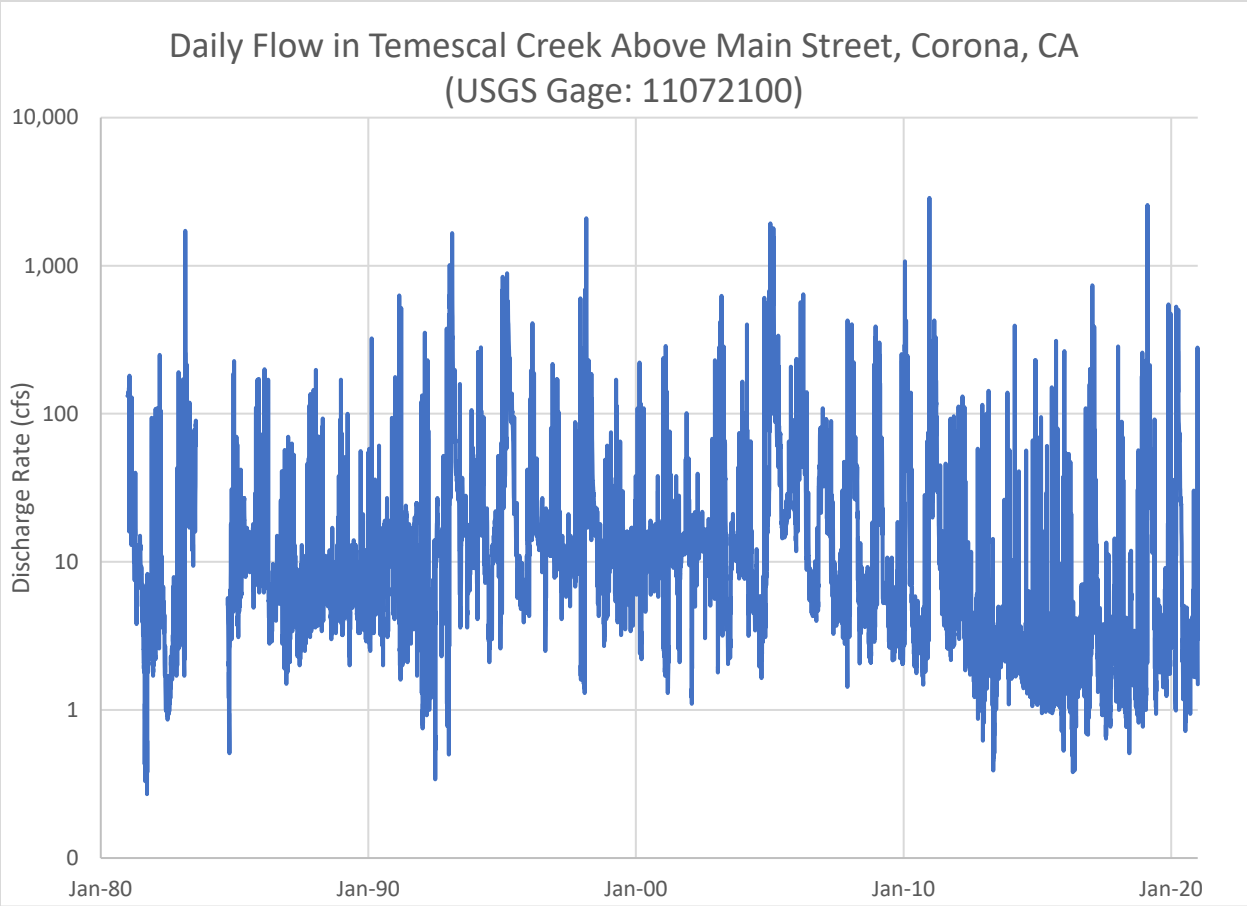
Figure 20. Least Bell's Vireo Territories 2021



Stream Flow Measurements

Figure 21 shows all the available daily measurements of streamflow in Temescal Creek at Main Street in Corona, CA, which is USGS Gage 11072100. What is important to note is the decline in the daily minimum flows that started in the mid-2000s and have been persistently at 1 cfs or less since 2012. These changes in flows correlate with the changes in vegetation described above.

Figure 21 Daily Flow in Temescal Creek at Main Street, Corona, CA



Conclusion

Aerial imagery of the downstream portion of Temescal Creek below Lincoln Ave. indicated that this portion of the Santa Ana River Watershed saw many decades of optimum growth and health of its riparian species', mainly Black Willow and Mulefat. These important riparian species provided refuge to many species of birds and wildlife including least Bell's Vireo and Southwestern Willow Flycatcher.

There is evidence that this portion of the watershed saw considerable dieback around 2009 but it's possible that this began earlier with subtle habitat transitional changes noted as early as 2003. The 2009 event is substantial but the inability of the habitat to recover and establish new trees and shrubs in later years shows a shift in the water regime. This condition can no longer sustain water dependent riparian species and may even exclude more xeric species. The further decline of Temescal Creek habitat will eventually exclude riparian nesting bird species entirely if the structure of the habitat cannot repair itself.

City of Corona
Utilities Department
"Protecting Public Health"

Office: 951.736.2234
Fax: 951.735.3786

755 Public Safety Way
Corona, CA 92878 – www.CoronaCA.gov

January 13, 2021

To: Adam Hutchinson, Orange County Water District

RE: OWCD Comments on Draft Temescal Basin GSP 12.14.2021

The Temescal Basin Groundwater Sustainability Agency (GSA) appreciates your thorough review of our Groundwater Sustainability Plan (GSP). Throughout the process, the Temescal Basin GSA has encouraged and welcomed public input, including the comment letter you submitted December 14, 2021. We have reviewed your comments. Detailed responses to your comments, including identification of edits to the GSP, are provided below.
Responses are organized to be consistent with your comments on specific pages and sections of the Draft GSP.

Comment on Page ES-8, Sustainable Management Criteria
Response:

The minimum threshold for interconnected surface water is a starting point and may be revised in future periodic evaluations as additional data and understanding of interconnected surface water and groundwater become available. This minimum threshold is discussed in greater detail in Chapter 6.

Comment on Page 2-25, Section 2.8.5, Neighboring Basin Coordination.
Response:

Corona is aware of future potential items of concerns and Corona representatives actively attend and engage in local inter-agency working groups / committees This comment also referenced comments OCWD submitted previously that included suggestions for additional information to be included in Chapter 2 of the GSP. Thank you for reminding us of these comments; text related to your comments has been added to Chapter 2.

Comment on Page 4-12. Section 4.6.4 Monitoring Networks.

Response:

The GSP used data for OCWD monitoring wells in the PBMZ, including PDHQ, PD3A, PD3B, PD4, PD6A, PD6B, PD9, PD10 through PD19, PD14R, PD22 through PD25. In fact, water levels from those wells were the basis for defining the depth to water minimum threshold for riparian vegetation. However, all of those wells are in the northern part of PBMZ. Thus, the data gap in the southern part identified in the Temescal Basin GSP still stands. We are aware that there are newly installed shallow monitoring wells in the southern portion of the PBMZ. However, those wells were installed during preparation of this GSP and any water level data collected from them does not correlate to the time period assessed in the Temescal GSP, which includes data through 2018. Data and

information from these newer wells will be used in future updates to the Temescal GSP.

Comment on Page 4-15. Section 4.10.1, Stream Flow Measurements.

Response:

The historical vegetation analysis along the lower reach of Temescal Wash by OCWD staff biologist David McMichael (attachment B of the comment letter) is excellent and is similar to analysis Todd Groundwater completed for reaches of Temescal Wash in the Bedford-Coldwater and Elsinore Basins. We concur with the finding that riparian vegetation canopy extent and density along Temescal Wash from North Livermore Avenue to below West Rincon Street decreased greatly beginning around 2009. OCWD's analysis concluded that decreased base flow in Temescal Wash was a likely cause of the die-back. Flows at the gage near Main Street do show a decrease in base flow beginning around 2009. The analysis attributed the decrease in flows to decreased discharges from Corona water reclamation facilities. However, we note that discharges at that time were from WRF-1 to Butterfield Drain, which enters Prado Wetlands downstream of the gage and impacted reach. Also, those discharges were not decreased until a State Water Resources Control Board decision was made in 2011.

Declining groundwater elevations might have contributed to the vegetation die-back, but historical data are insufficient to verify that hypothesis. The nearest well with water level data was the Butterfield Park well, which had a period of record only for 2011-2016. Water levels declined steadily during that period, which coincided with drought conditions and small water-level declines in other Temescal Basin wells. However, water levels had been higher in 2009, and had also been lower than the 2011-2016 range in the late 1990s and early 2000s, when there was no vegetation die-back. So available water level data do not entirely correlate with the timing of changes in vegetation.

The GSP affirms the possibility that declines in water table elevation in the southern part of the PBMZ could impact riparian vegetation, and the sustainable management criteria for interconnected surface water are designed to prevent such impacts in the future.

Finally, it should be emphasized that SGMA does not require that GSPs restore groundwater conditions (including GDEs) to any state they were in prior to 2015.

Comment on Page 4-15. Section 4.10.2, Depth to Groundwater.

Response:

See response to above comment regarding Page 4-12. Section 4.6.4 Monitoring Networks.

Comment on Page 4-17. Section 4.10.3, Riparian Vegetation.

Response:

With respect to vegetation die-back along the lowermost reach of Temescal Wash, see response to above comment Page 4-15. Section 4.10.1, Stream Flow Measurements.

With respect to NCCAG vegetation mapping, the NCCAG riparian vegetation and wetland maps were both evaluated during the analysis of interconnected surface water and GDEs. The vegetation polygons are included in Figure 4-21 and

Section 4.10.3 “Riparian Vegetation” includes a page of discussion of the mapping and the related NDVI and NDMI information.

Comment on Page 4-18 to-21. Section 4.10.4, Wetlands and Interconnected Surface Water.

Response:

The text has been changed to state that the target impoundment elevation behind Prado Dam is 505 feet in all seasons.

The temporal correlation of factors potentially associated with vegetation in Prado Wetlands is not flawed due to “critical data gaps that need to be filled to adequately understand the interconnection of surface water and groundwater”. Additional data are always useful. Nevertheless, the analysis stands on its own as making good use of available data. Specifically, it includes information from OCWD wells in the Prado Wetlands. The GSP furthermore concurs that there is a data gap regarding water table elevations in the southern part of the wetlands. That data gap does not undermine the conclusions drawn from the rest of the data. The data gap will be filled primarily to confirm relationships of pumping and water levels farther south in the Temescal Basin with water table depths along the southern edge of the wetlands.

If regional groundwater models used for the Prado Basin Adaptive Management Plan, the 2019 Annual Report of the Prado Basin Habitat Sustainability Committee, and the Upper Santa Ana River Habitat Conservation Plan are found to be flawed based on OCWD’s review, revised modeling results can be considered during the 5-year update of the GSP.

We agree that the Santa Ana River and the pool of water impounded behind Prado Dam are almost certainly hydraulically connected with a shallow water table at least most of the time. However, the shallow water table is not strongly connected to deeper aquifers and pumping stresses due to the relative abundance of fine-grained sediments in the Prado Wetlands part of the Chino-Temescal Basins region.[1] The draft GSP does not assert that Prado Wetlands are entirely disconnected from groundwater, but that as a practical matter the water supply for the wetlands is almost entirely derived from surface inflows.

If surface inflows to Prado are expected to decline in the future as the comment suggests, OCWD is free to intervene with the wastewater dischargers who currently supply those flows. It is worth noting that the City of Corona continues to comply with an agreement adopted in 1968 and modified in 2011 to provide reclaimed water inflow to the Prado Wetlands. Furthermore, as long as the pool behind Prado Dam is held at a constant elevation, groundwater discharge into that area will remain essentially constant.

[1] “The distinction between aquifer systems is most pronounced within the west-southwest portions of the Chino Basin. This is likely because of the relative abundance of fine-grained sediments in the southwest (multiple layers of clays and silts). Groundwater flowing from high-elevation forebay areas in the north and east become confined beneath these fine-grained sediments in the west-southwest, and these sediments effectively isolate the shallow aquifer system from the deep aquifer system(s).” (from page 2.9, last paragraph, of Wildermuth Environmental, Inc. October 2015. 2013 Chino Basin groundwater model update and recalculation of safe yield pursuant to the peace agreement. Prepared for Chino Basin Watermaster).

The comment states that supplemental surface inflows to the Prado Wetlands "would help recharge groundwater and support groundwater levels". Percolation from the river would likely maintain the shallow water table described above. But with respect to the overall Temescal Basin, the Prado Wetlands cannot simultaneously be a recharge boundary and a discharge boundary.

Comment on Page 5-19. Section 5.7.2.4, Riparian Evapotranspiration.

Response:

We have removed the mention of "potential riparian vegetation" in Prado Wetlands from the text.

Comment on Page 6-4. Section 6.1, Summary of Sustainable Management Criteria.

Response:

The comment asserts that sustainable management criteria for interconnected surface water must be expressed as a rate of stream flow depletion. The GSP regulations do include a clause to that effect. However, the very next clause (§354.28(d)) states "An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence." This is explicitly discussed in section 6.7.5 of the GSP. If the primary beneficial use of interconnected surface water is riparian vegetation—as it is in the Prado Wetlands—then water table depth is an appropriate metric for defining sustainable management criteria. Plants do not care about the rate of flow across a stream bed, but they do care about the depth of the water table.

The Basin Plan's inclusion of WILD and RARE as beneficial uses of surface water in Prado Wetlands simply corroborates the GDE discussion in the GSP, which covers arroyo chub, least Bell's vireo and southwestern willow flycatcher (section 4.10.5), among other species.

The comment objects that minimum historical groundwater levels are used in the sustainable management criteria definitions for interconnected surface water. This statement was in the introductory summary of sustainable management criteria at the beginning of chapter 6. It was an editorial oversight. The statement has been changed to "The Minimum Threshold for **depletion of interconnected surface water** is defined as a depth to water of 15 feet in shallow monitoring wells in the southern Prado area, where declines to lower water levels are correlated with Temescal Basin pumping and/or water levels." The revision is consistent with the actual minimum threshold definition presented in section 6.7.

The last paragraph of the comment implies that the GSP is responsible for ensuring that groundwater management in the Chino Basin does not impact Prado Wetlands or downstream water users. The GSP must show that actions taken to achieve sustainability in the Temescal Basin do not impair the ability of adjacent basins to achieve sustainability. Potential effects of sustainable management criteria on adjacent basins are discussed in sections 6.2.6.3, 6.3.6.2, 6.5.4.2, 6.6.5.4, and 6.7.6.2. In contrast, the Chino Basin appeared to adopt its goal of "hydraulic control" (that is, zero groundwater outflow to Prado

Wetlands) without consideration of impact on Temescal Basin sustainability. The Temescal Basin GSA has no authority relating to subsurface outflows from the Chino subbasin.

Comment on Page 6-31. Section 6.6.6.1, Description of Measurable Objectives.

Response:

The GSP includes description and analysis of several constituents of concern. Nitrate and TDS were selected because objectives are set in the Basin Plan, there are sufficient baseline data, and they serve as indicators for both natural and anthropogenic impacts. Additional water quality minimum threshold components may be considered in future periodic evaluations of the plan. In addition, the monitoring network will continue to track and record water quality for the minimum threshold and for all constituents of concerns.

Comment on Page 6-32 to 6-33. Section 6.6.2.1, Surface Water Users.

Response:

This comment basically reiterates the previous comment on Page 4-18 to-21. Section 4.10.4, and the response to that comment applies here. Furthermore, the comment presents no information to refute the analysis in the GSP nor indicates which additional data specifically need to be collected to refute or improve the analysis.

Comment on Page 6-33, Section 6.7.2.3, Riparian Vegetation.

Response:

This comment also reiterates concerns presented in the comment on Page 4-18 to-21. Section 4.10.4, and the response to that comment applies here.

Comment on Page 6-33. Section 6.7.3, Definition of Undesirable Results.

Response:

The comment notes that OCWD has been working to expand and improve wetland habitat in Prado Wetlands for many years, primarily to provide habitat for the endangered least Bell's vireo, a bird that resides in the wetlands. The GSP does not interfere with that objective and program. The interconnected surface water sustainable management criteria are designed to avoid future impacts to Prado Wetlands vegetation (and by extension to the vireo) due to groundwater management.

Comment on Page 6-34. Section 6.7.6, Minimum Threshold.

Response:

There are no "data gaps and uncertainties regarding establishing the minimum threshold" for interconnected surface water. The data gaps relate to implementing the minimum threshold. We expect the minimum threshold to continue to be adequate. Shallow monitoring wells will be installed in the southern Prado Wetlands area during the first five-year GSP implementation period. During the five-year GSP update, the appropriateness of the 15-foot depth to water criterion used in the minimum threshold will be reviewed in light of data from the new wells. This could potentially lead to a revised minimum threshold definition.

Comment on Page 6-35. Section 6.7.6.2, Effect of Minimum Threshold on Sustainability of Adjacent Areas.

Response:

It is a simple matter of groundwater hydraulics that if groundwater levels within the Temescal Basin do not drop below historical minimum water levels, the discharge at the Basin boundary (to Prado Wetlands, the Santa Ana River and/or Chino Basin) will not drop below its historical minimum.

The comment expresses a concern about "any reduction in rising groundwater" that contributes to Prado Dam outflow. However, nothing in the GSP contemplates a reduction in groundwater outflow from the Temescal Basin.

Comment on Page 6-36. Section 6.7.6.5, How the Minimum Threshold will be Monitored.

Response:

The Temescal Basin GSA likewise appreciates OCWD's efforts to monitor groundwater levels in the Prado Wetlands area. The information for OCWD's shallow wells in the northern Prado area was extremely useful for preparing the GSP. The Temescal Basin GSA intends to continue its cooperation with OCWD and share monitoring data from the new shallow wells to be installed in the southern part of the Prado Wetlands.

APPENDIX J

Temescal Groundwater Sustainability Plan
Numerical Groundwater Model
Documentation Report

Home Gardens
County Water District

TEMESCAL BASIN GROUNDWATER MODEL DOCUMENTATION REPORT

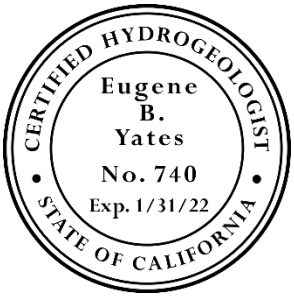
PREPARED FOR THE TEMESCAL GROUNDWATER SUSTAINABILITY PLAN

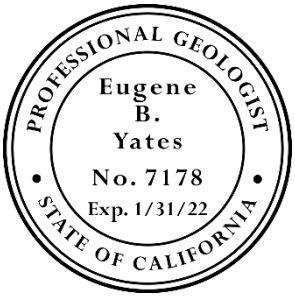
December 2021

TODD GROUNDWATER

2490 Mariner Square Loop, Suite 215
Alameda, CA 94501
510.747.6920
www.toddgroundwater.com

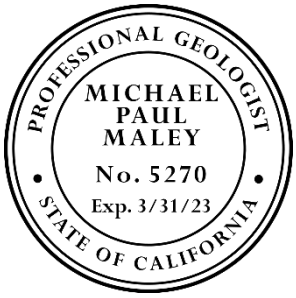
SIGNATURE PAGE





Gus Yates, PG, CHg
Senior Hydrologist
Todd Groundwater, Alameda, CA





Michael P. Maley, PG, CHg, CEG, PE
Principal Hydrogeologist
Todd Groundwater, Alameda, CA

Table of Contents

1. Introduction 1
   1.1. Scope and Objective 1
   1.2. Summary of Previous Models 1
2. Basin Geology and Structure 2
   2.1. Temescal Basin 2
      2.1.1. Groundwater Basin 2
      2.1.2. Physiography 2
      2.1.3. Hydrology 2
   2.2. Regional Geology 3
      2.2.1. Geologic Units 3
      2.2.2. Faults 3
      2.2.3. Definable Basin Bottom 3
   2.3. Groundwater conditions 4
      2.3.1. Basin Aquifer 4
      2.3.2. Basin Boundaries 5
      2.3.3. Recharge and Discharge Areas 5
      2.3.4. Primary Groundwater Uses 6
3. Rainfall-Runoff-Recharge Model 7
   3.1. Approach 7
   3.2. Land Use and Recharge Zones 8
   3.3. Rainfall 8
   3.4. Interception 9
   3.5. Runoff and Infiltration 9
   3.6. Root Zone Depth and Moisture Content 10
   3.7. Evapotranspiration 10
   3.8. Irrigation 11
   3.9. Deep Percolation from Root Zone to Shallow Groundwater 11
   3.10. Movement of Shallow Groundwater to Deep Recharge and Stream Base Flow 12
   3.11. Evapotranspiration by Riparian Vegetation 12
   3.12. Groundwater Inflow 13
   3.13. Calibration of Rainfall-Runoff-Recharge Model 13
4. Numerical Groundwater Model Development 15
   4.1. General Approach 15
   4.2. Model Setup 15
      4.2.1. Model Code Selection 15
      4.2.2. Base Period 16
      4.2.3. Model Domain and Grid 16
      4.2.4. Model Layers 17
      4.2.5. Faults 18
      4.2.6. Aquifer Conditions 18
   4.3. Boundary Conditions 19
      4.3.1. Surface Recharge 19
      4.3.2. Streams 19
      4.3.3. Mountain Front Recharge 21
      4.3.4. Evapotranspiration 21
      4.3.5. Groundwater Pumping 22

4.3.6. Recycled Water Recharge Ponds 22
4.3.7. Subsurface Flow with Adjacent Groundwater Basins 23
4.4. Aquifer Properties 24
4.4.1. Aquifer Characteristics 24
4.4.2. Zone Approach 24
4.4.3. Hydraulic Conductivity 25
4.4.4. Vertical Conductance 25
4.4.5. Specific Yield and Specific Storage 25
4.5. Initial Condition 25
5. Historical Model Results 26
5.1. Calibration Methodology 26
5.1.1. Approach 26
5.1.2. Calibration Methodology 26
5.2. Sensitivity Analysis 27
5.3. Statistical Calibration 27
5.4. Groundwater Level Trends 28
5.5. Evaluation Of Groundwater Flow 29
5.6. Model-Based Hydrologic Budget 31
6. Simulation of Future Conditions 32
7. SGMA Requirements 33
7.1. Model Data Gaps 33
7.2. Model Accuracy 34
7.3. Limitations to Calibration 34
8. References Cited 36

List of Tables (all tables follow text)

Table 1 Average Annual Groundwater Pumping
Table 2 Aquifer Properties
Table 3 Summary of Primary Calibration for The Temescal Basin Model (in Text)
Table 4 Statistical Calibration by Well

List of Figures (all figures follow text)

Figure 1. Location and Topography of the Temescal Basin
Figure 2 Rivers, Streams, Wetlands and Tributary Watersheds
Figure 3 Land Use in 1990, 2018 and 2068
Figure 4 Average Annual Rainfall
Figure 5 Relationship of Rainfall to Infiltration
Figure 6 Rainfall to Runoff Calibration
Figure 7 Extent of MODFLOW Model Domain
Figure 8 Location of Channel Aquifer
Figure 9 Topographic Elevation of the Top of Model Layer 1
Figure 10 Bottom Elevation Distribution for Model Layer 1
Figure 11 Bottom Elevation Distribution for Model Layer 2
Figure 12 Bottom Elevation Distribution for Model Layer 3
Figure 13 Schematic Cross Sections to Illustrate Relative Model Layer Thicknesses
Figure 14 Location of Faults Applied in MODFLOW Model
Figure 15 Location of Streams Applied in MODFLOW Model
Figure 16 Distribution of Specified Flux Boundary for Mountain Front Recharge
Figure 17 Distribution of Evapotranspiration (ET) Zones
Figure 18 Locations of Metered Municipal or Industrial Well Applied in MODFLOW Model
Figure 19 Approximated Locations of Agricultural Pumping Wells Applied in MODFLOW Model
Figure 20 Annual Groundwater Pumping Applied in MODFLOW Model
Figure 21 Location of Recycled Water Recharge Ponds
Figure 22 Boundary Conditions Applied at the Basin Margins in the MODFLOW Model
Figure 23 Distribution of Aquifer Property Zones for Layers 1, 2 and 3
Figure 24 Initial Groundwater Elevations Applied in the MODFLOW Model
Figure 25 Location of Monitoring Wells Used for Calibration
Figure 26 Scatter Plot Comparing Simulated to Measured Groundwater Levels
Figure 27 Calibration Hydrographs Corona Wells 6, 7 and 7A HG-01
Figure 28 Calibration Hydrographs Corona Wells 8, 8A, 9, 9A
Figure 29 Calibration Hydrographs Corona Wells 11, 12, 12A and 13
Figure 30 Calibration Hydrographs Corona Wells 14, 15, 16 and 17
Figure 31 Calibration Hydrographs Corona Wells 17A, 19, 22 and 23
Figure 32 Calibration Hydrographs Corona Wells 24, 25, 27 and 28
Figure 33 Calibration Hydrographs Corona Wells 29 and 31, Butterfield and 3S7W-27F6

Figure 34 Layer 1 Groundwater Elevations End of Simulation September 2018
Figure 35 Layer 3 Groundwater Elevations End of Simulation September 2018
Figure 36 Groundwater Elevations near Highest Levels in Layer 1 January 1997
Figure 37 Groundwater Elevations near Highest Levels in Layer 3 January 1997
Figure 38 Groundwater Elevations near Lowest Levels in Layer 1 August 2014
Figure 39 Groundwater Elevations near Lowest Levels in Layer 3 August 2014

1. INTRODUCTION

The groundwater model was developed to support the Groundwater Sustainability Plan (GSP) for the Temescal Subbasin (Basin) of the Upper Santa Ana Valley Basin (Department of Water Resource [DWR] Groundwater Basin 8-002.09) and is prepared in accordance with Sustainable Groundwater Management Act (SGMA). For convenience, DWR Basin 8-002.09 (DWR 2016b) will be referred to as the Temescal Basin (Basin) in this memo.

1.1. SCOPE AND OBJECTIVE

SGMA effectively requires that groundwater modeling be used to demonstrate that a GSP will achieve sustainable basin operation. A previous model of the Temescal Basin model was updated and refined to simulate surface water and groundwater conditions for the entire Basin, update key parameters, match the DWR Basin boundary, and improve discretization, geologic layering and aquifer parameter distribution to reflect new information. The resulting model focuses on applicability to SGMA GSP regulations, including consistency with DWR Best Management Practices for surface water and groundwater modeling (DWR 2016a). This comprehensive groundwater model serves as a quantitative tool for computing Basin-wide water budgets and the effects of sustainability criteria and management actions.

1.2. SUMMARY OF PREVIOUS MODELS

A groundwater model of the Temescal Basin was previously developed to support development of the 2008 City of Corona Groundwater Management Plan (Todd and AKM, 2008). That model did not cover the entire extent of the Basin as defined by DWR and simulated the period from 1990 through 2004. However, information regarding bedrock elevations, aquifer characteristics, layering, inflows and outflows served as a starting point for constructing the new model.

The development of the Temescal Basin Model utilized information from groundwater model from adjacent basins. The Model developed for this GSP also includes a portion of the Chino Basin to better simulate the interactions with the adjoining basin and assess conditions in the Prado wetlands area. Information for the northern part of the model flow domain in the Chino Basin was based on documentation of the Chino Basin groundwater model o developed in 2015 and has been updated several times since then (WEI, 2015 2020). In the vicinity of the Arlington Gap, a groundwater model of the Riverside-Arlington Basin, which simulates conditions on the eastern side of the Arlington Gap, was used to help understand groundwater flow through Arlington Gap into the Temescal Basin (Geoscience, 2009, WRIME, 2010, 2011).

2. BASIN GEOLOGY AND STRUCTURE

The following summarizes the hydrogeologic conceptual model (HCM) and groundwater conditions from the main body of the Temescal Basin GSP report. The HCM and groundwater conditions create a foundation for the technical aspects of the Basin's hydrogeology necessary for model development. This section references figures and text from **GSP Sections 3 and 4**.

2.1. TEMESCAL BASIN

The Temescal Basin covers approximately 23,500 acres or 37 square miles of the southwest part of upper Santa Ana Valley in western Riverside County as shown on **Figure 1**. The following summarizes the physical description of the Temescal Basin and surrounding areas as described in the GSP.

2.1.1. Groundwater Basin

The Basin covers approximately 23,500 acres or 37 square miles of the southwest part of upper Santa Ana Valley in western Riverside County (**Figure 1**). The Basin is located between the Santa Ana Mountains to the west and a lower, parallel range of hills to the east.

The Basin has connection four other groundwater basins or subbasins defined by DWR Bulletin 118 (DWR 2016b). The Basin is separated from the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin (DWR Basin No. 8-004.02) to the south by a groundwater divide Eagle Canyon and Bedford Canyon. The Basin is connected to the east by a narrow body of alluvium through Arlington Gap to the Riverside-Arlington Subbasin of the Santa Ana Valley Groundwater Basin (DWR Basin No. 8-002.03). To the north, the Basin adjoins the Chino Subbasin of the Santa Ana Valley Groundwater Basin (DWR Basin No. 8-002.01) along a line that approximately follows the Santa Ana River. This boundary is permeable, and groundwater can flow in either direction between the two basins depending on their respective groundwater levels. To the west, the Basin has a narrow connection along the Santa Ana River with the Coastal Plain of Orange County Groundwater Basin (DWR Basin No. 8 001).

SGMA allows a groundwater basin to be subdivided into management areas if it facilitates sustainable management in areas within the Basin where groundwater conditions or water use and supplies are distinctly different. The Temescal Basin has not been divided into management areas; the GSP treats it as a single unit.

2.1.2. Physiography

Ground surface elevations at the surface of the Basin slope northward toward the Santa Ana River at a slope of 200-300 feet per mile. Elevations range from approximately 470 feet above mean sea level (msl) at the base of Prado Dam to approximately 1,500 feet above msl to the south (see **GSP Figure 3-1**). The tributary watersheds reach up to approximately 4,000 feet msl at the highest peak in the Santa Ana Mountain watersheds west of the Basin. Watersheds east of the Basin are significantly lower in elevation and rise only to about 1,600 feet.

2.1.3. Hydrology

The Basin covers a portion of the Santa Ana River watershed. **Figure 2** shows the locations of the Santa Ana River, Temescal Wash, Prado wetlands area, minor streams and tributary watersheds to the

Temescal Basin. The Santa Ana River roughly follows the northern edge of the Basin, flowing from east to west. Prado Dam impounds the river near the western edge of the Basin, where the river enters a canyon that passes through the Santa Ana Mountains to the coastal plain in Orange County. The largest surface waterway in the interior of the Basin is Temescal Wash, which originates near Lake Elsinore and flows through the Bedford-Coldwater Subbasin before entering the southern edge of the Temescal Basin. It continues north through the City of Corona and discharges into the Prado wetlands. A number of small streams enter the Basin from watersheds in the Santa Ana Mountains. Flow in all of them is ephemeral, and with the exception of Wardlow Wash at the northwest corner of the Basin, all of the small creek channels are lined beginning 1,500 to 6,100 feet downstream of the point where they enter the Basin. The Temescal Wash channel is also cement lined along about half of its length between the Basin boundary and the Santa Ana River.

2.2. REGIONAL GEOLOGY

The Basin is located within one of the structural blocks of the Peninsular Ranges of Southern California. The Basin occurs in a linear low-lying block, referred to as the Elsinore-Temecula trough, between the Santa Ana Mountains on the west and the Perris Plain on the east (Todd and AKM 2008). The trough extends from Corona southeast approximately 30 miles and was formed along an extensive northwest-southeast trending fault zone including the Elsinore, Chino, and related faults.

2.2.1. Geologic Units

The oldest rocks in the Basin crop out at the foot of the Santa Ana Mountains. These units are composed principally of volcanic (including the Santiago Peak Volcanics) and metamorphic rocks (including the Bedford Canyon Formation) of Jurassic and Cretaceous age. A thin rim of younger sedimentary units of Tertiary age also crops out along the mountain front generally lying between the Elsinore and Chino faults. This zone of sedimentary units broadens to the north and contains numerous mapped formations of Cretaceous and Tertiary age. The northeastern side of the valley is flanked primarily by granitic rocks of Cretaceous age. Erosion of these units has filled in the trough over time resulting in quaternary-age alluvial fan, channel, and other deposits making up the permeable portions of the Basin (USGS 2004, 2006).

The geologic map (see **GSP Figure 3-5**) shows the distribution of these units in the Basin (USGS 2004, 2006). The main surficial deposits on the floor of the Basin include younger and older alluvial fans deposited from the erosion of volcanic rocks and Bedford Canyon Formation to the west. These units prograde across the Basin to the northeast and are truncated by channel deposits along Temescal Wash.

2.2.2. Faults

The Basin was formed along an extensive northwest-southeast trending fault zone including the Elsinore, Chino, and related faults. The Elsinore and Chino fault zones bound the Basin on the west and trend along the mountain fronts. The Elsinore Fault Zone extends approximately 200 km from Baja California north to the Corona area. It passes through the western margin of the Basin. Some fault traces are inside the Basin and may function as partial barriers to groundwater flow (see **GSP Figure 3-5**).

2.2.3. Definable Basin Bottom

The Basin bottom is defined by bedrock, which is shallow around the perimeter and deep in the center. Depth to bedrock ranges in depth from 10 feet to approximately over 1,000 feet (see **GSP Figure 3-11)**.

The greatest Basin thickness is in the central-west part of the Basin (see **GSP Figure 3-7**). The formation of a trough along the Elsinore-Chino Fault zone is indicated by the asymmetric basin geometry.

Bedrock is much shallower in the eastern portion of the Basin, however there is a slight deepening near the Arlington Gap (see **GSP Figure 3-8**). Here, unconsolidated sediments are approximately 250 feet thick. This area is interpreted to have been eroded by a branch of the ancestral Santa Ana River. The Basin is only about 100 feet thick in the Norco area but over 1,000 feet thick beneath the Santa Ana River, where the Basin adjoins the Chino Basin.

2.3. GROUNDWATER CONDITIONS

Understanding the groundwater conditions is important in development of the surface water and groundwater models. A summary of the discussion of the groundwater conditions and water balance based on the model results is provided in **GSP Sections 4 and 5** is provided below.

2.3.1. Basin Aquifer

Three aquifers provide water supply to wells within the Basin. These include the Channel Aquifer, the Alluvial Fan aquifers and the Sandstone Aquifer (Todd and AKM 2008). Of these three aquifers, the Channel Aquifer is the only principal aquifer as it the most productive aquifer and provides most of the groundwater supply in the Basin. The Alluvial Fan and Sandstone Aquifers have historically been used to a lesser extent than the principal aquifer. The combined Alluvial Fan and Sandstone Aquifers are referred to as the Secondary Aquifers within the Basin.

The Channel Aquifer is the principal aquifer in the Basin. This aquifer is a package of relatively homogeneous and highly permeable sands up to 200 feet thick that have been encountered in many of the Corona wells in the northern half of Basin. This sand package is interpreted as channel deposits of an ancestral arm of the Santa Ana River and, as such, has been referred to as the Channel Aquifer (Todd and AKM 2008). The alignment of the aquifer suggests that an ancestral river channel had entered the Basin at Arlington Gap, eroding the sedimentary units and possibly older alluvial fan deposits in the area. Permeable channel sands were deposited in the eroded channel over time. From the Arlington Gap, the Channel Aquifer trends northwest toward Prado Dam.

The Alluvial Fan Aquifer is composed of both older and recent alluvial fans that have been deposited through time along the mountain front on the western edge of the Basin. These fans have prograded across the Basin from west to east (see **GSP Figure 3-5**). Although these deposits are relatively thick, the entire unit is heterogeneous and cannot be considered one single aquifer. Rather, sand lenses within the deposits collectively form the Alluvial Fan Aquifers. Lithologic data from wells are insufficient to map out the extent of the aquifers or characterize the deposits. Limited data indicate relatively fine-grained textures throughout much of the area, especially with depth (Todd and AKM 2008).

The Sandstone Aquifer is composed of the older sedimentary units underlying the alluvial Basin that provide sufficient well yields to categorize them as aquifers. Although generally grouped with other bedrock units, the subsurface sedimentary rocks of Tertiary age in the northeast Basin area contain sandstone layers that are screened in several Corona wells. Due to the limited production, small areal extent, increasing depths, and relatively low permeability in most areas, the Sandstone Aquifer is not considered a primary source of water supply.

2.3.2. Basin Boundaries

The Temescal Basin as defined by DWR is bounded on the west by the Santa Ana Mountains and the east by low-lying El Sobrante de San Jacinto and La Sierra hills. The northeastern arm of the Temescal Basin, referred to as the Norco area, consists of relatively low permeability alluvium and bedrock residuum flanked on the east and west by bedrock outcrops. The Basin is connected to four adjacent groundwater basins (**Figure 1**) defined by DWR Bulletin 118 (DWR 2016b). These include:

- The boundary with the Chino Basin (DWR Basin No. 8-002.01) to the north is generally marked by the Santa Ana River and a series of low-lying hills in the Norco area.
- Groundwater from the Riverside-Arlington Basin (DWR Basin No. 8-002.03) flows into the Basin through the Arlington Gap. The Arlington Gap is a narrow restriction along the eastern side of the Basin north of the Temescal Wash.
- The boundary with the Coastal Plain of Orange County Basin (DWR Basin No. 8-001) is a narrow canyon where the Santa Ana River exits the Temescal Basin to the Coastal Plain of Orange County Basin.
- The southern boundary of the Basin is the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin (DWR Basin No. 8-004.02). The boundary is located at the Bedford Canyon. Generally, there is little to no groundwater flow along this boundary at the eastern portion where it borders the alluvium along the Temescal Wash.

The remaining lateral boundaries of the Basin are formed by contacts with bedrock units. The entire western Basin boundary and much of the eastern boundary of the Basin are contacts between Basin sedimentary units and upland bedrock outcrops (Todd and AKM 2008).

2.3.3. Recharge and Discharge Areas

Recharge to the Basin occurs primarily from stream percolation, wastewater discharge and deep percolation of rainfall and irrigation water, and to a lesser extent from pipe leaks and subsurface inflow from bedrock areas and other basins, as shown in **GSP Table 5-4**. Recharge from streams occurs along the unlined reach of Temescal Wash above Temescal Lake and the unlined reaches of tributary streams along the western edge of the Basin. Recharge associated with wastewater occurs when treated wastewater is discharged to ponds. Deep percolation from irrigation includes historical agricultural irrigation as well as current urban irrigation.

Large amounts of runoff from the mountains flows into channels and the shallow subsurface at the edges of the Basin and then into and through the Basin. Stream flows are flashy, and during brief high-flow events, the amount of stream recharge is limited by the percolation capacities of the unlined channel reaches upstream of the stormwater detention basins. The creek channels are lined with cement downstream of the detention basins.

Return flows are those portions of applied water (e.g., landscape irrigation) that are not consumed by evapotranspiration and hence return to the groundwater system through deep percolation or infiltration. Return flows associated with urban, industrial, and agricultural water uses all have the potential to contribute to recharge to the Basin (Todd and AKM 2008).

Discharge from the Basin is primarily from groundwater pumping. Smaller outflows are to the Santa Ana River near the Prado wetlands, evapotranspiration in the wetlands, and subsurface outflow to the Chino Basin (see **GSP Table 5-4**).

2.3.4. Primary Groundwater Uses

The primary groundwater uses in the Basin are municipal pumping, with limited private pumping for small water system, commercial, industrial and residential users. Groundwater use estimates are included in **GSP Section 5 (Water Budget)**. The Channel Aquifer is primarily used for municipal water supply. Most of the pumping in this area is from wells owned and operated by the City of Corona, with some additional pumping by small community water system, small commercial users and aggregate mines. Until the 1990s, there was significant agricultural pumping to irrigate citrus orchards.

3. RAINFALL-RUNOFF-RECHARGE MODEL

A rainfall-runoff-recharge model developed by Todd Groundwater was used to prepare estimates of groundwater recharge from rainfall, irrigation, bedrock inflow, and pipe leaks. It also generated the estimates of groundwater use for agricultural irrigation and flows in ungauged streams tributary to or within the basin. Several commercially available software programs were used to prepare model input and evaluate model output, such as Microsoft Excel and ArcGIS. Finally, the rainfall-runoff-recharge model and several pre-processing utility programs were developed in the Fortran 90 programming language by Todd Groundwater.

3.1. APPROACH

The rainfall-runoff-recharge model is built around a soil moisture balance of the root zone, which is simulated continuously using daily time steps for the 29-year calibration period. Numerous variables are involved in the physical processes of rainfall, interception, runoff, infiltration, root zone soil moisture storage, evapotranspiration, irrigation, shallow groundwater storage, recharge of deeper regional aquifers from shallow groundwater, and lateral flow of shallow groundwater into streams. Accordingly, the groundwater basin and tributary watersheds were divided into small recharge zones over which the most influential variables were relatively homogeneous. The daily water balance was then simulated for each zone, and the results aggregated geographically to cells in the groundwater model grid and temporally to the model stress periods.

The rainfall-runoff-recharge model provides several benefits to the groundwater modeling effort:

- It represents the hydrological processes with governing equations that reflect the actual physical processes, at least in a simplified way. This allows sensitivity or suspected errors to be traced to specific assumptions and processes.
- It enforces the principle of conservation of mass on the recharge and stream flow values. Beginning with rainfall, all water mass is accounted for as it moves through the hydrological system.
- It allows additional data sets to be included in model calibration. In tributary watersheds with gauged stream flow data, measured flows can be compared with simulated flows, which consist of the sum of direct runoff and shallow-groundwater seepage to streams. Simulated irrigation frequency can be compared with actual grower practices, and applied irrigation amounts can be compared with water delivery data recorded by the District. Simulated urban irrigation amounts can be compared with seasonal variations in measured urban water use, which are primarily related to urban irrigation.
- It provides estimates of stream flow in ungauged tributary streams, as well as runoff from valley floor areas within the active model domain.
- It provides estimates of inflow from bedrock and/or upland areas adjacent to the active model domain and constrains the amounts of inflow according to the water balance for each tributary watershed.
- It simulates the effects of runoff from impervious surfaces in urban areas, either to storm drainage systems or to adjacent pervious soils.
- It simulates changes in land use over the 29-year calibration period and the resulting changes in recharge and irrigation demand.

- It combines and parses all of these flows—plus estimated recharge from leaky water and sewer pipes—into recharge values by model cell and stress period in the format required by MODFLOW.

The following sections describe the input data sets and the assumptions and governing equations used to simulate each hydrologic process included in the rainfall-runoff-recharge model.

3.2. LAND USE AND RECHARGE ZONES

Recharge zones were developed by intersecting and editing numerous maps in GIS. The starting point was a map of the Temescal Basin and the boundaries of all surrounding watersheds that flow into it. The Basin and tributary watersheds were then divided into numerous polygons reflecting land use as of 1990 and changes in land use since then. Land use was delineated into 13 categories based on DWR land use maps for Riverside County from 1993 and 2000, a statewide crop map developed by LandIQ for DWR in 2014 and Google Earth historical aerial imagery available for 1990-2018. The primary change in land use has been urbanization of undeveloped (natural vegetation) areas. Polygons were delineated to represent the locations of changes in land use so that a single, fixed set of polygons could accurately represent the evolution of land use by changing the use type of a polygon beginning in the year that land use changed. Additional divisions of polygons were made on the basis of soil texture, annual rainfall and watershed. This resulted in a total of 224 polygons ranging in size from 2 to 4,529 acres. A map of the zones and their land uses in 1990 and 2018 is shown in **Figure 3.**

Land use in each zone was assigned to one of sixteen categories (see **GSP Table 5-2**). Each land use category is further divided into irrigated, non-irrigated and impervious subareas. These are not explicitly mapped but are expressed as percentages of total zone area. Citrus orchards irrigated with groundwater were common in the Basin in the early 1990s, but except for one small grove those have all been replaced by urban development. Natural land cover categories are grassland, shrubs/trees, dense riparian, sparse riparian and open water. Developed land uses are residential, low-density residential, turf, commercial, industrial and vacant. The natural and developed land uses were mapped by inspection of Google Earth aerial photography. The categories are listed in **GSP Table 5-2** along with their total acreages in 1990, 2018 and 2068 (estimated) in the groundwater basin management areas and tributary watersheds.

3.3. RAINFALL

The distribution of average annual rainfall over the basin and tributary watersheds was obtained from PRISM climate modeling (http://www.prism.oregonstate.edu/). Annual precipitation varies from 11 inches in the Norco area to about 14 inches at the south end of the Basin. It increases to about 21 inches at the top of the highest tributary watershed in the Santa Ana Mountains to the west. **Figure 4** shows the average annual rainfall distribution across the Temescal Basin and its surrounding watersheds. Each recharge zone was assigned an average annual rainfall value based on its location.

The surface hydrology model requires daily rainfall as one of two transient inputs. Daily rainfall for the Elsinore station was used for this purpose, with missing values supplied by correlation with rainfall at the Riverside Fire Station and Claremont-Pomona Stations, both of which also have long periods of record. Daily rainfall for each recharge zone was calculated as Elsinore daily rainfall multiplied by the ratio of zonal average-annual rainfall to Elsinore average-annual rainfall.

3.4. INTERCEPTION

Plant leaves intercept some of the rain that falls from the sky, and the amount is roughly proportional to the total leaf area of the vegetation canopy. The estimated interception on each day of rain ranged from zero for industrial, idle and vacant land uses, to 0.03 inch for turf and 0.06 inch for trees in full leaf. These estimates were inferred from published results of interception studies (Viessman and others, 1977). For each day of the simulation, rainfall reaching the land surface (throughfall) is calculated as rainfall minus interception. Interception storage is assumed to completely evaporate each day and is not carried over from one day to the next.

3.5. RUNOFF AND INFILTRATION

Most throughfall infiltrates into the soil, but direct runoff occurs when net rainfall exceeds a certain threshold. The threshold at which runoff commences and the percent of additional rainfall that runs off are significantly influenced by a number of variables, including soil texture, soil compaction, leaf litter, ground slope, and antecedent moisture. These factors can be highly variable within a recharge zone, and data are not normally available for them. Also, the intercept and slope of the rainfall-runoff relationship depend on the time increment of analysis. Most analytical equations for infiltration and runoff apply to spatial scales of a few square meters over periods of minutes to hours (Viessman and others, 1977). They are suitable for detailed analysis of individual storm events. The curve number approach to estimating runoff also applies to single, large storm events. It is not suitable for continuous simulation of runoff over the complete range of rainfall intensities (Van Mullen and others, 2002). The approach used in the rainfall-runoff-recharge model is similar but less complex than the approach used in popular watershed models such as HSPF (Bicknell and others, 1997).

In the rainfall-runoff-recharge model, daily infiltration is simulated as a three-segment linear function of throughfall, and throughfall in excess of infiltration is assumed to become runoff. The general shape of the relationship of daily infiltration to daily net rainfall is shown in **Figure 5** (upper graph). Below a specified runoff threshold, all daily throughfall is assumed to infiltrate. Above that amount, a fixed percentage of throughfall is assumed to infiltrate, which is the slope of the second segment of the infiltration function. Finally, an upper limit is imposed that represents the maximum infiltration capacity of the soil. The runoff threshold, the percentage of excess net rainfall that infiltrates, and the maximum daily infiltration capacity were assumed to vary by land use and were among the variables adjusted for model calibration. The runoff threshold ranged from 0.2 inches per day (in/d) for unpaved areas in industrial and commercial zones to 1.0 in/d for turf and natural vegetation areas. The infiltration percentage for excess rainfall ranged from 60 percent in commercial and industrial areas to 94 percent in areas of natural vegetation. The maximum daily infiltration was set to 2.5 in/d in upland tributary areas and 4 in/d for zones overlying the Basin. These values were selected on the basis of calibration, although results were not very sensitive to this parameter.

The above parameter values are for soils that are relatively dry. Infiltration rates decrease as soils become more saturated. This phenomenon led to the development of the Antecedent Runoff Condition adjustment factor for rainfall-runoff equations (Rawls and others, 1993). However, application of the concept has been focused on individual storm events. For the purpose of the rainfall-runoff-recharge model, the adjustment provides a means of simulating empirical observations that a given amount of rainfall produces less runoff at the beginning of the rainy season when soils are relatively dry than at the end of the rainy season when soils are relatively wet. This effect is included in the recharge model as a multiplier that decreases the estimated infiltration as soil saturation increases. This multiplier is applied to the runoff threshold, the infiltration slope and the maximum infiltration rate. The multiplier

decreases from 1.0 when the soil is dry to a user-selected value between 1.0 and 0.60 when the soil is fully saturated (lower graph in **Figure 5**). A low value has the effect of decreasing infiltration (and potential groundwater recharge) toward the end of the rainy season or in very wet years, and also to increase simulated peak runoff during large storm events. The multiplier under saturated conditions was assumed to be 0.75 for the Temescal rainfall-runoff-recharge model.

Runoff from impervious surfaces was assumed to equal 100 percent of rainfall. Runoff that flows into a storm drain system (known as "connected impervious runoff") contributes to stream flow but not groundwater recharge. However, runoff from some impervious surfaces flows onto adjacent areas of pervious soils ("disconnected impervious runoff"). The surface hydrology model treats this type of runoff as if it were a large increment of additional rainfall where it flows over or ponds on the pervious soils. The excess water can quickly saturate the soil and initiate deep percolation. The model incorporates this process by means of a variable representing the fraction of impervious runoff that becomes deep percolation. Data and literature values are not available for this variable. It was estimated to be 20 percent in residential, commercial and industrial areas and 80 percent in low-density residential areas.

3.6. ROOT ZONE DEPTH AND MOISTURE CONTENT

The storage capacity of the root zone equals the product of the vegetation root depth and the available water capacity of the soil. The available water capacity for each recharge zone was a depth-weighted average for the dominant soil type, as reported in the soil survey (NRCS, 2015). Root depth is a complex variable. Except for cropland, vegetation cover typically consists of a mix of species with different root depths. At a very local scale, roots are deepest directly beneath a plant and shallower between plants. Root density and water extraction also typically decrease with depth within the root zone. To complicate matters, root depth is somewhat facultative for some plants, which means that roots will tend to grow deeper in soils with low available water capacity, such as sands. Finally, root depth in upland watershed areas can be restricted by shallow bedrock.

The root depth selected for each recharge zone essentially represents an average of all these factors. Simulated recharge and stream base flow are both quite sensitive to vegetation root depth, and values were adjusted during the joint calibration of the rainfall-runoff-recharge model and the groundwater flow model. Separate root depths were specified for irrigated and non-irrigated vegetation in each recharge zone. Root depths for turf and crops were required to be the same in all zones. In upland watersheds root depth can be affected by the depth to bedrock, which is often shallow. Outflow from individual tributaries flowing into the basin is not gaged, and uniform rooting depths for grass and shrubs/trees were used throughout all of the watersheds.

3.7. EVAPOTRANSPIRATION

Evapotranspiration is affected by meteorologic conditions, plant type, plant maturity, and soil moisture availability. All of these factors are included in the rainfall-runoff-recharge model. The evaporative demand created by meteorological conditions is represented by reference evapotranspiration (ETo). Numerous equations have been developed over the years relating ETo to solar radiation, air temperature, relative humidity and wind speed. For the purposes of this study, daily values of ETo were obtained from a microclimate station in Temecula (about 20 miles south of the Basin) that is part of the California Irrigation Management Information System (CIMIS) network.

Vegetation factors are lumped into multipliers called crop coefficients. Reference ET is the amount of water evapotranspired from a broad expanse of turf mowed to a height of 4-6 inches with ample irrigation. ETo is multiplied by a crop coefficient to obtain the actual ET of a different crop or vegetation type at a particular stage in its growth and development. Although primarily used for agricultural crops, crop coefficients can also be applied to urban landscape plants and natural vegetation. The only agricultural crop in the Basin is citrus trees, which have a crop coefficient that ranges from 0.5 in winter to 0.91 in mid-summer (U.N. Food and Agriculture Organization, 2006). Irrigated landscaping was assumed to consist primarily of turf, for which a crop coefficient of 0.8 was used in all months (Snyder and others, 2007). Non-irrigated natural grassland consists of annual grasses that go dormant in summer once soil moisture has been depleted. A crop coefficient of 1.0 was assigned in all months, but actual ET decreases to zero as the grasses lower soil moisture to the wilting point in summer. Natural shrubs/trees were assigned a crop coefficient of 0.8 year-round. Those perennial species have deeper roots and do not tend to fully deplete root zone soil moisture during a single dry season (Blaney and others, 1963). Many riparian phreatophytes are deciduous, and a crop coefficient of 0.75 was assigned for winter months to reflect a reduced leaf area index. Their tall stature and linear distribution within an arid landscape raises the crop coefficient in summer months, and a coefficient of 1.10 was assigned to reflect those factors.

3.8. IRRIGATION

Evapotranspiration gradually depletes soil moisture, and for irrigated areas the rainfall-runoff-recharge model triggers an irrigation event whenever soil moisture falls below a specified threshold. The amount of applied irrigation water is equal to the volume required to refill soil moisture storage to field capacity, divided by the assumed irrigation efficiency. An irrigation threshold equal to 70 percent of maximum soil moisture storage was used for citrus, and a threshold of 0.8 was used for urban landscaping. This variable primarily affects the frequency of irrigation; a higher threshold results in more frequent irrigation but approximately the same total amount of water applied annually. Ten percent of water applied to citrus was assumed to percolate past the root zone, and 15 percent was assumed for urban irrigation. This reflects nonuniformity of applied water, such as uneven overlap of sprinkler spray areas. There are additional sources of irrigation inefficiency, such as evaporation of sprinkler spray mist and sprinkler overspray or runoff onto impervious surfaces in urban areas. Thus, total irrigation efficiency is less than 90 percent for citrus and 85 percent for urban landscaping. Total efficiency was used to estimate applied water, but only the deep percolation component was used to estimate deep percolation. Urban irrigation in the Basin is supplied by municipal water purveyors, and irrigation use is included in their metered deliveries.

The rainfall-runoff-recharge model was only used to estimate groundwater pumping for citrus irrigation. Because irrigation is assumed to completely refill soil moisture storage and is less than 100 percent efficient, simulated soil moisture exceeds capacity immediately following an irrigation event. The excess is assumed to become deep percolation beneath the root zone.

3.9. DEEP PERCOLATION FROM ROOT ZONE TO SHALLOW GROUNDWATER

The surface hydrology model updates soil moisture storage each day to reflect inflows and outflows. Rainfall infiltration and applied irrigation water are added to the ending storage of the previous day, and ET is subtracted. If the resulting soil moisture storage exceeds the root zone storage capacity, all of the excess is assumed to percolate down from the root zone to shallow groundwater on that day. In

modeling parlance, this is known as a “bathtub model”; vertical unsaturated flow and preferential flow through cracks and root tubes in the soil are not considered.

3.10. MOVEMENT OF SHALLOW GROUNDWATER TO DEEP RECHARGE AND STREAM BASE FLOW

A shallow groundwater storage component may not be part of all groundwater systems, but its presence is sometimes indicated by groundwater hydrographs and stream base flow. In upland watersheds, for example, the shallow groundwater reservoir is what supplies base flow to streams. Without it, simulated stream flow consists of large flows occurring only on rainy days. Physically, it represents the overall permeability and storage capacity of deep soil horizons and bedrock fractures beneath hillsides bordering a gaining stream. It allows the integration of shallow and deep, fast and slow flow paths between the point of rainfall infiltration and the stream. In valley floor areas with flat terrain and deep deposits of unconsolidated basin fill, the presence of a shallow groundwater system is sometimes evident in a lack of response of deep well hydrographs to rainfall recharge events or even wet versus dry years. The shallow zone in that case attenuates the pulses of recharge percolating beneath the root zone into a relatively steady recharge flux, and there may be little outflow to streams.

In the surface hydrology model, the only inflow to shallow groundwater storage is deep percolation from the root zone. There are two outflows: laterally to a nearby creek and downward to the regional groundwater flow system. Outflow to streams is specified as a certain percentage of current groundwater storage, which results in a first-order logarithmic recession of stream base flow, consistent with gaged stream flows. Outflow to the regional groundwater system is simulated as a constant downward flux. This is consistent with flow across confining layers in which the vertical head gradient is near unity. Both outflows are calculated and subtracted from shallow groundwater storage each day. They continue until the storage has been exhausted, resuming whenever a new influx of deep percolation from the root zone arrives. There is no assumed maximum capacity of shallow groundwater storage.

The two parameters defining shallow groundwater flow are the recession constant for flow to streams and the constant downward flow rate for deep recharge. Both of these are obtained by calibration. The recession constant can generally be calibrated by matching simulated to measured stream base flow in gaged watersheds. The deep recharge rate can be used to adjust the long-term partitioning of shallow groundwater mass into base flow versus recharge.

The shallow groundwater component of the surface hydrology model is simple but adequate to capture the fundamental behaviors of logarithmic stream base flow recession and attenuated deep recharge. Other watershed models invoke more complex systems of storage and flow to simulate these processes. For example, the Precipitation and Runoff Modeling System (PRMS) developed by the U.S. Geological Survey includes a total of seven storage components between the point where a raindrop reaches the ground and the stream into which it ultimately flows (Markstrom and others, 2015). This larger number of components and parameters enables relatively detailed matching of observed stream flow hydrographs but is unnecessarily complex for the purposes of groundwater modeling.

3.11. EVAPOTRANSPIRATION BY RIPARIAN VEGETATION

In locations where the water table is shallow, some plants (phreatophytes) can extract water directly from the water table to meet evaporative demand. The rainfall-runoff-recharge model was used to estimate the amount that would be drawn from the water table if a shallow water table were present.

The potential use of groundwater by phreatophytes was assumed to equal the ET demand of the vegetation minus the amount that could be supplied by soil moisture. In practice, this was accomplished by temporarily simulating the vegetation as if it were irrigated using the rainfall-runoff-recharge model, then using the simulated irrigation rates as the maximum rate of withdrawal by roots from the water table. This rate of groundwater use is thought to decrease with increasing depth to the water table because fewer shrub and tree roots are able to reach the water table and the energetics of withdrawing the water become less favorable. The use of groundwater decreases from the maximum rate when the water table is at the land surface to zero when the water table is 20 feet or more below the ground surface. These calculations are applied at model cells where aerial photographs indicate the presence of dense, lush riparian vegetation, which is a sign of phreatophytic water use. These calculations were also made using the MODFLOW evapotranspiration (EVT) module.

3.12. GROUNDWATER INFLOW

Groundwater inflow into the basin from adjacent uplands—also called mountain front recharge—is difficult to estimate. If the basin is bounded by igneous or metamorphic rocks with very limited groundwater flow through fractures, it can be reasonable to assume that inflow from bedrock is negligibly small. If the bedrock is fractured, the total amount of inflow across the long “no-flow” boundaries on the east and west sides of the Basin can be cumulatively significant. Subsurface inflow across those boundaries was estimated using the rainfall-runoff-model results for the tributary watersheds. By this method, the estimates must be consistent with conservation of mass in the watersheds; that is, with the estimates of rainfall, ET, and surface outflow. The resulting estimates are still highly uncertain, however, because groundwater outflow from the watersheds—and surface outflow, too, for that matter—are both small compared to the two largest flows in the watershed water balances: rainfall and evapotranspiration. Thus, a small error in the estimate of either of those flows can result in a large error in groundwater outflow.

Ultimately, groundwater flows produced by the rainfall-runoff-recharge model were calibrated based on their effects on simulated groundwater levels at nearby wells within the basin and on the simulated amount of stream base flow exiting the watersheds. The initial groundwater inflow estimates were generally too high. The estimates were lowered primarily by increasing the estimated root depth of natural vegetation in the watersheds, which is highly uncertain due to the effects of shallow bedrock on rooting depth.

Groundwater inflow from tributary watersheds was smoothed over time to reflect attenuation of recharge pulses that occur during wet months and wet years as they gradually flow through long, relatively slow flow pathways. Smoothing was accomplished by a moving average of simulated groundwater recharge in the tributary areas over the preceding 2 to 10 years. This range represents local variability that was indicated by rates of recession in stream base flow and groundwater levels near the basin boundary during prolonged droughts. The final estimate of average annual groundwater inflow during the calibration period was 5,400 to 7,200 AFY under normal climatic conditions.

3.13. CALIBRATION OF RAINFALL-RUNOFF-RECHARGE MODEL

Parameters in the rainfall-runoff-recharge model were jointly calibrated with the groundwater model. The total amount of dispersed recharge and annual variations in recharge influence simulated groundwater levels, and parameters in the rainfall-runoff-recharge model were adjusted to improve the fit between measured and simulated groundwater hydrographs. The rainfall-runoff-recharge model was also calibrated based on a comparison of measured and simulated daily stream flow at two stream

gages on Temescal Wash, one below Lee Lake at the upstream end of the Bedford-Coldwater Subbasin (Temescal Wash at Corona Lake; USGS 11071900) and one at Main Street downstream of the wastewater treatment plant in Corona (Temescal Creek above Main Street at Corona; USGS 11072100). Characteristics and model parameters for that watershed were assumed to also apply to similar watersheds along the western edge of the Basin. Unfortunately, the gage began operation in 2019, which is after the 1990-2018 model simulation period. Nevertheless, the general pattern of flow peaks and base flow recession simulated in prior years was similar to the gaged pattern in 2019-2020, as shown in **Figure 6**.

4. NUMERICAL GROUNDWATER MODEL DEVELOPMENT

The numerical model incorporated the hydrogeological data from the basin and hydrologic model and is capable of simulating historical and future conditions. The following section describes the development of each of the components in the MODFLOW model.

4.1. GENERAL APPROACH

The Temescal Basin Model is a numerical groundwater model, which is a mathematical description of the hydrogeological conceptual model (Bear and Verruijt, 1987). The advantage of a numerical model is that, once in a mathematical format, the model quantitatively combines data on basin geometry, aquifer properties, recharge, and discharge to simulate changes in groundwater elevations and calculate the water balance over time.

The Temescal Basin Model is setup to represent the physical features that influence groundwater flow including the geology, hydrology and climate. Each of these features is mapped onto a model grid that represents the vertical and horizontal distribution of parameters over the Basin based on the hydrogeological conceptual model. The parameters can also be varied through time over a defined base period to represent seasonal variations in precipitation, streamflow and groundwater pumping. A more detailed discussion of how each of these parameters was developed and entered into the Temescal Basin Model is summarized below.

- Model Setup - representation of the physical groundwater basin
- Boundary Conditions – representation of the inflows and outflows from outside of the model
- Aquifer Properties – representation of the flow characteristics of the aquifer
- Initial Conditions – representation of groundwater conditions prior to the model period

The model development was focused on the HCM, as described in **GSP Sections 3 and 4**, with emphasis on defining boundary conditions and flow paths. Aquifer parameters were assigned on a subregional basis within each model layer to represent reasonable aquifer properties for the aquifer being simulated.

4.2. MODEL SETUP

The model also incorporates spatial distribution of the physical features of the Basin and the temporal distribution of time-varying parameters such as precipitation and recharge. The following describes the basic components required to construct a numerical model.

4.2.1. Model Code Selection

The model setup utilizes the MODFLOW modeling code developed by the United States Geological Survey (USGS). The Temescal Basin Model uses MODFLOW-NWT (Niswonger et. al., 2011), which is a standalone version of MODFLOW-2005 (Harbaugh, 2005) that includes an advanced mathematical solver that provides a more robust solution to complex conditions such as rewetting of dry model cells, unconfined conditions and groundwater-surface water interactions. These features improve the ability of the Model to evaluate complex groundwater-surface water interactions and projects to increase future groundwater levels in the Basin.

4.2.2. Base Period

The Temescal Basin Model is setup using water years that run from October through to the following September to capture the cause and effect relationship on groundwater levels of wintertime rain and subsequent summertime groundwater pumping. The model simulates the 29-year base period from October 1989 through September 2018 to represent Water Years (WY) 1990 through 2018. This retains the starting date of prior models, which coincides with the beginning of some key data sets and also the beginning of the period of rapid land use conversion from agricultural to urban. The ending year is the most recent year for which all necessary model input data were available. The 29-year simulation period is desirable for model calibration purposes because it includes a wide range of hydrologic and water use conditions, including wet periods, droughts, changes in groundwater pumping and implementation of lake management measures.

To simulate this base period, the model is subdivided into time intervals termed stress periods. For each water year, monthly stress periods were defined to provide the ability of the model to evaluate temporal at a monthly scale. For the base period, a total of 348 stress periods were defined. Time-dependent parameters, such as groundwater pumping or precipitation recharge, are assigned to for each stress period.

Conditions during the stress period are constant, but parameters can be varied from stress period to stress period. A stress period can be subdivided into shorter time periods, or timesteps, to allow for more temporal resolution within each stress period to help with model convergence. For the Temescal Basin Model, each stress period was simulated using three (3) timesteps. MODFLOW calculates the groundwater elevations and water balance for each time step. The model results provide the groundwater elevations for the final timestep of each stress period, and the summation of the water balance changes for all timesteps for each stress period.

4.2.3. Model Domain and Grid

MODFLOW requires the application of a rectangular grid that encompasses the entire area, or domain, that will be modeled. The model grid forms the mathematical framework for the model. Each grid cell has to be populated with aquifer properties. Physical features such as streams and wells are mapped onto the model grid. Using this information, the MODFLOW model calculates a groundwater elevation at each model grid cell for each timestep. The density of model grid cells is what defines the resolution of the model in resolving drawdown and other hydrologic effects.

The model domain covers all of the Temescal Basin and a portion of the Chino Area in the Prado area (**Figure 7**). The Temescal Basin occupies about 75 percent, approximately 37 square miles, of the southern model domain. The extent of the model domain for the Temescal Basin Model is shown on **Figure 7**. A portion of the Chino Basin was included in the Temescal Basin Model domain to allow for a more natural boundary along the Santa Ana River and Prado wetlands area. The boundary with the Chino Subbasin (DWR Basin No. 8-2.01) to the north is generally marked by the Santa Ana River and a series of low-lying hills in the Norco area. The northern boundary was set at a distance sufficient far so that the assigned boundary condition would not affect groundwater conditions in the Temescal Basin.

The Temescal Basin Model consists of 568 rows, 480 columns and 3 layers. The rows and columns have a uniform spacing of 100 feet. Each 100-foot square represents a model cell. MODFLOW calculates one groundwater level for the center point of each grid cell for each timestep. The total number of grid cells in the Temescal Basin Model is 817,920 cells, of which 425,304 are active cells where MODFLOW calculates a groundwater levels. The active areas, which represent the area within the groundwater

basin where groundwater elevations are simulated, covers approximately 35,526 acres. Areas outside of the Basin are represented as no-flow cells where MODFLOW does not perform calculations.

4.2.4. Model Layers

The model layers represent the geologic units that compose the Principal and Secondary Aquifers of the Basin based on the geology and HCM presented in **GSP Section 3** and summarized in **Section 2**. Model layers provide vertical resolution for the model to simulate variations in groundwater elevation, aquifer stresses, and water quality with depth. The model layers are based on an evaluation of the following data sets:

- Surficial geology,
- Faulting,
- Lithologic borehole logs.
- Well construction logs, and
- Previously completed local hydrogeologic conceptualizations and cross sections.

This information was collected and translated into a unified GIS compatible database structure for cross section construction and geographic evaluation. This approach allows any hydrostratigraphic structures relevant to groundwater flow in the Basin to be easily translated from GIS for use in other formats.

For the Temescal Basin Model, three model layers were defined to simulate hydrogeologic characteristics of the principal and secondary aquifers within the Temescal Basin. The model layers are numbered from 1 through 3 from top to bottom. In the Temescal Basin, three model layers were defined that represent the following geologic units:

- Model Layer 1 – Channel Aquifer (Principal Aquifer)
- Model Layer 2 – Alluvial Fan Aquifer (Secondary Aquifer), and
- Model Layer 3 - Sandstone Aquifer (Secondary Aquifer)

Figure 8 shows the general outline of the Channel Aquifer within the Temescal Basin. The top of Model Layer 1 represents the topography that is based on topographic elevation points every 10 meters were extracted from the National Elevation Dataset (http://ned.usgs.gov) throughout the model domain **Figure 9**.

The model layers represent the aquifers within the Temescal Basin. **Figures 10 through 12** show the areal extent and bottom elevation of each of the model layers over the entire model domain. **Figure 13** shows two cross section help to illustrate the shapes and relative thicknesses of three model layers in the Temescal Basin. These cross sections follow along the model grid with the upper cross section on **Figure 13** located along model-grid row 262 and the lower cross section on **Figure 13** located along model-grid column 322 (**Figure 8)**. These The following discussion provides a summary of the geologic units represented by each model layer in accordance with the HCM.

Model Layer 1 represents the Channel Aquifer in the Temescal Basin, which is the primary water supply unit in the Basin (Todd and AKM 2008) where the larger wells are completed. The alluvial deposits are a mix of interlayered gravels, sands, silts, and clays resulting from alluvial fan and fluvial processes. Model Layer 1 ranges up to 200 feet thick. Alluvial aquifer materials are present in other parts of this hydrologic area, but their extent and production capacity are uncertain. In these areas, Model Layer 1 represents a relatively thin layer that is rarely saturated. The extension of Model Layer 1 is a requirement of MODFLOW to provide for continuity across the model domain. In these areas, Model Layer 1 has a minimum thickness of ten feet, and is conceptualized as the soil and shallow unconsolidated sediments that overlie the older alluvial fan and consolidated sedimentary geologic units.

Model Layer 2 represent the Alluvial Fan Aquifer (Secondary Aquifer) that is composed of heterogeneous sand and fine-grained sediments. Although these deposits are relatively thick, the entire unit is heterogeneous and cannot be considered one single aquifer. Rather, sand lenses within the deposits collectively form the Alluvial Fan Aquifers. Lithologic data from wells are insufficient to map out the extent of the aquifers or characterize the deposits. Limited data indicate relatively fine-grained textures throughout much of the area, especially with depth (Todd and AKM 2008).

Model Layer 3 represents the Sandstone Aquifer (Secondary Aquifer) that consists of sedimentary rocks of Tertiary age containing sandstone layers that are penetrated by several Corona wells (Todd and AKM 2008). Due to the limited production, depth, and relatively low permeability in most areas, the Sandstone Aquifer is not considered a primary source of water supply. The bottom of Model Layer 3, which the lowest model layer in the Model, is a no-flow boundary condition, representing the older bedrock formations that are assumed to be relatively impermeable.

In the Chino Basin, Model Layers 1, 2 and 3 represents the aquifer layer defined in the Chino Basin Model (WEI, 2015, 2020). The definition of the model layers in the Chino Basin were set up to conform as well as possible to the model layers used in the Chino Basin Model (WEI, 2015, 2020). These Chino Basin layers were correlated to the three model layers defined in the Temescal Basin.

4.2.5. Faults

The Elsinore and Chino fault zones bound the Basin on the west and parallel the base of the Santa Ana Mountains. The faults within the Basin were simulated using the Horizontal Flow Boundary (HFB) Package in MODFLOW that allows a conductance parameter to be placed between adjacent model cells to limit groundwater flow. Flow across the faults was based on assigned conductance values that ranged from 0.01 ft^2/d in the alluvial sediments in the Prado area to 0.000002 ft^2/d in the sandstone aquifer in the Temescal Basin. The fault locations within the Temescal Basin model are shown on **Figure 14**. For the model, all faults extended across model Layers 1 through 3. The fault hydraulic conductivities were based on an initial estimate that was refined during model calibration.

The HFB Package was also used to assign a low conductance (0.0000003 ft^2/d) to represent the engineered clay core of the Prado Dam that is designed to limit underflow underneath the dam through the unconsolidated sediments in Model Layer 1.

4.2.6. Aquifer Conditions

Groundwater conditions for each model layer can be defined as unconfined, fully-confined, or convertible between confined and unconfined based on the relation of the simulated groundwater level to the top of the model layer. Unconfined conditions exist when groundwater levels are below the top of the physical aquifer layer whereas confined conditions exist when groundwater levels are above the top of the physical aquifer layer. For the Temescal Basin Model, Model Layer 1 is defined as unconfined throughout the model domain. Model Layers 2 and 3 are defined as convertible between confined and unconfined conditions.

Because of the historical changes in groundwater levels, areas within the Basin can be temporarily unsaturated. Prior MODFLOW versions set a dewatered cell to a no-flow condition for the rest of the simulation if the cell is dewatered. An important advantage of using MODFLOW-NWT compared to previous MODFLOW versions is that unsaturated groundwater heads will be calculated for dry cells, whereas standard MODFLOW excludes these calculations (Niswonger et. al., 2011). This resaturation capability of MODFLOW-NWT was utilized for the Temescal Basin Model.

In MODFLOW-NWT, head is simulated continuously from saturated to unsaturated conditions. MODFLOW-NWT will calculate a head in an unsaturated cell while not allowing water to flow out of that cell, which provides a continuous solution for groundwater flow. Inflow to an unsaturated cell, either from adjacent cells, overlying cells, or an external source simulated by one of the stress packages, automatically flows downward to an underlying saturated cell if there are deeper layers. An unsaturated cell has a head below the cell bottom and is considered to have no water in storage, so changes in storage also are zero for these cells. The model accounts for this situation by setting the storage coefficient for an unsaturated cell to zero. This allows for the continuous solution of head not to affect the overall water balance results (Niswonger et. al., 2011).

Because groundwater heads are calculated for unsaturated cells using this approach, it is necessary for the model user to interpret the head in a cell relative to the cell bottom. If the head in a cell is at or below the cell-bottom altitude, then the water table is not contained within this cell (Niswonger et. al., 2011).

4.3. BOUNDARY CONDITIONS

Model boundary conditions represent the hydrologic budget by simulating where groundwater enters and exits the basin. Boundary condition data must be entered for each stress period at each model grid cell where a boundary condition is defined in the model. MODFLOW NWT provides a number of boundary condition options to numerically represent the different physical processes included in the hydrologic budget. The physical distribution and volumes of groundwater inflow and outflow for each budget component need to be accounted for geographically within the model domain. A discussion of each boundary condition of the groundwater budget is provided below.

4.3.1. Surface Recharge

The rainfall-runoff-recharge model outlined in **Section 3** describes the methodology to define both the spatial distribution and monthly volume of surface recharge to groundwater within the Temescal Basin model. The rainfall-runoff-recharge model calculates the monthly contributions from precipitation and return flows to surficial groundwater recharge. The surface recharge is spatially distributed across the model domain using zones that are defined by a combination of geology and land use. This calculated surface recharge is applied using the MODFLOW recharge package.

4.3.2. Streams

The groundwater model dynamically simulates groundwater recharge from stream percolation and groundwater discharge into streams. Percolation from streams is a function of stream flow and—where the water table is equal to or higher than the stream bed elevation—the difference in water level between the creek and water table.

The MODFLOW stream flow routing (SFR2) package is used to simulate these processes. Each stream in the basin is simulated as a sequence of reaches, each of which is a model grid cell along the alignment of the channel. Flow is specified at the upstream end of each stream segment and routed down the reaches, with flow to or from the aquifer calculated on the basis of wetted channel area, channel bed hydraulic conductivity and the difference in elevation between the stream surface and the simulated groundwater level at that reach. By this means conservation of mass is applied concurrently to the stream and the aquifer. Streams can dry up completely as they cross the basin; and conversely, groundwater discharge can create stream flow in a segment that is dry farther upstream. The stream

flow routing module allows for a network of channel segments, with multiple inflows or diversions at the start of each segment.

The Temescal Basin model includes a network of 39 stream segments containing a total of 2,688 stream reaches (**Figure 15**). Seventeen segments are used to simulate eight streams that drain watersheds in the Santa Ana Mountains along the west side of the Basin. Streams that flow across the Temescal Basin to Temescal Wash are divided into multiple segments to represent the natural, concrete-lined and unlined engineered streambed conditions present on these streams. Temescal Wash is composed of seven segments that represent varying lined and unlined conditions along Temescal Wash (**Figure 15**). An additional five segments represent the short sections of four streams that drain watersheds from upland areas east of Temescal Wash.

In general, the upland stream reaches are more than 20 feet above the water table and are not hydraulically coupled to groundwater. Percolation from those reaches is independent of groundwater levels and not affected by pumping. Reaches where groundwater appears to be hydraulically coupled to surface water primarily include most of the length of Temescal Wash, Santa Ana River, and the lower ends of some larger tributaries in the Prado wetland area.

In the Chino Basin, the Santa Ana River is represented by five segments (**Figure 15**). The areas upstream of the Prado wetland area were represented by a single long segment, and the other four segments defined areas within the Prado wetland area and downstream of the Prado Dam. Five other segments simulated streams in the Chino Basin. Stream bed permeability was estimated by model calibration. For unlined streams, calibrated values for the stream bed permeability ranged from 0.1 to 25.0 feet per day (ft/d); whereas for concrete-lined streams, the stream bed permeability ranged from 0.00003 to 0.03 ft/d.

To develop estimates of surface and subsurface inflows from these tributary areas to the groundwater basin, a rainfall-runoff-recharge model (**see Section 3**) is used to simulate the entire watershed tributary to the Basin. This model simulates all near-surface hydrologic processes, including rainfall, runoff, infiltration, evapotranspiration, effects of impervious areas and irrigation, soil moisture storage and percolation to stream base flow and deep groundwater recharge. The calculated runoff is included in the SFR2 Package. Inflows for Temescal Wash are coordinated with output from the Bedford-Coldwater numerical model and USGS gauge data as discussed as part of the rainfall-runoff model documentation in **Section 3**.

The lower Temescal Wash and Butterfield Drain in the Prado area along the northern boundary of the Temescal Basin were simulated using the MODFLOW Drain Package. This is because the Prado Area is primarily a groundwater discharge area (**Figure 15)**. During model calibration, these two stream segments experienced numerical instability due to the interaction of two head-dependent boundaries of groundwater-surface water interactions using SFR2 and the high evapotranspiration applied to the Prado Area. During model calibration, the MODFLOW output showed that these areas were principally areas of groundwater discharge to streams or ET, so converting these areas to drains was appropriate to improve the overall model performance.

Similarly, areas in the Norco area include large storm drain channels for drainage and stormwater management (**Figure 15**). Occasional shallow groundwater conditions during high rainfall periods led to numerical instability that was relieved by converting these drainage channels to the MODFLOW Drain Package.

4.3.3. Mountain Front Recharge

Groundwater inflow into the basin from adjacent uplands—also called mountain front recharge (MFR)—were calculated by the rainfall-runoff-recharge model (see **Section 3**). MFR represents subsurface inflow of groundwater from the low-permeability rocks adjacent from the surrounding watershed to the groundwater Basin. The MODFLOW well package was applied along the basin margin in Model Layer 3 which represents the weathered bedrock. The distribution of the cells assigned to represent MFR are shown on **Figure 16.**

The rainfall-runoff-recharge model (see **Section 3**) was used to calculate a monthly subsurface inflow from each watershed based on precipitation recharge in the upstream watershed, with delays and attenuation due to long travel times through bedrock fractures. A set of cells in the well package were assigned to each watershed and the monthly inflow was distributed evenly to those cells assigned to that watershed. Therefore, the distribution of inflow incorporates the size and rainfall for each of the defined watersheds that contribute flow to the Basin.

4.3.4. Evapotranspiration

Evapotranspiration (ET) represents groundwater outflow from evaporation to the atmosphere and uptake by plants from the saturated zone. This is distinct from ET associated with soil moisture before it reaches the groundwater aquifer that is sustained by the total available precipitation not accounted for by runoff or recharge (see **Section 3**).

The MODFLOW evapotranspiration (EVT) package is used simulate ET directly from the groundwater aquifer. ET is defined over the entire model domain; however, ET only occurs in areas of shallow groundwater. In the Basin, this is generally limited to riparian areas adjacent to streams. ET includes uptake from both phreatophytes (plants that require groundwater) and mesophytes (plants that can utilize groundwater) either directly from the saturated zone or from the overlying capillary fringe (Meinzer, 1927; Robinson, 1958; and Lewis and Burgy, 1964). ET from the capillary fringe is replenished with groundwater from the underlying aquifer, so it is also considered a loss of groundwater (Lubczynski, 2011).

In the MODFLOW EVT package, the ET rate decreases with increasing depth to the water table because fewer shrub and tree roots are able to reach the water table and the energetics of withdrawing the water become less favorable. In the groundwater model, the consumptive use of groundwater due to ET decreases from the maximum rate when the water table is at the land surface and diminishes linearly down to zero when the water table reaches the extinction depth for that location.

In the Temescal Basin Model, three ET zones were defined as shown on **Figure 17**. The first zone represents locations where aerial photographs indicate the presence of dense, lush riparian vegetation indicates areas of shallow groundwater where the plants (phreatophytes) can regularly uptake water directly from the water table to meet evaporative demand. These primarily occur in the Prado wetland area, along the Temescal Wash, Santa Ana River and in some of the upland canyons along the basin margin. The extinction depth for these locations was set at 20 feet below the ground surface. Over most of the remaining model domain, the extinction depth was set at the ground surface. The third area represents areas the Norco area where the extinction depth was set at 1.0 feet below the ground surface to better control periods of high groundwater. ET rates applied in the Temescal Basin Model use the ET data from the rainfall-runoff-recharge model (see **Section 3**).

4.3.5. Groundwater Pumping

Groundwater pumpage is the largest groundwater outflow from the Basin. Corona is the primary producer of groundwater in the Basin. Corona has 18 wells that extract water from the Basin for the purpose of potable water supply (Michael Baker 2021). Norco has four active wells but they are located in the unadjudicated portion of the Chino Subbasin not the Basin. Thirty-eight wells within the Basin produced groundwater in one or more years during 1990-2018, and the reported annual pumping amounts were obtained from WMWD.

A number of private wells were historically installed in the Basin. There are no records of which of these wells are currently active. However, the GSA agencies searched for existing active wells within the Basin. This search included reviewing water use records and contacting owners of large private properties (domestic, commercial, and industrial), inquiring about private wells in discussions with knowledgeable local residents and community leaders, and polling interested parties during public meetings. This effort indicated that the only private pumpers in the Basin are All American Asphalt, Dart Corporation, and 3M. No active private domestic wells were identified in this search. **Figure 18** shows the locations of wells with measured pumping rates in the Basin by Corona, Norco and private pumpers.

Citrus orchards irrigated with groundwater were common in the Basin in the early 1990s, but except for one small grove those have all been replaced by urban development. Agricultural irrigation pumping of the orchards was estimated by the rainfall-runoff-recharge model, with pumping assigned to a hypothetical irrigation well at the center of each irrigated recharge zone. This pumping was phased out over time as urban development occurred. Urban irrigation is supplied by the municipal water system, which uses imported water and local wells. Locations of agricultural pumping are distributed based on the estimated agriculture pumping requirements calculated using the rainfall-runoff model (**Figure 19**).

Municipal well extractions are measured and these data are entered directly into the model. Annual production by municipal wells is shown in **Figure 20**. All pumping wells are included as analytical elements that are simulated by the MODFLOW well package in the model. **Table 1** summarizes the average annual groundwater pumping for each well over the simulation period along with the assigned model layer.

4.3.6. Recycled Water Recharge Ponds

Wastewater is treated at three Corona-owned and operated Water Reclamation Facilities (WRF-1, WRF-2 and WRF-3). The average annual production of treated wastewater (effluent) from these sources is approximately 11.35 mgd, or 12,700 acre-feet per year (AFY). Supply is anticipated to increase incrementally due to population growth by an additional 0.88 mgd through 2040 (about 7.8 percent).

WRF effluent is allocated to three end uses: 1) discharge to Temescal Wash or the Santa Ana River (SWRCB 2021), 2) reuse via the reclaimed water distribution system, and 3) discharge to offsite percolation ponds. WRF-1 and WRF-2 both contribute effluent to all of these end uses while WRF-3 only contributes effluent to the reclaimed water system.

The MODFLOW Well Package was used to simulate recharge at the WRF recharge pond as recharge wells. The volume of flow for each recharge pond was distributed evenly over the area of the ponds. The three offsite percolation ponds overlie the Basin and allow for recharge. One of the ponds is located along Lincoln Avenue and the other two at the end of Rincon Street near Cota Street, as shown in **Figure 21**. Average annual WRF discharge to the recharge ponds from 2016 through 2020 ranged from 1,364 to 5,273 AFY at WRF-1, and 734 to 1,462 AFY at WRF-2.

4.3.7. Subsurface Flow with Adjacent Groundwater Basins

To simulate potential subsurface groundwater and outflow with adjacent groundwater basins, either a specified head or general head boundary was defined using MODFLOW. Constant head boundaries allow sufficient inflow or outflow at that model cell to achieve the specified head. Head boundaries were defined at the locations shown on **Figure 22** at the following areas:

- **Arlington Gap** - The Basin margin with the Upper Santa Ana Valley – Riverside-Arlington Basin at the location known as the Arlington Gap.
- **Santa Ana River Flow Boundary** - The Basin margin with the Coastal Plain of Orange County Groundwater Basin near the outflow of the Santa Ana River from the Temescal Basin.
- **Bedford-Coldwater Flow Boundary** - The basin margin along the far southeastern corner of the Basin to coordinate with a similar boundary condition applied in the groundwater model for the Bedford-Coldwater Basin.
- **Chino Basin Interior Flow Boundary** - The northern model domain boundary located within the Chino Basin.

At the Arlington Gap, a MODFLOW General Head Boundary (GHB) package was applied along the basin margin. The distribution of the GHB cells is shown on **Figure 22.** The MODFLOW general head boundary (GHB) package allows for a more flexible simulation of the groundwater elevation at the cell by calculating the inflow or outflow at that model cell based on a conductance and a specified head at a user-defined distance on the external side of the boundary. The GHB boundary was defined based on an earlier groundwater flux calculation for the Arlington Gap (Todd and AKM 2008). The GHB parameters were varied during calibration to better match measured groundwater levels in the area.

The boundary with the Coastal Plan of Orange County Basin is a narrow canyon where the Santa Ana River exits the Temescal Basin. A MODFLOW constant head boundary was applied at this location. The specified head at this boundary was set at a comparable level with the stage of the Santa Ana River to simulate subsurface flow towards the Coastal Plan of Orange County Basin.

The Bedford-Coldwater Basin boundary is generally considered have little to no groundwater flow except where the alluvium along Temescal Wash thins as the wash leaves the subbasin and traverses northward through bedrock (a reach referred to as Temescal Canyon) before entering Temescal Basin. A MODFLOW constant head was applied at this location at a comparable level with the stage as was applied in the Bedford-Coldwater Basin to allow for groundwater flow through the channel deposits of Temescal Wash.

The Chino Basin interior flow boundary is located along the northern model domain. A portion of the Chino Basin was included in the Temescal Basin Model domain to allow for a more natural boundary along the Santa Ana River and Prado wetlands area. As a result, a boundary condition was defined within the Chino Basin. This northern boundary was set at a distance sufficiently far from the Santa Ana River that the assigned boundary condition would not affect simulated river-aquifer interactions or simulated groundwater conditions in the Temescal Basin. A MODFLOW constant head was applied to represent the general groundwater elevation pattern in the Chino Basin based on available groundwater elevations with some minor adjustments during model calibration. The objective of this boundary condition is to provide a realistic representation of groundwater conditions within the Chino Basin with respect to understanding the water balance for the Temescal Basin.

4.4. AQUIFER PROPERTIES

Aquifer properties represent the physical and hydrogeologic characteristics of the aquifers within the Basin that control groundwater flow. Aquifer properties must be assigned to each active grid cell in the model. The conceptual model provides the framework necessary to define aquifer properties.

4.4.1. Aquifer Characteristics

The groundwater model represents the basin fill materials in terms of their ability to store and transmit groundwater. Horizontal and vertical hydraulic conductivity define the permeability of the aquifer, which is its ability to transmit groundwater flow. The ability to store water consists of two components. At the water table, storage of water associated with filling or draining the empty (air-filled) interstices between mineral grains is represented by the specific yield of the aquifer. In deep aquifers, there is a much smaller ability to store and release groundwater that derives from the compressibility of the water and aquifer materials (specific storativity). Thus, the initial response to pumping from a deep aquifer is a large drop in water level (head) within that aquifer. With sufficient time, however, the decrease in head creates downward movement of groundwater that eventually accesses the storage capacity at the water table. In other words, the storage response of the aquifer depends partly on the duration of pumping and observation. For groundwater management purposes, storage responses over periods of months to decades are usually the most relevant.

Aquifer characteristics can be estimated in two ways. The first is by means of an aquifer test in which one well is pumped while water levels are measured at a nearby well. This approach typically measures horizontal hydraulic conductivity over distances of tens to hundreds of feet and storage responses over periods of 1 to 3 days. The second approach is to calibrate a groundwater flow model such that the aquifer characteristics reproduce measured historical water levels throughout the basin given estimates of historical recharge and pumping. The latter approach produces estimates of aquifer characteristics averaged over spatial scales of thousands to tens of thousands of feet and time scales of months to decades. The estimates account for preferential flow through localized sand and gravel lenses in the basin fill materials and for delayed water-table responses to deep pumping. Also, model calibration provides estimates of vertical hydraulic conductivity across the layers of alluvial deposits, which is rarely measured by aquifer tests. The temporal and spatial scales represented by the model calibration approach are better for addressing most long-term groundwater management questions.

4.4.2. Zone Approach

Because of the limited data for aquifer properties for the Basin, a zoned distribution pattern was used that applied aquifer properties over subregional areas with similar geologic conditions. Although the units are heterogeneous, the approach was to get a representative average value for each aquifer property for limited number of zones around the basin. This was to avoid the patchwork quilt type of aquifer property distribution that does not show any relation to the underlying geologic conditions that define the aquifer property. **Figure 23** shows the distribution of aquifer characteristics after calibration of hydraulic conductivity and specific storage, respectively. The initial estimates of hydraulic conductivity and specific yield were from available local data, which incorporated major geologic features such as relatively permeable sediments in the upper parts of alluvial fans.

4.4.3. Hydraulic Conductivity

Hydraulic conductivity represents the ability of the water to flow through the aquifer, and is defined horizontally within a model layer to represent groundwater flow through the aquifer and vertically between adjacent model layers to represent groundwater exchange between aquifers. The determination of the horizontal hydraulic conductivity is based on an assessment of lithologic description, available aquifer test data and model calibration. Since each model layer represents a thick interval composed of varying lithologies, the horizontal hydraulic conductivity represents an average value over the entire vertical thickness that includes the finer-grained layers in addition to any specific sand and gravel zone. For the Temescal Basin model, horizontal hydraulic conductivity is defined using regionalized blocks based on the geologic character of the unit and refined during calibration. The hydraulic conductivity used in the Temescal Basin model varies within a reasonable value range for the aquifer characteristics for each aquifer to achieve the model calibration. The final simulated horizontal hydraulic conductivities are listed in **Table 2.**

4.4.4. Vertical Conductance

In general, groundwater flow within an aquifer is dominantly horizontal whereas flow between adjacent aquifers is essentially vertical. The application of vertical hydraulic conductivity recognizes the inherent anisotropy present in natural geologic formations. Vertical groundwater flow is equivalent to Ohm's Law for serial electrical flow through different resistivity layers. Based on this analogy, vertical groundwater flow, similar to serial electrical flow, is limited by the lowest conductivity (or highest resistivity) layer encountered. Therefore, vertical groundwater flow is defined by the lowest-permeability, areally extensive layer that controls the exchange of groundwater between aquifer or model layers. MODFLOW requires the input of a vertical hydraulic conductivity (Kz) for each layer. The vertical hydraulic conductivity values used in the model to calculate the VCONT are summarized in **Table 2**.

4.4.5. Specific Yield and Specific Storage

Aquifer storage defines the ability of the aquifer to take in or release water. Under unconfined conditions, water released from or put into aquifer storage represents the physical draining of groundwater from interstitial pore space within the aquifer. Unconfined storage is defined by specific yield. Under confined conditions, water released from or put into aquifer storage is derived from the compressibility of water as a result of changes in the aquifer pressure within the interstitial pore space. MODFLOW NWT requires the use of specific storage, which is in the units of $feet^{-1}$. Reasonable ranges for the specific yield and specific storage were varied within a reasonable range during the model calibration and the values are listed in **Table 2**, respectively.

4.5. INITIAL CONDITION

The model also requires that groundwater levels be specified at the start of the simulation. They were estimated based on contouring of available water level data. As the initial heads may not be representative of stable initial conditions, the first stress period representing pre-1990 conditions was run as steady-state condition to facilitate the calculation of a stable hydrologic system. In addition, initial conditions for the earlier groundwater model (Todd and AKM 2008), and simulated groundwater conditions for September 1989 from the Chino Model (WEI, 2015, 2020) were included to help guide the contouring. **Figure 24** provides the starting head used to provide a reasonable representation of the September 1989 groundwater conditions for Layers 1, 2 and 3.

5. HISTORICAL MODEL RESULTS

The Temescal Basin model was calibrated to reduce uncertainty by matching model results to observed data. An extensive calibration process was designed to better constrain the range of aquifer properties and boundary conditions for the model, thereby reducing uncertainty in the results.

5.1. CALIBRATION METHODOLOGY

For the Temescal Basin model, the calibration simulation uses a 29-year period that covers water year (WY) 1990 to WY2018. This aspect of the calibration is important to demonstrate that the model has the capability to simulate historical changes in groundwater elevations, and is therefore capable of forecasting future changes in groundwater elevations. This capability is necessary for the model to serve as a useful groundwater management tool.

5.1.1. Approach

The transient calibration is a process that compares the simulated groundwater levels from the model to observed groundwater level measurements. During calibration, boundary condition parameters and aquifer properties are varied within the reasonable range defined by the hydrogeological conceptual model. Different combinations are tested to determine the set of parameters and properties that produce an acceptable correlation between simulated and measured groundwater elevations. Other data sets, such as key water budget components, surface water conditions, or hydrogeological conceptual model, were also used to further constrain the calibration.

There are multiple combinations of aquifer properties and boundary conditions that can be used to match a single set of groundwater elevation data. Calibrating to multiple data sets under differing stresses (i.e. recharge and discharge rates) reduces this “non-uniqueness”, thereby reducing the uncertainty. Performing a comprehensive calibration over a 29-year base period infers the calibration has been performed over wet, dry, and normal years with varying degrees of pumping. To that end, the Temescal Basin model was primarily calibrated using groundwater levels. The measures of calibration are primarily from a statistical analysis along with a visual assessment groundwater level trends from hydrographs. The groundwater elevation maps and water budget data considered during the model calibration are assessed in context with the model results, so are discussed in the next section.

5.1.2. Calibration Methodology

Joint calibration of the rainfall-runoff-recharge model, the surface water budget models and the groundwater flow model applied heuristic methods (i.e. trial-and-error adjustments) to selected variables, as informed by the timing and location of model residuals. In accordance with the principle of parsimony in modeling (DWR 2016a), calibration began with a small number of broad zones for hydraulic conductivity and storage. Zones were subdivided during calibration if a pattern of residuals at multiple wells warranted it. Although storage and hydraulic conductivity are not necessarily correlated, in practice they often are to some degree. Thus, for simplicity, similar zonation patterns were used for both variables.

In practice, most of the calibration effort focused on adjustments to horizontal and vertical hydraulic conductivity, the locations and conductances of faults, stream bed vertical hydraulic conductivity, and several tributary watershed parameters: root depths of natural vegetation, rainfall-runoff thresholds and slopes, and the leakage and recession rates for shallow groundwater. Variables that were not

adjusted during calibration include land use, crop root depths, pumping locations, and groundwater pumping.

The model calibration process was also evaluated using a statistical comparison of differences (or residuals) between measured and simulated groundwater elevations. An initial sensitivity analysis was performed using an automated parameter estimation process to provide an initial estimate of hydraulic parameter values and zonation. During the final model calibration, adjustments were made to model inputs and parameters in areas based on the degree and pattern of discrepancies between measured and simulated water levels. Water levels for some wells were easy to reproduce with the model, while others were more difficult. Additionally, a visual inspection of superimposed measured and simulated water-level hydrographs was used to verify consistency with long-term trends. This process of manually calibrating a groundwater model also produced considerable insight into the groundwater flow system and the factors that influence it.

5.2. SENSITIVITY ANALYSIS

The sensitivity analysis was used to determine which model parameters should be calibrated. The model parameters include the hydraulic properties of the aquifer, boundary conditions, as well as any other aspect of the model that can be parameterized. The objective of the sensitivity analysis was to identify those model parameters with a high sensitivity with respect to simulation of groundwater elevations. For the sensitivity analysis, PEST (Doherty, 2004) was selected due to its robust capabilities to automate the parameter estimation and further evaluate the model.

Parameter sensitivity measures the impact of a small parameter change on the calculated system response. If a small model parameter changes results in a large change in the simulated water levels of the model domain, the parameter is regarded as highly sensitive. For the initial sensitivity analysis, all model parameters were included. The purpose was to exclude insensitive parameters from the final adjusted parameter set. During these processes, the covariance matrix from sensitivity analysis was used as the basis for eliminating insensitive parameters from the final test. A total of 21 hydraulic parameters were included in the initial sensitivity analysis. The results indicated that results are relatively sensitive to the hydraulic conductivities and specific yield of layer 1, and also to the hydraulic conductivity of Layer 2 in some areas.

5.3. STATISTICAL CALIBRATION

Model calibration was based on observed groundwater elevations from 3,166 measurements in 29 wells over the 29-year base period from October 1989 through September 2018 (WY1990-2018). The locations of these wells are shown on **Figure 25**.

The statistical calibration consists of a rigorous analysis comparing the difference, or residual, between measured and simulated groundwater elevations. An initial assessment of the model calibration is a comparison of observed versus simulated groundwater elevations of the entire calibration data set using a scatter plot (**Figure 26**). As indicated on **Figure 26**, the scatter along the correlation line is minor in comparison to the range of the data. The correlation coefficient for the data on this graph is 0.934, which indicates a strong correlation between simulated and observed groundwater elevations.

A more detailed tabulation of the statistical analysis for the model calibration is presented in **Table 3**. A summary of the key statistical measures shown on **Table 3** are provided below:

- The residual mean is computed by dividing the sum of the residuals by the number of residual data values. If the mean is significantly higher or lower than zero, it indicates overall model bias toward high or low water levels. The residual mean is -1.7 feet, which is close to zero.
- The absolute residual mean is the arithmetic average for the absolute value of the residual so it provides a measure of the overall error in the model. The absolute residual mean is 11.1 feet.
- The residual standard deviation evaluates the scatter of the data. A lower standard deviation indicates a closer fit between the simulated and observed data. The standard deviation for the calibrated model is 8.7 feet.
- The Root Mean Square (RMS) Error is the square root of the arithmetic mean of the squares of the residuals is provides another measure of the overall error in the model. The RMS Error for the calibrated model is 11.3 feet.
- The scaled absolute residual the ratio of the absolute residual mean is divided by the range of observed groundwater elevations. This ratio helps to put the variation of the residuals into perspective with respect to the scale of the groundwater basin. This ratio for the Temescal Basin Model is 0.024, which puts the statistical variability at less than 2.5 percent of the range. A ratio below 0.10 is generally considered a well calibrated (ESI 2020).

The statistical comparison is also consistent when evaluated by aquifer as shown on **Table 3**, which summarizes the statistical parameters for calibration wells screened primarily in the Channel Aquifer and the Secondary Aquifers (combined Alluvial Fan Aquifer and Sandstone Aquifer). The variability is primarily attributed to the greater number of groundwater levels from active pumping that increases the variability of the observed data over the calibration period. The statistical results are of high quality and are one indication that each aquifer is well calibrated. **Table 4** provides a summary statistics for each of the 29 wells used in the calibration process. The statistical parameters are considered reasonable, indicating that the model is well calibrated.

It should be noted that some degree of difference (or residual) between the observed and simulated groundwater elevations is expected. Residuals may be due in part to localized effects or data quality issues. Therefore, a limited outlier analysis was applied to remove groundwater elevations that did not reflect groundwater conditions in the aquifer. For example, data quality issues, which typically look like isolated spikes along an otherwise consistent long-term trend, were removed. Elevated residuals can result from using groundwater elevations from pumping wells as calibration targets due to excessive drawdown due to a low well efficiency of the pumping well. Pumping well groundwater levels used for the calibration data set except those where the drawdown highly deviated from the long-term trend that were interpreted to be represent well efficiency issues within the pumping well.

5.4. GROUNDWATER LEVEL TRENDS

Hydrographs provide a detailed time history of groundwater elevations for specific wells. This time history data includes the impact of varying climatic and pumping stresses on the groundwater basin. Comparing hydrographs of model results versus observed data provides another measure of model accuracy. For calibration purposes, the hydrographs were inspected to evaluate how well the model results matched the overall magnitude and trend of the observed groundwater elevation data over time. For the transient model, it was considered more important to honor the overall trend of the data. A

hydrograph was considered a good match if the model simulated the trend, even if the simulated groundwater elevations were consistently offset from the measured ones.

Groundwater elevation data for 28 hydrographs from different parts of the basin are included on **Figures 27 through 33**. Locations of the wells used for the hydrographs are shown on **Figure 25**. To facilitate a comparison of the relative groundwater trends observed in these wells, a consistent vertical scale of 200 feet is used on **Figures 27 through 33**. The vertical scale on the hydrographs ranges from 450 to 650 feet, except for Corona 27 well, which is located in the upland areas and has groundwater elevations outside of that range.

The majority of the hydrographs are from wells completed in the Channel Aquifer and adjacent Secondary Aquifers located in the northern portion of the Temescal Basin. The hydrographs from wells in this area show several trends that can be summarized as follows:

- From 1990 through 2000, groundwater elevations typically showed a stable to increasing trend with cumulative groundwater changes ranging from near zero to increases of over 20 feet.
- From 2001 through 2009, groundwater elevations showed a general declining trend of 20 to 40 feet of cumulative decline over this period.
- From 2010 through 2018, groundwater levels showed a variable, but overall stable trend, with groundwater levels fluctuating by plus or minus 10 to 20 feet.

During these periods, the average groundwater recharge was roughly similar, with a mixture of wet, normal and dry water year types. From 1990 to 2000, the average annual groundwater pumping in the Channel Aquifer area was at its lowest levels for the simulation period. Groundwater pumping in the Channel Aquifer area peaked during 2001 through 2009, then declined from 2010 to 2018. Based on this, the primary factor affecting the groundwater levels in the Channel Aquifer area is the amount of groundwater pumping.

In summary, trends in simulated groundwater elevations are similar to trends in the measured groundwater level data, indicating good model calibration. As noted above, most of the differences are due to using groundwater level data from active production wells. Groundwater elevations near active production wells can be chronically lower than in nearby surrounding areas due to residual pumping drawdown. MODFLOW calculates the average groundwater elevation over the entire area of each model cell rather than the elevation at the well location itself. It does not simulate localized pumping drawdown around the well.

5.5. EVALUATION OF GROUNDWATER FLOW

The Temescal Basin Model simulates monthly groundwater elevations for 348 months from October 1989 through September 2018. In general, the overall groundwater flow directions remained generally consistent over this period with some variations observed near the major groundwater pumping centers. To evaluate the range of groundwater elevations, we have selected a few key time periods. These include:

- **Figure 34** – September 2018 for Model Layer 1 – End of Historical Simulation Period
- **Figure 35** – September 2018 for Model Layer 3 – End of Historical Simulation Period
- **Figure 36** – January 1997 for Model Layer 1 – Period of consistently high groundwater levels
- **Figure 37** – January 1997 or Model Layer 3 – Period of consistently high groundwater levels
- **Figure 38** – August 2014 for Model Layer 1 – Period of consistently low groundwater levels
- **Figure 39** – August 2014 or Model Layer 3 – Period of consistently low groundwater levels

The high and low conditions represent a combination of climatic conditions and groundwater pumping demands. For the purposes of evaluating groundwater flow directions, we have selected Layers 1 and 3 as representative of the three layers. In general, the groundwater map for Layer 1 is representative of groundwater conditions in the Channel Aquifer, the upper part of the Alluvial Aquifer in the Temescal Basin, and the shallow aquifer in the Chino Basin. The groundwater map for Layer 3 is representative of groundwater conditions in the Secondary Aquifers.

Figure 34 shows the groundwater level contours and flow directions for Layer 1 at the end of the historical simulation period representing September 2018 conditions Groundwater flow in the Channel Aquifer was from east to west, generally following Temescal Wash. In the Norco area, groundwater flow in Layer 1 was localized to internal drainage and downward percolation. In the Chino Basin, groundwater flow was from northeast to southwest generally following the Santa Ana River. For much of the southern Temescal Basin and areas in the Norco area, Layer 1 is unsaturated, shown on the figures by the purple areas.

In the Secondary Aquifers, groundwater flow was generally from the basin margins towards the Santa Ana River and the Prado wetlands area in September 2018 (**Figure 35**). Underneath the Channel Aquifer, groundwater flow in the Secondary Aquifers flowed from southeast to northwest generally parallel to Temescal Wash. In the Norco area, groundwater flow was generally southwest along the long axis of the valley where it then converged with groundwater flowing northwest toward the Santa Ana River. In the Chino Basin, groundwater flow is from northeast to southwest along the Santa Ana River.

In the southern Temescal Basin, the groundwater gradient in September 2018 was steeper due to the geology of the area. The fault zone along the western margin is configured to be a groundwater barrier limiting flow across the fault. This is based on the HCM and groundwater levels from the Corona 27 well. Groundwater flow in the faulted area flowed to the north where it reached the Santa Ana River downstream of Prado Dam. Below Prado Dam, groundwater flow is towards the Coastal Plain of Orange County Groundwater Basin through either discharge to the Santa Ana River or subsurface flow.

Figure 36 shows simulated groundwater elevation contours for January 1997 in Layer 1. During this period, widespread high groundwater levels were observed reflecting a period of high precipitation and below average groundwater pumping rates. In spite of the contrast in hydrologic conditions, the general groundwater flow directions were generally consistent with those in September 2018 (**Figure 34**).

Groundwater elevations in January 1997 in Layer 3 were also generally consistent with September 2018, with groundwater flowing from the basin margins towards the Santa Ana River and the Prado wetlands (**Figure 37**). The most significant difference was lower groundwater elevations with a localized groundwater depression in the southern Temescal Basin as a result of estimated agricultural groundwater pumping at this time.

Figure 38 shows the groundwater elevations in layer 1 for August 2014. During this period, widespread low groundwater levels were observed reflecting several preceding dry years. In general, the groundwater flow directions were similar to those in 1997 and 2018 (**Figures 34 and 36**). The main differences are lower groundwater levels due to groundwater pumping and limited recharge in the Channel Aquifer.

In the Secondary Aquifers (Layer 3), groundwater elevations were also similar to September 2018 and January 1997, with groundwater flowing from the basin margins towards the Santa Ana River and the Prado wetlands area (**Figure 39**). By 2014, agricultural pumping in the Temescal Basin had disappeared due to urbanization. As a result, groundwater pumping in the southern part of Temescal Basin decreased to near zero, and flow was consistently towards the north.

The simulated groundwater flow patterns were consistent with the hydrogeological conceptual model. These maps are included to demonstrate that the model provides reasonable simulation of groundwater elevation and flow direction even during the more extreme climatic periods during the base period. This further demonstrates that the model is well calibrated and can accurately simulate wet and dry weather periods.

5.6. MODEL-BASED HYDROLOGIC BUDGET

GSP regulations (§354.18(c)(2)(B)) indicate a need to identify an average hydrologic study period that cover as least 10 years that includes a range of hydrologic conditions (e.g. wet, normal, dry and critically dry) for purposes of the groundwater analyses in the basin-wide water budgets. In order to select a consistent study period, the Temescal GSA is using a 29-year base period covering the simulation period from WY1990 through WY2018. Water years used for the Temescal Basin Model run from October through to the following September to capture the cause and effect relationship on groundwater levels of wintertime rain and subsequent summertime groundwater pumping. Additional analysis of the historical water budget is provided in **GSP Section 5** ("Water Budget") and tables summarizing the water budget results are presented in **Appendix K**.

6. SIMULATION OF FUTURE CONDITIONS

GSP regulations §354.18(c)(3) require simulation of several future scenarios to determine their effects on water balances, yield and sustainability indicators. The following scenarios to simulate future conditions include:

- **Baseline Scenario** - This represents a continuation of existing land and water use patterns, imported water availability, and climate.
- **Growth Plus Climate Change Scenario** - This scenario implements anticipated changes in land use and associated water use, such as urban expansion, and anticipated effects of future climate change on local hydrology (rainfall recharge and stream percolation) and on the availability of imported water supplies.

The historical period used for model calibration consisted of only 29 years (water years 1990 through 2018). The Sustainable Groundwater Management Act requires that future simulations cover a 50-year period. To obtain 50 years of hydrology, rainfall, reference ET and streamflow were assumed to repeat the 1993 to 2017 sequence twice. Rainfall during that period equaled 99 percent of the long-term average. Surface and subsurface inflows from tributary watersheds simulated using the rainfall-runoff-recharge model were also replicated to obtain 50 years of data. The initial conditions for the future baseline simulation equaled the ending water levels of the calibration simulation, or September 2018. Thus, the future simulation period nominally covers water years 2019 to 2068.

Both of the future simulations assumed that the level of development and related water demand are constant throughout the simulation. That is, development in the growth plus climate change simulation is not phased in over time but rather corresponds to 2068 development throughout the simulation. This is the best way to demonstrate whether 2068 land use is sustainable because it allows for assessment of the effects of variations in climatic conditions (wet and dry cycles) on groundwater conditions, avoids subjective decisions about the concurrent timing of droughts and development, and provides time for the full effect of future conditions on groundwater to become apparent.

Additional details regarding assumptions and inputs for the future scenarios are presented in **GSP Section 5.5.3** “Simulation of Future Conditions”. Water budget results for the two future scenarios are described in Section 5 of the main GSP text. Both scenarios showed essentially no net change in groundwater storage from 2018 to 2068 (see **GSP Figure 5-10**). Contours of simulated groundwater elevations in model layers 1 and 3 were also very similar to those in 2018, consistent with the water budget results and with the SMCs for groundwater elevations and storage, which preclude future declines to levels below minimum historical levels.

The future Baseline Scenario and Growth Plus Climate Change Scenario can serve as reference conditions against which to compare alternative management scenarios. Additional data and assumptions used in the future baseline simulation are described in **GSP Section 5.5.3** (“Simulation of Future Conditions”). Inputs and results of other scenarios related to specific management actions recommended in the GSP are also described in **Section 8** (“Management Actions”) and water budget results are presented in **Appendix K**.

7. SGMA REQUIREMENTS

As noted in the SGMA Modeling Best Management Practices (BMP) guidelines (DWR 2016a), the description of the model application should include detailed information on the model conceptualization, assumptions, data inputs, boundary conditions, calibration, sensitivity and uncertainty analysis, and there applicable modeling elements such as model limitations. A DWR requirement for using model results in future water budget reporting for Annual Reports is to report the model accuracy. The following information addresses these reporting requirements.

7.1. MODEL DATA GAPS

When evaluating model results, it is important to consider the strengths and limitations of the numerical model. The horizontal and vertical resolution used to construct the model dictates the range of scales that the model can evaluate. The Temescal Basin Model is designed as a regional or basin-wide model to evaluate long-term, regional trends and the overall groundwater inflow and outflow to the basin. Within that scale, conditions are averaged. However, this model may not contain the site-specific details necessary to evaluate some localized conditions due to geologic complexity or unique localized effects. For these areas, a more localized model may be required if such a detailed analysis is necessary. The regional model can provide a broader regional context to support the development of these localized models.

The groundwater flow model is an appropriate tool for evaluating groundwater conditions at the basin and subarea scale over periods of months to decades. Given its reasonable calibration under a wide range of historical hydrologic and water management conditions, it should produce reliable results under a similar range of future conditions. However, some aspects of the model and some types of applications may be less reliable. Limitations in model accuracy and in types of applications include the following:

- As with any regional model, the model cannot simulate details of water levels and flow at spatial scales smaller than one model cell. It cannot, for example, simulate drawdown within a pumping well. It can only simulate the average effect of that pumping on the average water level of the cell in which the well is located.
- The monthly stress periods of the model preclude simulation of brief hydrologic stresses. For example, the model cannot simulate the effects of daily pumping cycles on water levels, or the amount of recharge associated with peak stream flow events.
- Surface and subsurface inflows from tributary watersheds around the perimeter of the basin remain uncertain. The rainfall-runoff-recharge model simulates watershed hydrology explicitly but flows from the watersheds to the groundwater basin are small compared to rainfall and ET. Accurate data for those variables within the watershed areas are not available, and a small error in rainfall or ET can result in a large error in simulated watershed outflow.
- Model calibration is better in some parts of the basin than others. Any future model calibration would benefit from additional groundwater elevation data in areas outside of the Channel Aquifer.

7.2. MODEL ACCURACY

A numerical model mathematically describes the conceptual model by solving the mass balance and motion equations that govern groundwater flow and chemical transport (Bear and Verruijt 1987). To solve these equations, an iterative method is used to solve the matrix equations. For these iterative techniques, the procedure is repeated until the convergence criteria are met. The convergence criteria may be groundwater elevation change, mass balance difference, or both. Convergence defines whether the model is mathematically stable and capable of producing reliable results.

For this model, the Newton (NWT) Solver Package was used (Niswonger et. al., 2011). The convergence criteria for NWT included both a maximum change in groundwater elevation and a maximum mass balance differential for a cell. For this model, the convergence parameter for groundwater elevation was set at 0.1 feet and 5,000 cubic feet per day for mass balance differential. Convergence is evaluated at the grid cell level. If a single cell does not meet the requirement, then the solution procedure is repeated. The model was able to successfully converge using the set convergence parameters.

The primary method to check whether the model is numerically stable is to evaluate the differential in mass balance. Iterative techniques provide an approximate solution for the model; therefore, there is always a mass balance differential. This differential should be small, and typically a differential of less than 1.00 percent is considered as a good solution. The mass balance differential for Temescal Basin Model is 0.02 percent. These values further indicate that numerical model that is accurately simulating the flow of groundwater in the Basin.

The model calibration and comparison of the hydrologic budget results demonstrate that the model is consistent with the conceptual model to produce these results. The calibration correlation coefficient of 0.934 demonstrates a strong comparison between measured and simulated groundwater elevations. Other statistical calibration parameters show that the scaled ratio of the calibration residuals to the range of observed groundwater levels is about 2.5 percent.

Based on these parameters, the accuracy of the Temescal Basin Model in developing SGMA water budgets is conservatively considered to range between 10 to 15 percent when also considering total level of uncertainty resulting from input parameter, assumptions, calibration accuracy and numerical stability. Since the calibration accuracy and numerical stability are well below this range, the input parameter assumptions are the main source of uncertainty with the model results.

7.3. LIMITATIONS TO CALIBRATION

All inputs to a model are estimates that are subject to errors or uncertainty, but some are better known than others. Also, some have relatively pronounced effects on simulation results. For example, the amount of water pumped by municipal wells is metered and is considered highly accurate compared to most model inputs. Accordingly, the amount of municipal pumping was not adjusted during calibration.

Variables were selected for adjustment during calibration based on their relative uncertainty, the sensitivity of results to that variable, and whether the variable might logically be connected to an observed pattern of residuals based on hydrologic processes.

The measured water levels that serve as the basis for calibration are themselves subject to uncertainty stemming from wellhead elevation errors, effects of recent pumping at the measured well, and wells that for unknown reasons have water levels inconsistent with water levels at nearby wells. Almost all of the wells used to monitor water levels are active water supply wells located in or adjacent to the Channel Aquifer. If a well was pumping shortly before the water level is measured, the water level will

be much lower (by feet to tens of feet) than if the well had been idle for a day or more. In some hydrographs, pumping-affected water levels stand out as obvious anomalies. A number of those points were removed from the calibration data set. In other cases, water levels fluctuate over a wide range seasonally and between measurements, and pumping effects could not be systematically identified and eliminated.

8. REFERENCES CITED

Bear, J. and A. Verruijt, 1987, Modeling Groundwater Flow and Pollution, D. Reidel Publishing Company, Boston, 414 p.

Bicknell, B.R., Imhoff, J.C., Kittle, J.L., Jr., Donigian, A.S., Jr., and Johanson, R.C., 1997, Hydrological Simulation Program--Fortran, User's manual for version 11: U.S. Environmental Protection Agency, National Exposure Research Laboratory, Athens, Ga., EPA/600/R-97/080, 755 .

Blaney, H.F., P.R. Nixon, G.P. Lawless and E.J. Wiedmann. October 1963. ,Utilization of the waters of the Santa Ynez River basin for agriculture in southern Santa Barbara County, California. U.S. Department of Agriculture, Agricultural Research Service., Riverside, CA.

California Department of Water Resources (DWR), 2016a. Management Practices for the Sustainable Management of Groundwater, Modeling BMP, Sacramento, CA: Technical Memorandum.

California Department of Water Resources (DWR), 2016b, California Groundwater, Bulletin 118, Interim update December 22. https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118

Doherty, J. 1994, PEST, Watermark Computing, Corinda, Australia, 122p.

Environmental Simulations Inc. (ESI), 2020. Guide to Using Groundwater Vistas, Version 8. Reinholds, PA.

Geoscience, 2009, Technical Memorandum Geohydrologic Evaluation Of The Riverside North Aquifer Storage And Recovery Project, technical report to the City of Riverside and RBF Consulting, October 23, 2009.

Lewis, D.C. and R.H. Burgy, 1964, The Relationship between oak tree roots and groundwater in fractured rock as determined by tritium tracing, Journal of Geophysical Research, Vol. 69 No. 12, 15 June 1964, p 2579-2588.

Lubczynski, M.W., 2011, Groundwater Evapotranspiration – Underestimated Role of Tree Transpiration and Bare Soil Evaporation in Groundwater Balances of Dry Lands, in Climate Change and its Effects on Water Resources, NATO Science for Peace and Security Series C: Environmental Security Volume 3, 2011, pp 183-190.

Markstrom, S.L., Regan, R.S., Hay, L.E., Viger, R.J., Webb, R.M.T., Payn, R.A., and LaFontaine, J.H., 2015, PRMS-IV, the precipitation-runoff modeling system, version 4: U.S. Geological Survey Techniques and Methods, book 6, chap. B7, 158 p., http://dx.doi.org/10.3133/tm6B7.

Meinzer, O.E., 1927, Plants as indicators of ground water: USGS Water-Supply Paper 577.

Michael Baker International, 2021, City of Corona 2020 Urban Water Management Plan, Volume 1, Draft, June https://www.coronaca.gov/home/showpublisheddocument/20172/637576204172900000.

Natural Resources Conservation Service (NRCS). 2015. SSURGO soil survey on-line map database available at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx . Downloaded 27 March 2015.

Niswonger, R.G., S. Panday, and M. Ibaraki, 2011, MODFLOW-NWT, A Newton Formulation for MODFLOW-2005, U.S. Geological Survey Techniques and Methods G-A37, 44p.

Rawls, W.J., L.R. Ahuja, D.L. Brakensiek and A. Shirmohammadi. 1993. , Infiltration and Soil Water Movement. Chapter 5 in D.R. Maidment, ed. Handbook of Hydrology, McGraw-Hill, Inc. New York, NY.

Robinson, T.W., 1958, Phreatophytes: USGS Water-Supply Paper 1428.

Todd Engineers and AKM Consulting Engineers (Todd and AKM), 2008, AB3030 Groundwater Management Plan, prepared for City of Corona, June.

United Nations Food and Agriculture Organization (UNFAP). 2006. Crop evapotranspiration. Technical Report No. 56. Rome, Italy.

United States Geological Survey (USGS), 2004, Preliminary Digital Geologic Map of the Santa Ana 30' x 60' Quadrangle, Southern California, Version 2.0 compiled by D.M. Morton, Open-File Report 99-172, http://pubs.usgs.gov/of/1999/of99-172/.

United States Geological Survey (USGS), 2006, Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangles, California, Version 1.0 compiled by Douglas M. Morton and Fred K. Miller, Open-File Report 2006-1217, http://pubs.usgs.gov/of/2006/1217/.

Van Mullen, J.A., D.E. Woodward, R.H. Hawkins, and A.T. Hjelmfelt, Jr., No date (but after 2001), Runoff curve number method: beyond the handbook, Curve-Number Working Group, Natural Resources

Viessman, W., Jr., J.W. Knapp, G.L. Lewis, and T.E. Harbaugh., 1977, Introduction to Hydrology, 2nd edition, Harper & Row, Publishers. New York, NY.

Wildermuth Environmental Inc. (WEI), 2015, 2013 Chino Basin Groundwater Model Update and Recalculation of Safe Yield Pursuant to the Peace Agreement, technical report prepared for Chino Basin Watermaster, October 2015.

Wildermuth Environmental Inc. (WEI), 2020, 2020 Safe Yield Recalculation Final Report, technical report prepared for Chino Basin Watermaster, May 15, 2020.

WRIME, 2011, Riverside-Arlington Groundwater Flow Model (RAGFM) Model Development and Scenarios, technical report prepared for City of Riverside Public Utilities and Western Municipal Water District, June 2011.

WRIME, 2010, Task 4 - Numerical Model Calibration, Validation, and Sensitivity Analysis for Riverside-Arlington Basins Numerical Groundwater Model and Groundwater Management Plans (GWMPs) Development, technical report to t Western Municipal Water District and RBF Consulting, May 25, 2010.

TABLES

Table 1 - Annual Metered Groundwater Pumping Volumes by Well (acre-feet per year)

Well_Name	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AA_Asphalt_#1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	25	25	25	25	25	25	25	25	25	25	0	1
AA_Asphalt_#2	0	0	0	0	0	0	0	0	0	0	0	0	374	515	588	378	204	180	288	330	310	357	344	337	366	184	98	212	265	0	0
Butterfield#1	240	240	205	191	190	51	74	100	100	60	12	0	0	0	0	0	0	12	4	0	0	0	0	0	0	0	0	0	0	0	0
Corona_#01	843	979	1,154	1,515	1,264	1,670	1,309	1,223	1,658	362	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	207
Corona_#02	0	0	209	1,053	1,049	1,143	1,004	858	1,014	211	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	202
Corona_#06	372	560	195	325	374	610	427	450	567	525	372	359	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	169	185
Corona_#07	396	544	306	524	254	578	316	421	751	830	845	860	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	414	278
Corona_#07A	0	0	0	0	0	0	0	0	0	0	0	0	0	830	1,276	1,244	1,242	1,215	1,262	713	752	720	749	785	1,146	990	1,144	617	1,197	243	380
Corona_#08	1,164	76	2,117	1,603	1,389	1,743	1,352	1,156	1,420	1,333	1,513	1,598	1,307	559	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corona_#08A	0	0	0	0	0	0	0	0	0	0	0	0	0	1,094	2,196	1,542	1,598	1,968	2,102	1,875	2,164	1,886	2,004	2,031	1,919	2,019	1,771	2,047	1,657	0	0
Corona_#09	443	703	552	639	507	459	242	544	531	535	507	755	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corona_#09A	0	0	0	0	0	0	0	0	0	0	0	0	0	1,162	2,554	2,159	1,266	1,455	1,622	1,487	1,512	1,519	1,612	1,547	1,550	1,495	1,227	1,419	1,327	0	0
Corona_#10thSt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corona_#11	209	456	423	407	153	422	295	361	143	632	490	403	119	297	511	582	589	575	600	243	143	34	0	0	0	0	0	0	0	385	410
Corona_#11A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	511	948	913	811	789	781	417	515	804	0	0
Corona_#12&12A	130	4	0	0	0	0	0	0	0	0	0	0	432	660	607	564	545	359	551	1,087	924	377	619	884	1,228	1,041	458	677	792	354	425
Corona_#13	701	429	3	70	272	1	0	55	334	31	0	0	0	120	278	529	544	772	701	598	574	381	527	498	345	257	0	0	0	324	205
Corona_#14L1	65	59	25	289	386	238	243	427	342	631	495	351	387	578	483	332	626	452	249	360	331	360	360	240	300	360	356	360	360	174	96
Corona_#14L2	10	6	4	62	93	54	50	107	81	153	119	80	92	141	120	83	152	110	604	854	775	798	1,025	455	550	602	431	573	482	0	0
Corona_#15	573	977	1,034	1,331	1,287	1,219	916	145	1,303	1,357	1,595	1,218	586	681	1,543	1,404	1,730	1,099	1,764	1,695	1,713	1,667	1,568	1,242	810	1,423	1,087	1,214	939	0	0
Corona_#17	1,030	211	1,045	1,087	1,223	1,360	995	863	1,003	1,142	976	331	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corona_#17A	0	0	0	0	0	0	0	0	0	0	0	0	304	1,285	706	826	1,518	1,706	1,465	1,215	1,055	1,101	1,191	1,231	1,027	1,212	1,230	1,074	1,019	0	0
Corona_#19	0	0	0	13	12	0	596	2,500	3,009	3,093	2,291	2,686	2,289	1,365	539	1,461	1,794	1,702	1,687	1,373	1,379	1,292	973	1,578	9	0	0	0	1,056	0	0
Corona_#22	0	0	0	0	0	0	0	0	0	0	0	0	4,658	4,044	3,016	2,014	2,362	2,309	1,950	1,269	769	1,450	2,250	2,698	2,570	2,687	1,921	2,272	2,169	178	0
Corona_#23	0	0	0	0	0	0	0	0	0	0	0	0	51	0	0	211	0	0	0	19	201	0	0	0	0	0	0	0	0	0	0
Corona_#24	0	0	0	0	0	0	0	0	0	0	0	191	652	315	200	384	497	283	56	163	0	0	94	109	26	0	0	0	0	0	0
Corona_#25	0	0	0	0	0	0	0	0	0	0	0	0	3,833	2,632	2,408	2,454	2,259	1,425	2,137	1,195	1,268	1,184	981	609	615	769	1,522	1,894	1,110	174	748
Corona_#26	0	0	0	0	0	0	0	0	0	0	0	347	1,419	1,365	1,009	1,055	819	813	317	102	420	109	8	501	603	545	42	0	0	565	522
Corona_#27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	209	408	414	224	658	633	677	684	584	643	565	494	364	306	375	45	45
Corona_#28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	807	2,388	2,270	2,369	2,440	2,009	1,842	1,643	1,703	1,379	1,195	1,115	612	814	1,048	9	8
Corona_#29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	823	831	523	783	793	974	89	7	0	0	0	0
Corona_#31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	915	752	5	0	0	855	0	0
Corona_LINCOLN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corona_Main#3	1,433	1,197	1,194	1,206	542	377	357	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corona_Main#4	75	491	1,004	1,190	1,195	765	175	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	175
Dairy_New_Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	533	227	329	175	90	105	106	114	119	115	29	0	0	0
Dart#1	84	91	95	114	120	122	123	123	123	129	165	171	159	154	53	128	205	238	224	195	140	124	110	98	99	101	102	102	112	56	57
Dart#2	0	0	0	0	0	0	0	0	0	4	7	11	13	18	146	75	18	4	0	0	0	7	2	0	0	1	1	1	1		
EVWMD-Kampling	411	284	157	40	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
HGCWD_#1	1	1	1	1	2	1	1	1	1	2	2	3	3	2	2	2	1	1	2	1	1	1	2	1	1	1	1	0	0		
HGCWD_#5	0	0	0	88	194	238	242	155	131	163	162	148	156	149	136	137	131	125	128	128	116	116	91	29	3	0	0	0	0		
JoyWC_10thSt	143	137	135	139	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
JoyWC_Lincoln	0	0	0	0	70	97	101	77	72	82	56	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Norch_#5	949	146	22	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Norco_#14	0	0	0	0	0	859	155	1,049	1,219	1,196	1,134	1,126	978	837	1,017	1,060	1,062	992	983	970	699	763	891	880	833	791	559	631	471		
Norco_#15	0	0	0	0	0	0	0	195	746	1,178	932	713	1,115	1,263	875	496	449	300	429	127	24	103	18	0	0	0	0	0	0		
Subtotals																															
Total	9,273	7,589	9,879	11,890	10,614	12,007	8,973	10,905	14,550	13,649	11,672	11,362	19,216	20,066	21,279	21,914	22,294	21,221	22,468	19,816	19,331	18,263	19,532	20,426	18,414	17,104	13,488	14,781	16,063	3,169	3,944

Table 2 - Annual Metered Groundwater Pumping Volumes by Well (acre-feet per year)

Horizontal Hydraulic Conductivity (feet/day)					
Zone	**Name**	**Basin**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**
1	Outer Channel	Temescal	60	7.5	2
2	Deep Channel	Temescal	125	10	3
3	Channel Margin	Temescal	45	7.5	2
4	South Basin	Temescal	20	2	1
5	Norco	Temescal	10	2	1
6	Fault South	Temescal	10	2	1
7	Fault North	Temescal	10	2	1
8	Upper Santa Ana	Chino	5	0.5	0.5
9	Chino	Chino	5	1	3
10	Prado	Chino	5	1	3
Vertical Hydraulic Conductivity (feet/day)					
Zone	**Name**	**Basin**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**
1	Outer Channel	Temescal	6	0.75	0.2
2	Deep Channel	Temescal	12.5	1	0.3
3	Channel Margin	Temescal	4.5	0.75	0.2
4	South Basin	Temescal	10	0.2	0.1
5	Norco	Temescal	1	0.2	0.1
6	Fault South	Temescal	10	2	0.1
7	Fault North	Temescal	10	0.2	0.1
8	Upper Santa Ana	Chino	0.5	0.025	0.025
9	Chino	Chino	0.5	0.1	0.3
10	Prado	Chino	0.5	0.1	0.3
Specific Storage (1/feet)					
Zone	**Name**	**Basin**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**
1	Outer Channel	Temescal	2.0E-04	2.0E-04	1.0E-05
2	Deep Channel	Temescal	1.0E-03	2.0E-04	1.0E-05
3	Channel Margin	Temescal	2.0E-04	2.0E-04	1.0E-05
4	South Basin	Temescal	1.0E-04	2.0E-05	1.0E-05
5	Norco	Temescal	1.0E-04	2.0E-05	5.0E-06
6	Fault South	Temescal	1.0E-04	2.0E-05	5.0E-06
7	Fault North	Temescal	1.0E-04	2.0E-05	5.0E-06
8	Upper Santa Ana	Chino	1.0E-04	2.0E-07	2.0E-07
9	Chino	Chino	1.0E-04	1.0E-06	2.0E-06
10	Prado	Chino	1.0E-04	1.0E-06	2.0E-06
Specific Yield (percentage)					
Zone	**Name**	**Basin**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**
1	Outer Channel	Temescal	0.10	0.06	0.02
2	Deep Channel	Temescal	0.15	0.08	0.02
3	Channel Margin	Temescal	0.10	0.08	0.02
4	South Basin	Temescal	0.08	0.03	0.02
5	Norco	Temescal	0.08	0.03	0.02
6	Fault South	Temescal	0.08	0.03	0.02
7	Fault North	Temescal	0.08	0.03	0.02
8	Upper Santa Ana	Chino	0.06	0.02	0.03
9	Chino	Chino	0.06	0.02	0.03
10	Prado	Chino	0.06	0.02	0.03

Table 3 - Temescal Model Calibration Statistics

Statistical Measure	Result	Explanation
Residual Mean	-1.73	Average error from residual for each point in calibration data set
Absolute Residual Mean	8.66	Total error from average for the absolute value of the residuals
Residual Standard Deviation	11.12	Average deviation of residual relative to the "residual mean"
Sum of Squares	458,178	Sum of squared value of residual for each calibration data point
RMS Error	11.26	Square root of the "Sum of Squares"
Maximum Residual	51.0	Highest residual during simulation
Minimum Residual	-59.0	Lowest residual during simulation
Number of Observations	3616	Number of GWEL measurements in calibration data set
Range in Observations	367	Difference of highest and lowest observed GWEL
Scaled Residual Mean	-0.0047	Residual Mean divided by "Range of Observations"
Scaled Absolute Residual Mean	0.0236	Absolute Residual Mean divided by "Range of Observations"
Scaled Residual Standard Deviation	0.0303	Residual Std. Deviation divided by "Range of Observations"
Scaled RMS Error	0.0306	RMS Error divided by "Range of Observations"
Correlation Coefficient	93.4%	Strength of relationship between observed and simulated GWEL

Notes: GWEL - groundwater elevation

Residual is the observed GWEL minus the simulated GWEL

Table 4 - Statistical Calibration by Well

Well ID	Model Layer	Number of Measured Data	Residual Mean (feet)	Absolute Residual Mean (feet)	Standard Deviation (feet)
3S7W27F6	1	66	-11.7	11.7	4.9
Butterfield	1	51	-0.7	3.3	4.2
Corona_11	1	307	-0.6	4.7	5.9
Corona_12	1	144	-5.3	6.1	5.1
Corona_12A	1	169	4.4	7.8	9.1
Corona_13	1	275	15.7	16.3	8.4
Corona_14	2	191	9.6	10.3	7.4
Corona_15	1	310	-4.8	7.6	8.5
Corona_16	2	112	-8.6	8.6	4.6
Corona_17	1	15	-1.2	1.9	2.4
Corona_17A	1	160	-5.4	9.4	10.6
Corona_19	1	251	-5.6	8.1	9.4
Corona_22	1	180	-1.6	8.1	10.0
Corona_23	1	35	-6.3	6.6	4.3
Corona_24	3	74	-1.9	6.6	8.4
Corona_25	1	134	0.6	5.9	7.3
Corona_26	2	61	-8.7	8.7	4.7
Corona_27	3	15	-13.0	43.2	45.5
Corona_28	1	102	-0.2	5.9	7.1
Corona_29	1	113	-7.9	9.0	6.9
Corona_31	1	97	4.8	6.3	6.3
Corona_6	1	60	-0.7	3.8	5.0
Corona_7	1	59	0.9	4.6	5.9
Corona_7A	1	111	-15.6	15.7	8.2
Corona_8	1	181	-10.7	11.2	9.0
Corona_8A	1	157	-1.0	4.8	6.1
Corona_9	1	147	-8.9	11.6	9.8
HG-01	1	27	3.4	4.8	4.2
Joy-Street	2	12	9.6	14.6	13.6
Grand Total	**3**	**3616**	**-1.73**	**8.7**	**11.12**

FIGURES

Path: \\todd-file\data\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Appendix I - Model Documentation\Figure I-01 Basin Topography.mxd

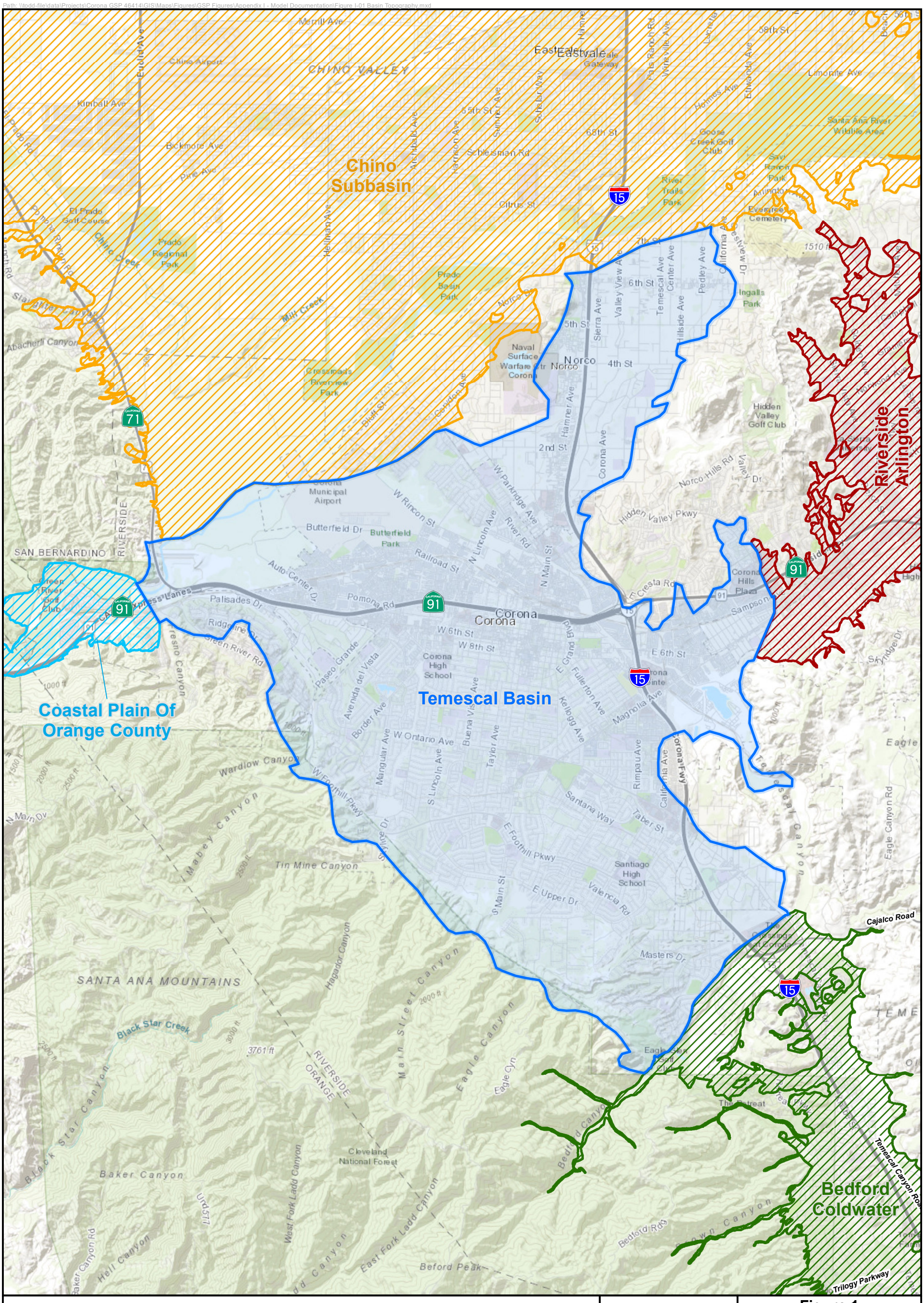
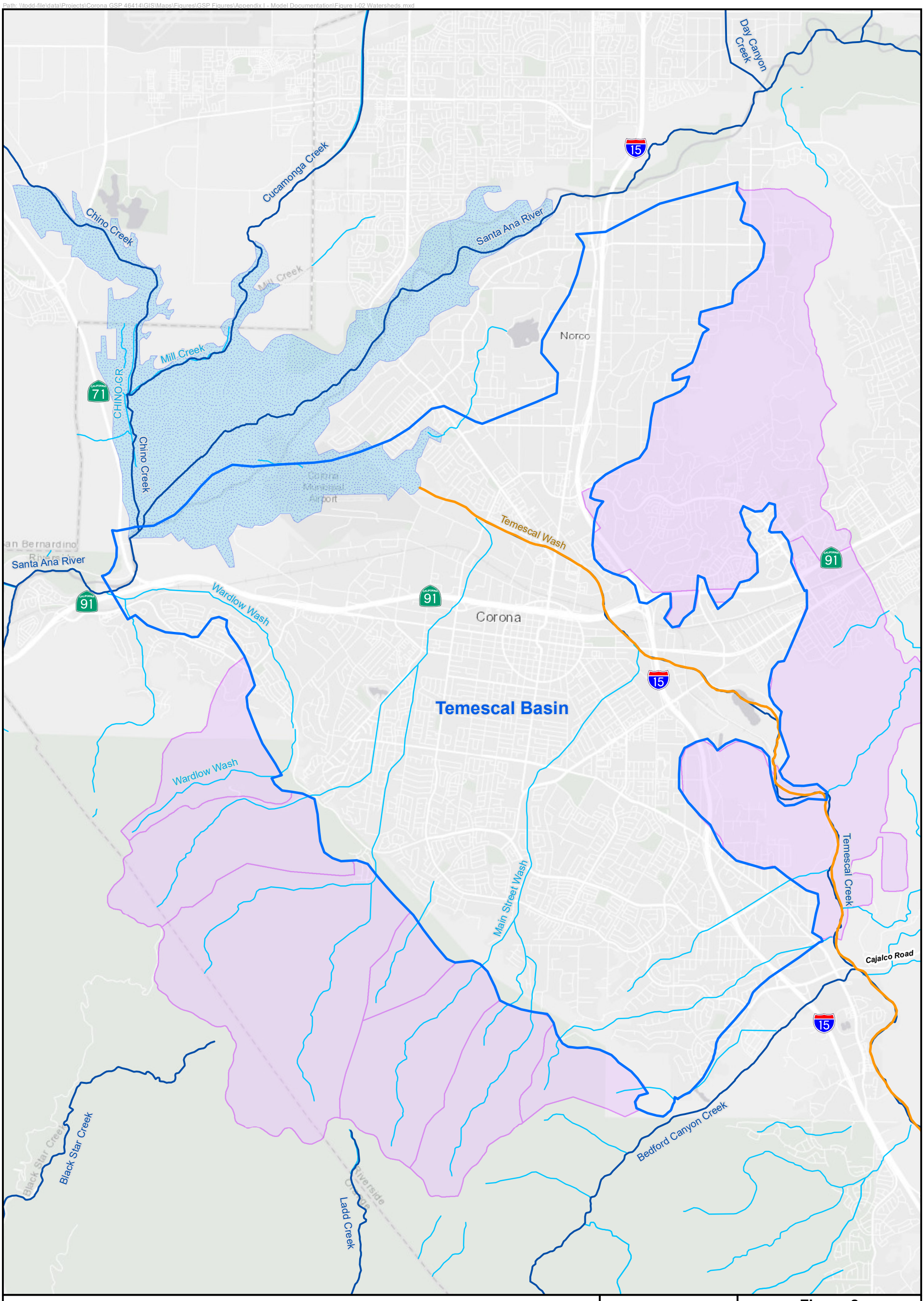


Figure 1
Location and Topography of the Temescal Basin

carollo
Engineers...Working Wonders With Water®

TODD GROUNDWATER

Path: \\todd-file\data\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Appendix I - Model Documentation\Figure I-02 Watersheds.mxd



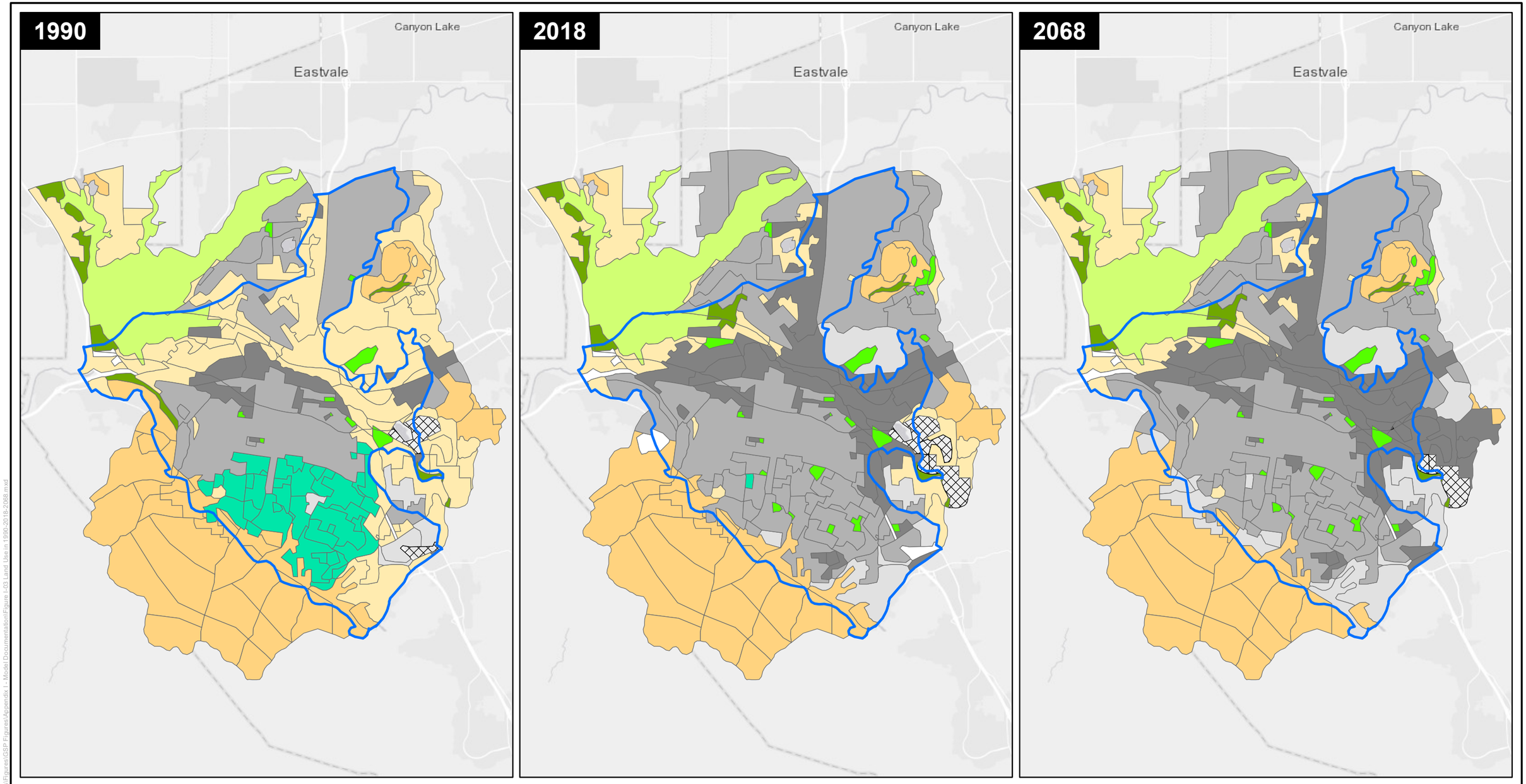
Temesal Basin
Temescal Wash
Rivers and Large Streams
Streams
Tributary Watersheds
Prado Wetlands

N

0 0.5 1
Miles

Figure 2
Rivers, Streams, Wetlands and Tributary Watersheds

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER



- Temescal Basin
- Citrus
- Dense Riparian
- Sparse Riparian
- Grassland
- Shrubs / Trees
- Commercial
- Industrial
- Quarries
- Stormwater Control and Recharge (former quarries)
- Turf
- Residential
- Low Density Residential
- Vacant

N

0 1 2 3
Miles

Figure 3
Land Use in 1990, 2018 and 2068

carollo
Engineers...Working Wonders With Water®

TODD GROUNDWATER

Path: \\todd-file\data\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Appendix I - Model Documentation\Figure I-03 Land Use in 1990-2018-2068.mxd

Path: \\todd-file\data\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Appendix I - Model Documentation\Figure I-04 Average Rainfall.mxd

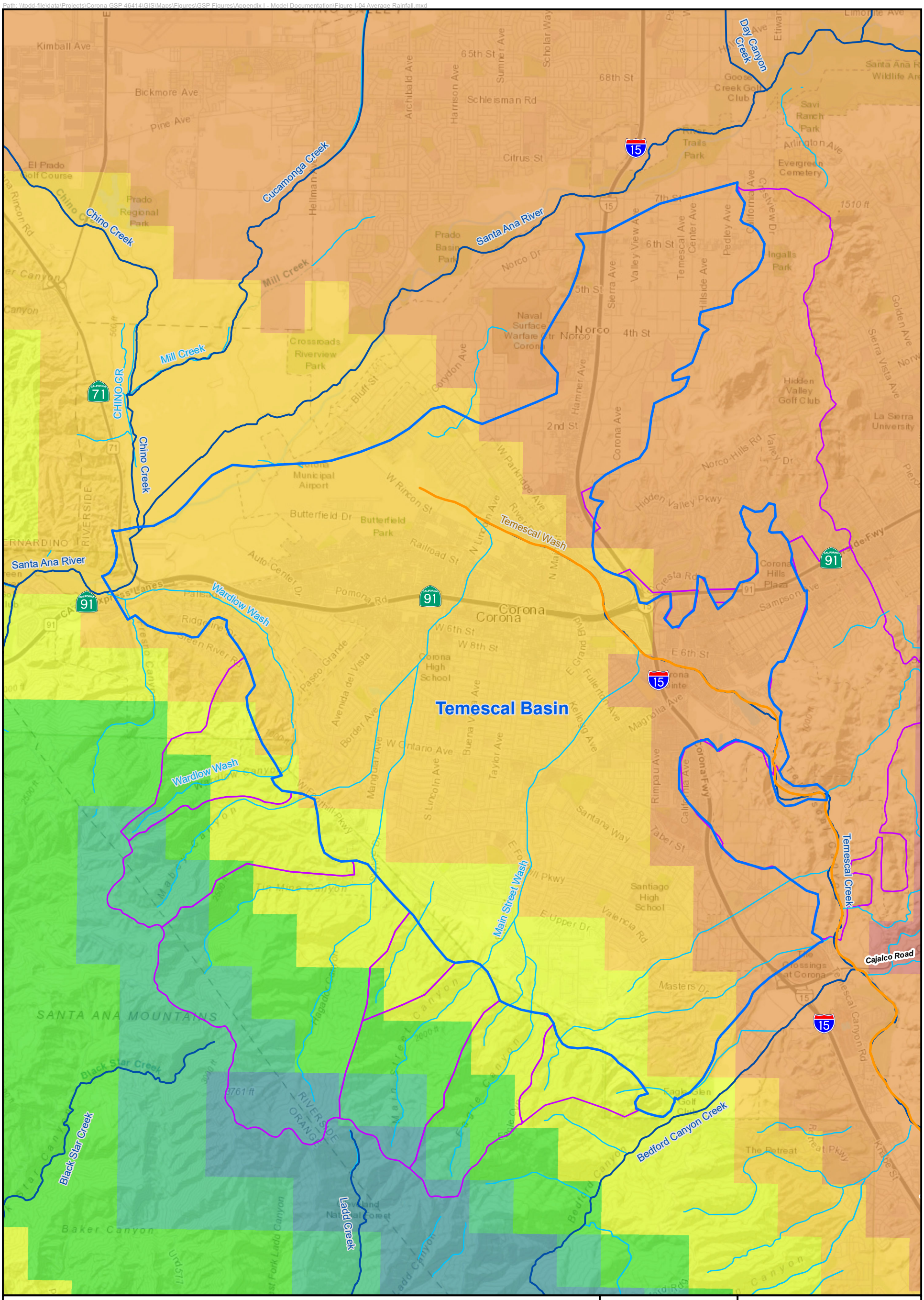
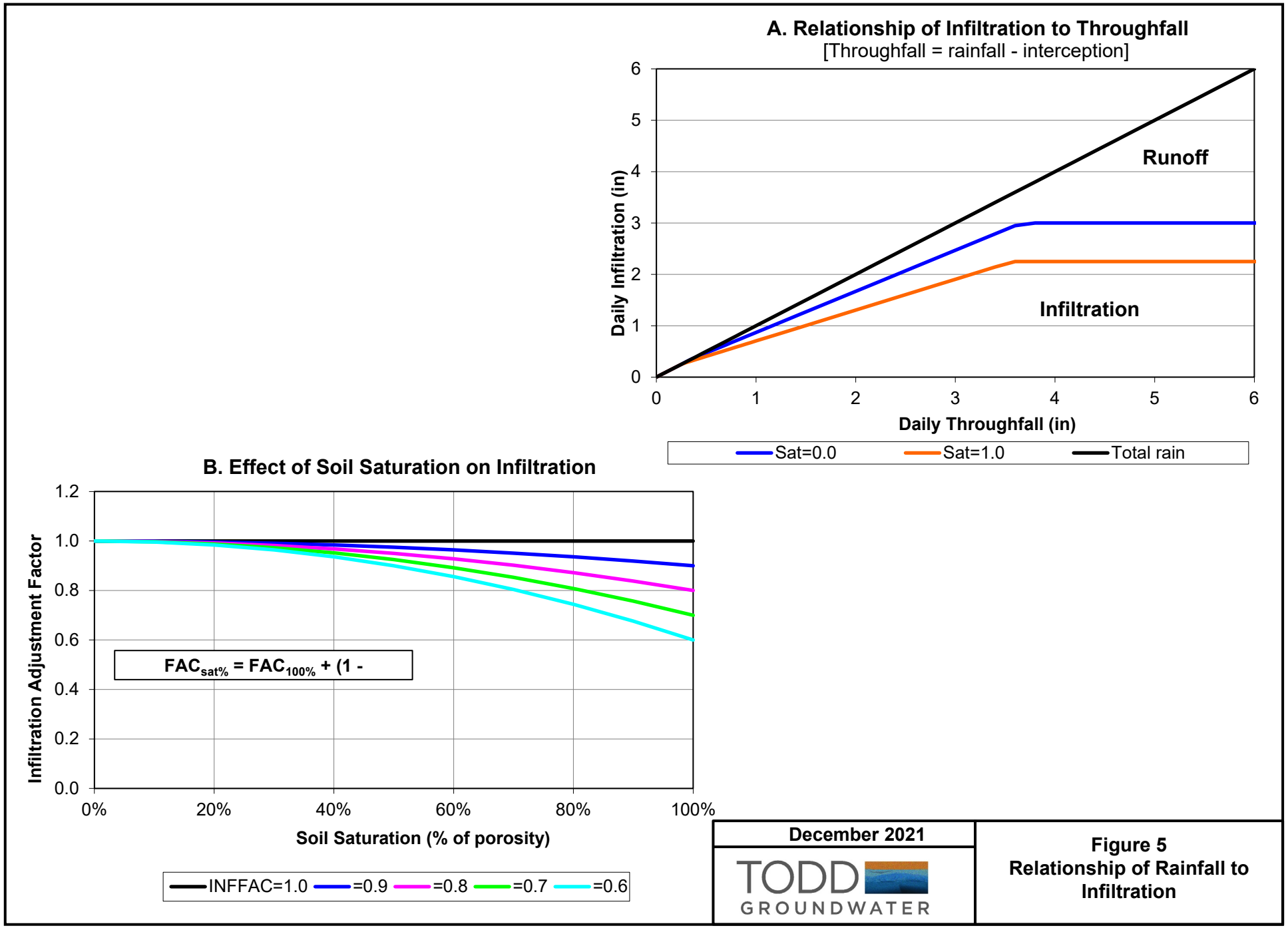


Figure 4
Average Annual Rainfall

carollo
Engineers...Working Wonders With Water®

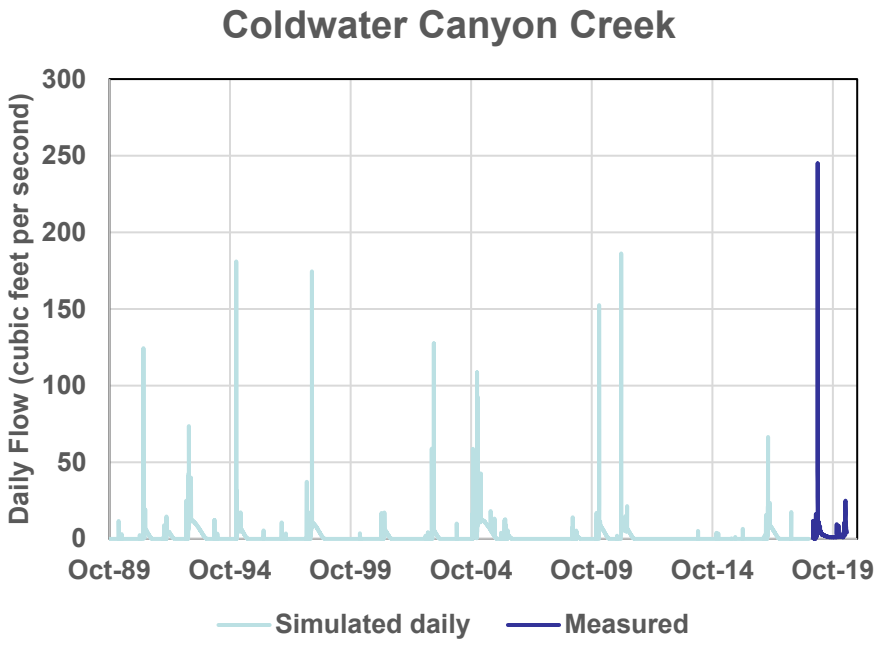
TODD GROUNDWATER

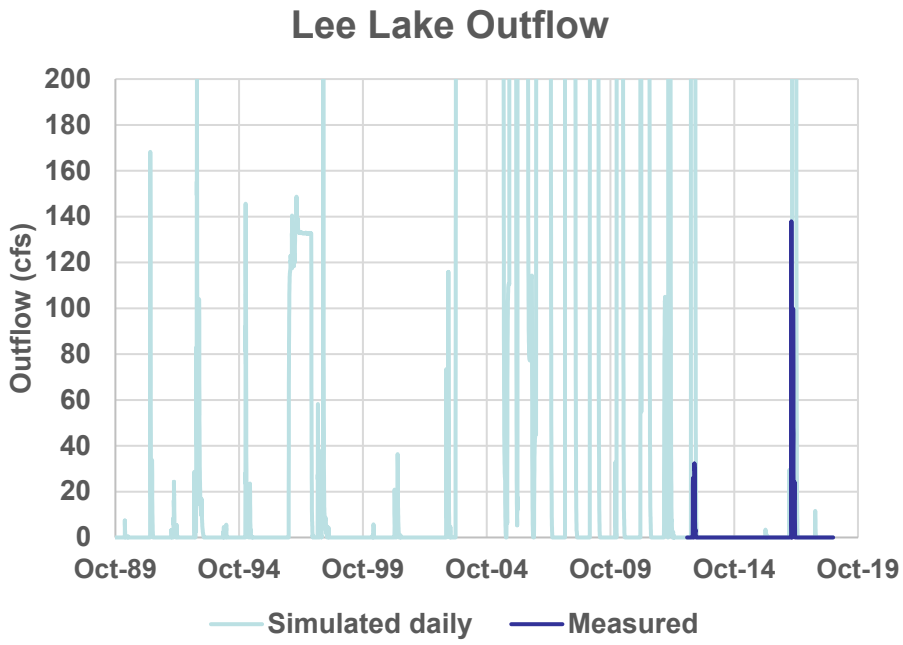


December 2021

TODD GROUNDWATER

Figure 5
Relationship of Rainfall to Infiltration





December 2021

TODD GROUNDWATER

Figure 6
Rainfall to Runoff Calibration

Path: \\todd-file\data\Projects\Corona GSP 46414\GIS\Maps\Figures\GSP Figures\Appendix I - Model Documentation\Figure I-07 Model Domain.mxd

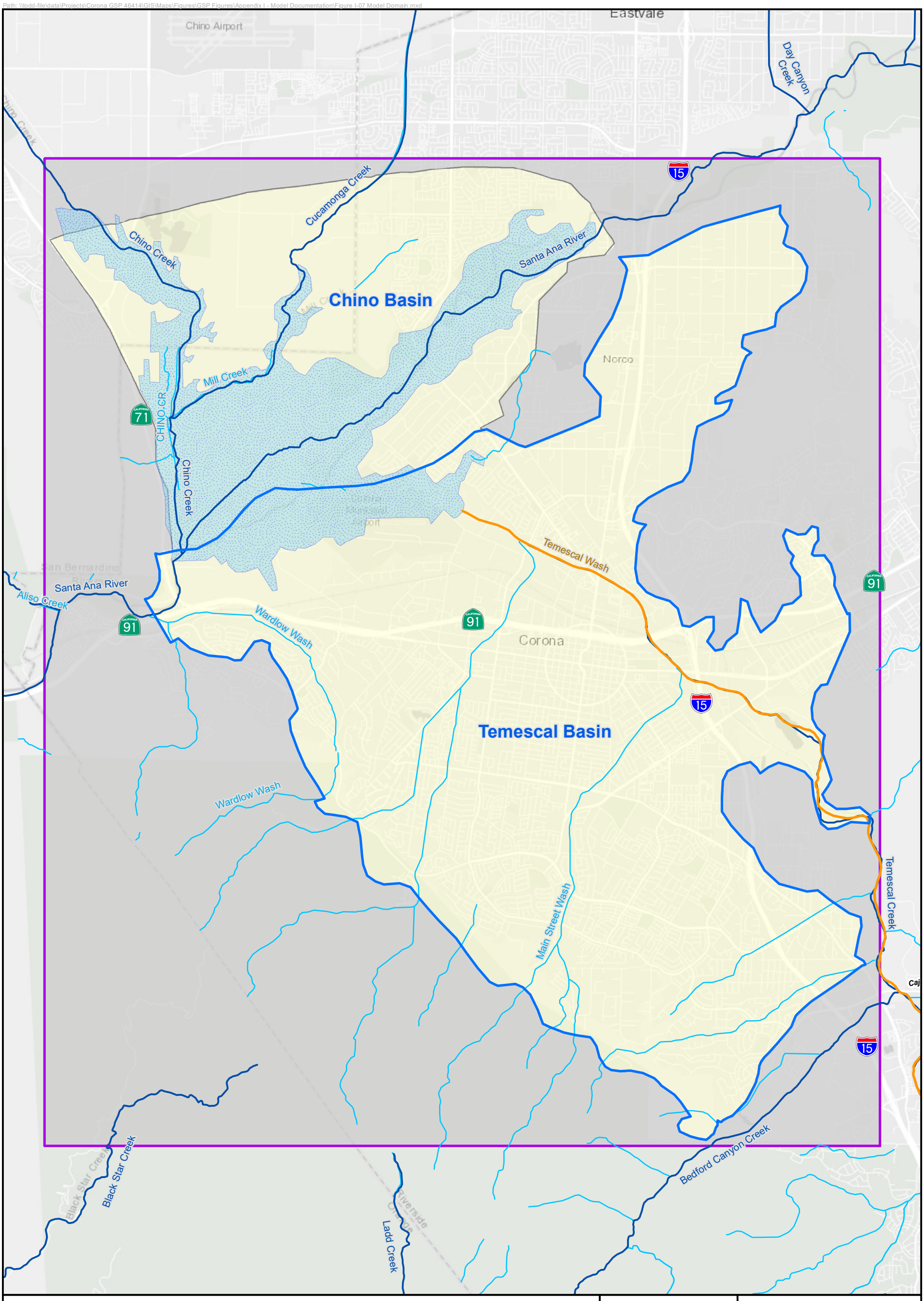
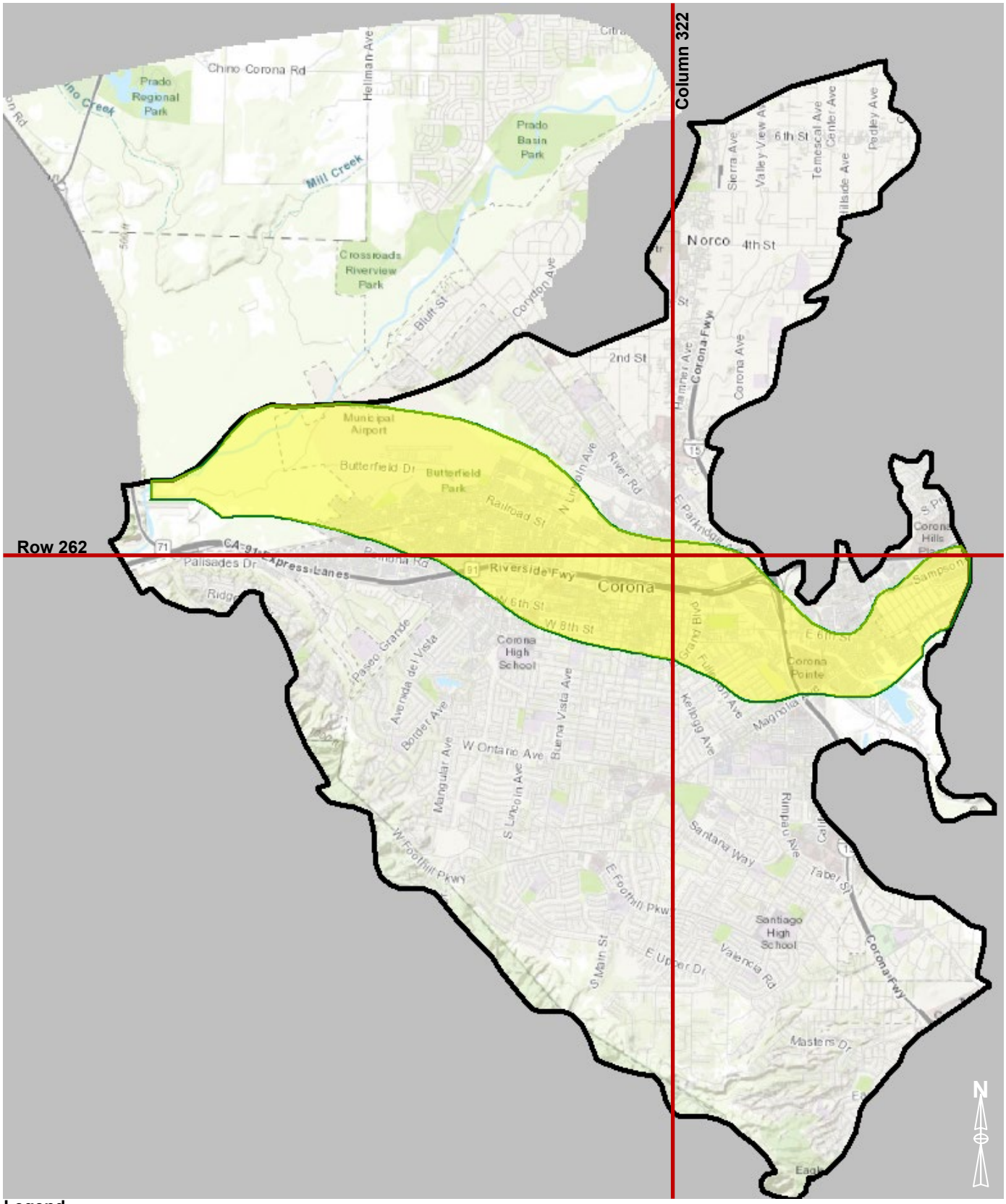


Figure 7
Extent of MODFLOW Model Domain

carollo
Engineers...Working Wonders With Water®
TODD GROUNDWATER



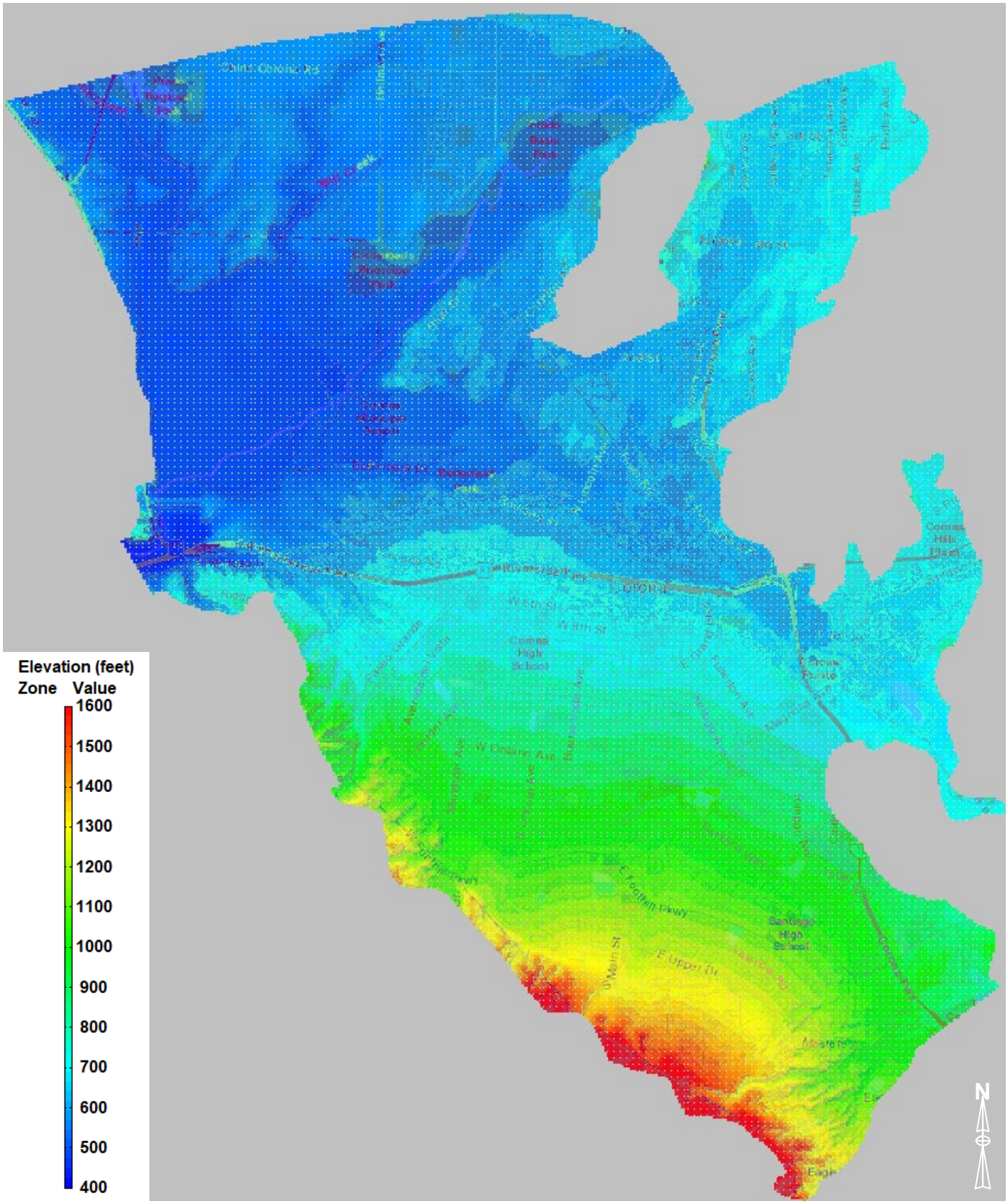
Legend

- Temescal Subbasin
- Channel Aquifer Outline
- Figure 13 Cross Section Trace

December 2021

TODD GROUNDWATER

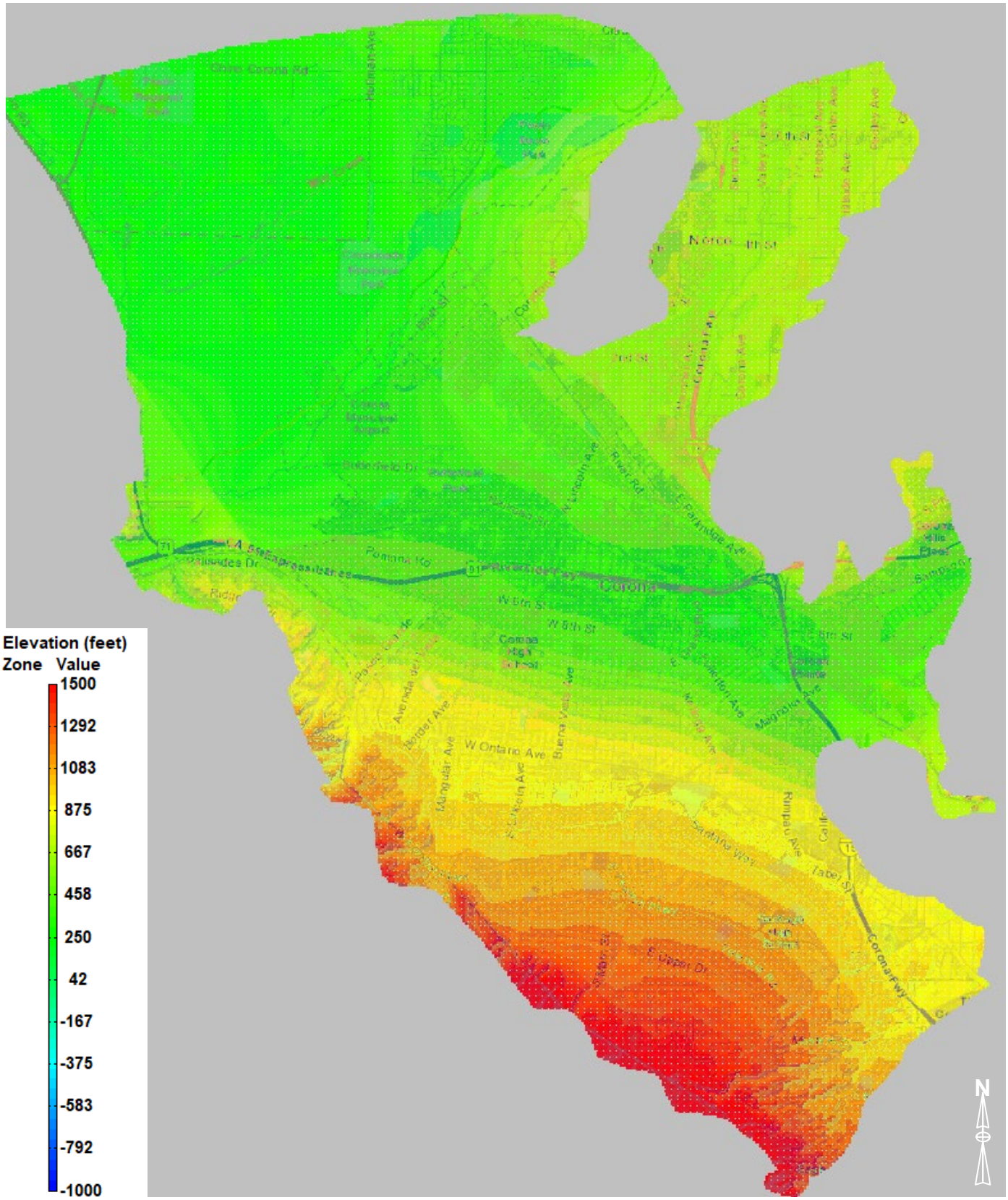
Figure 8
Location of Channel Aquifer



December 2021

TODD GROUNDWATER

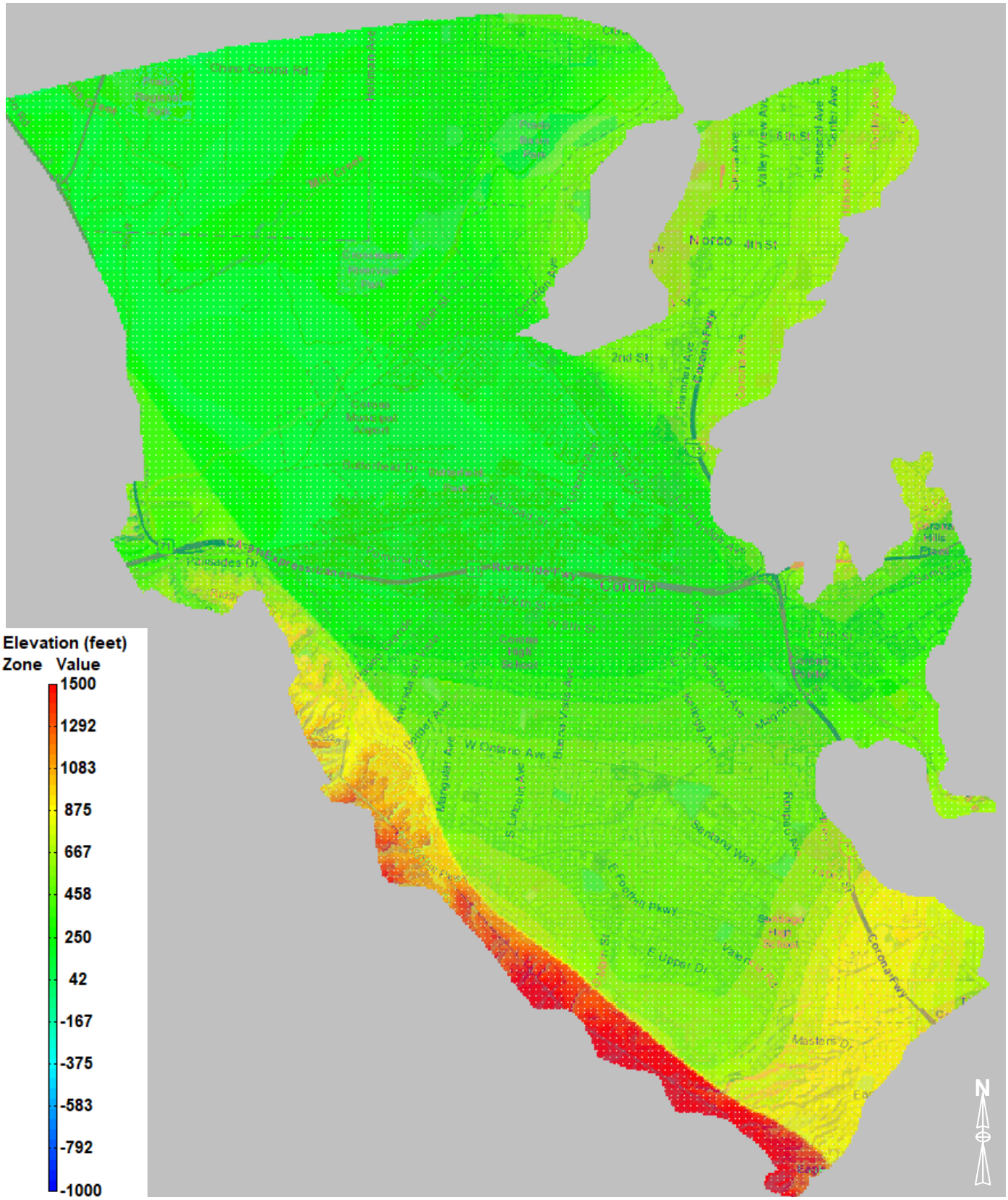
Figure 9
Topographic Elevation of Top of Model Layer 1



December 2021

TODD GROUNDWATER

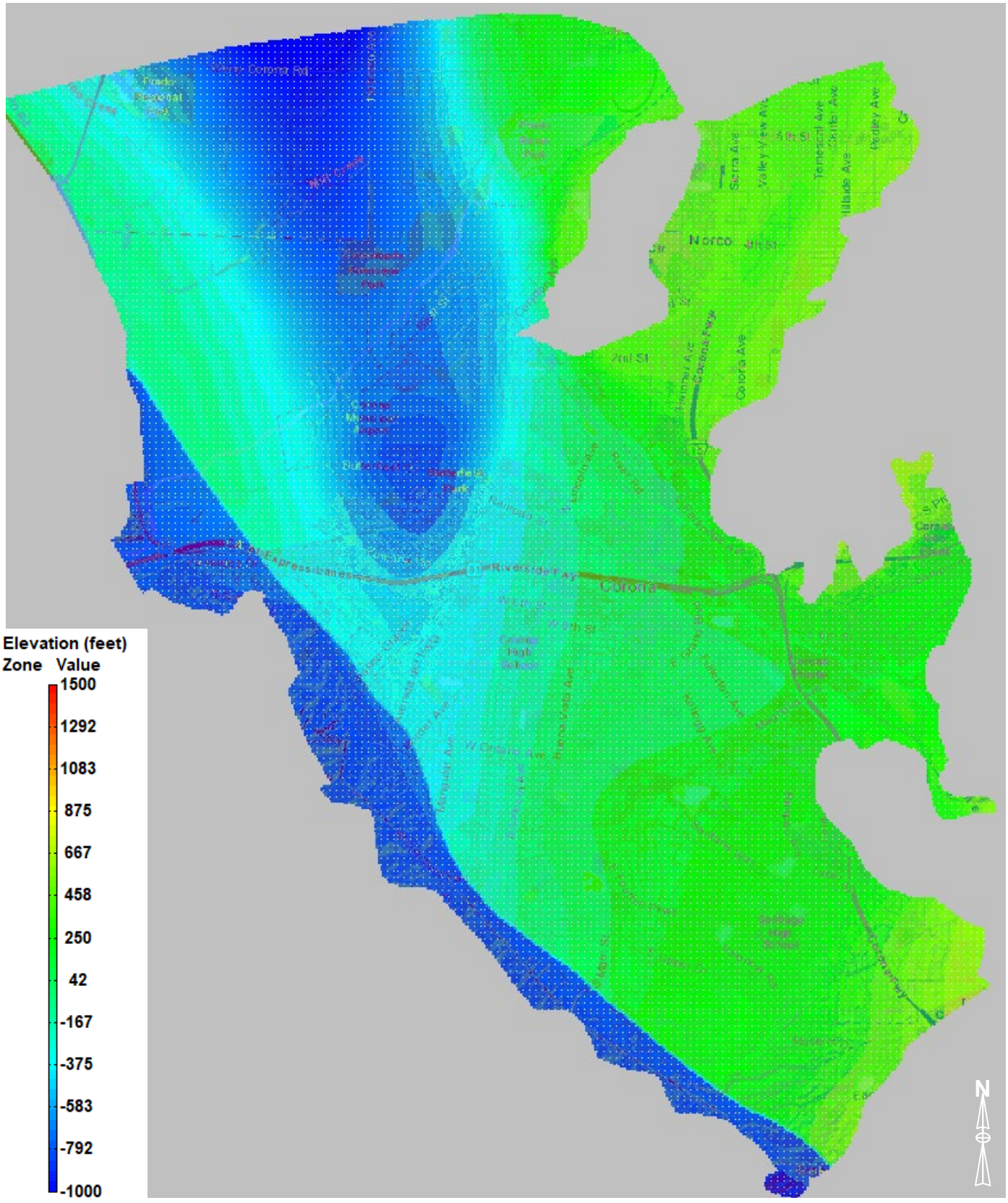
Figure 10
Bottom Elevation Distribution for Model Layer 1



December 2021

TODD GROUNDWATER

Figure 11
Bottom Elevation Distribution for Model Layer 2

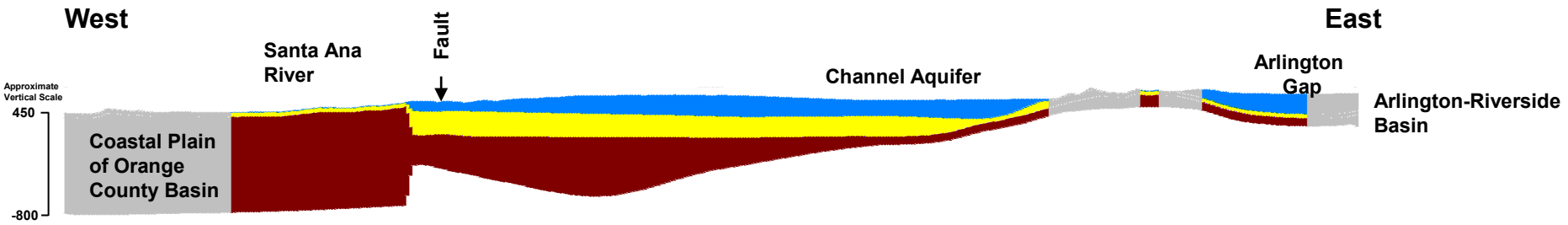


December 2021

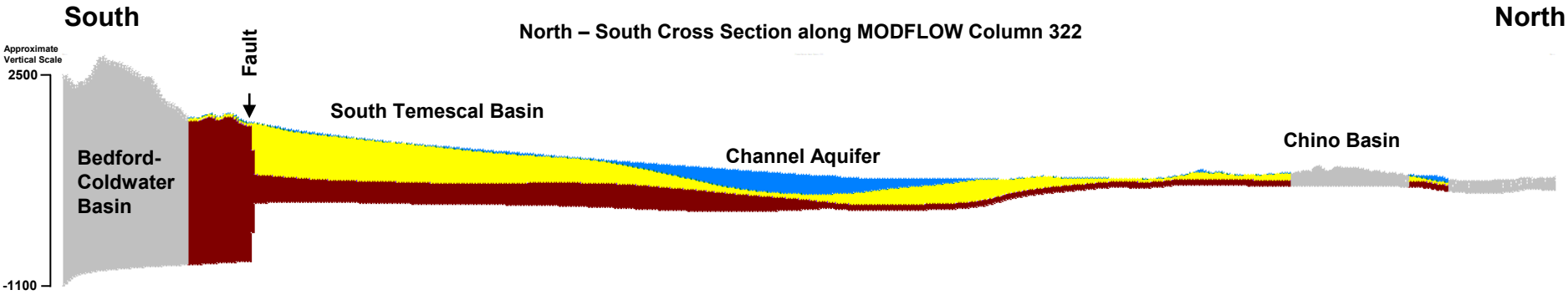
TODD GROUNDWATER

Figure 12
Bottom Elevation Distribution for Model Layer 3

East – West Cross Section along MODFLOW Row 262



North – South Cross Section along MODFLOW Column 322



0 0.5 1

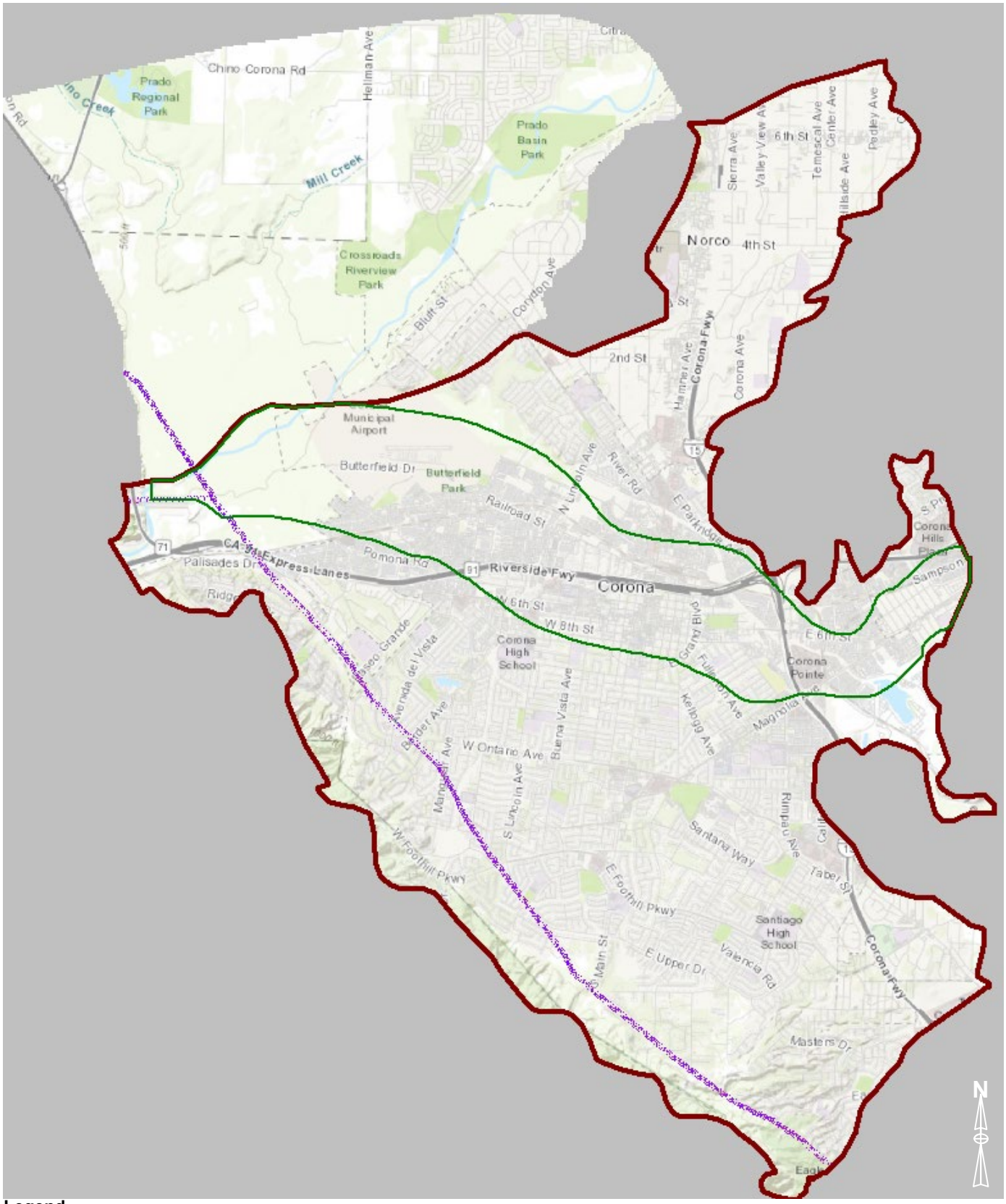
Scale: Miles

Note: The locations of these schematic cross sections are shown on Figure 8

December 2021

TODD GROUNDWATER

Figure 13
Schematic Cross Sections to Illustrate Relative Model Layer Thicknesses



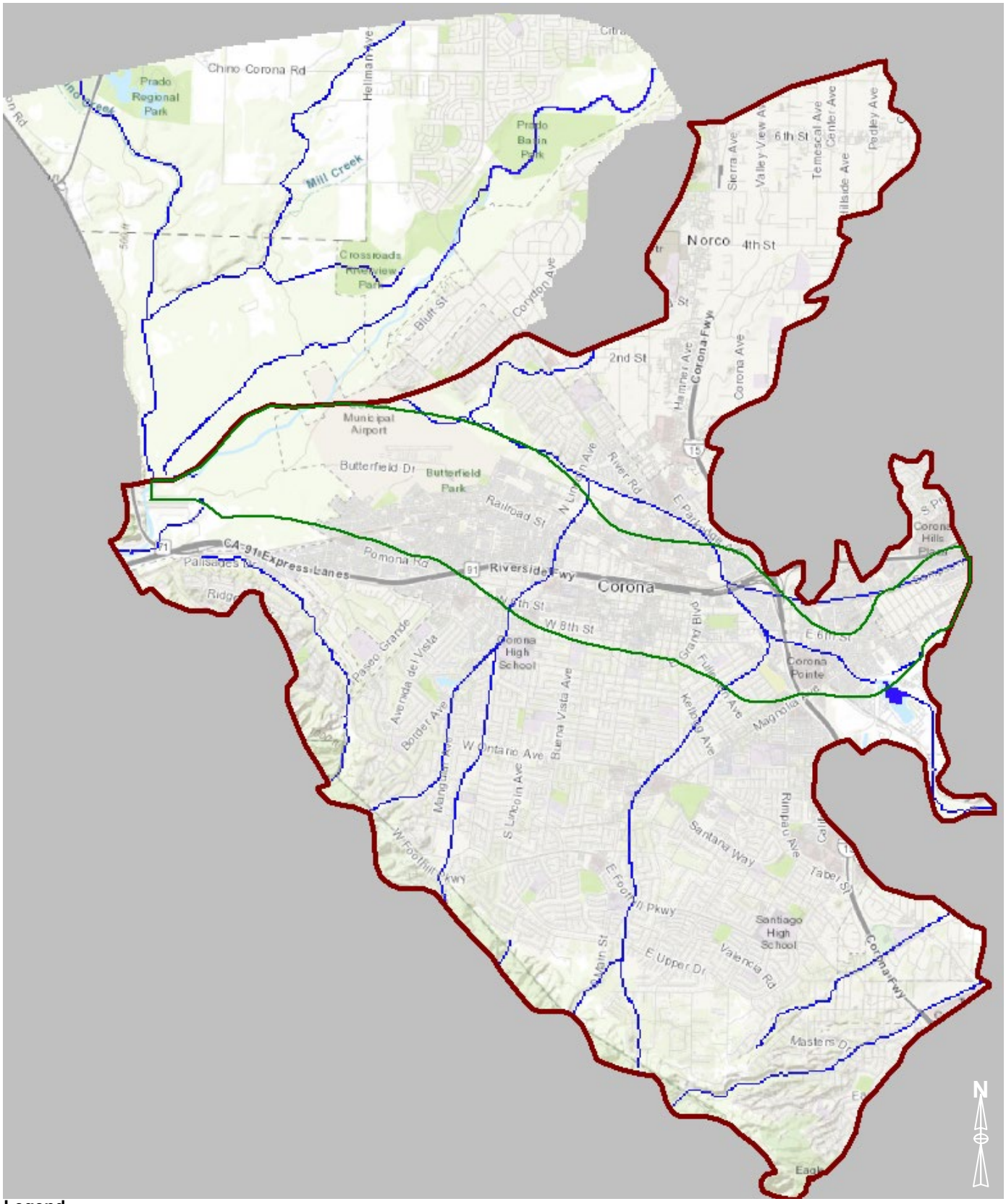
Legend

- Simulated Fault Location
- Temescal Subbasin
- Channel Aquifer Outline

December 2021

TODD GROUNDWATER

Figure 14
Location of Faults Applied in the MODFLOW Model



Legend

- Simulated Stream Location
- Temescal Subbasin
- Channel Aquifer Outline

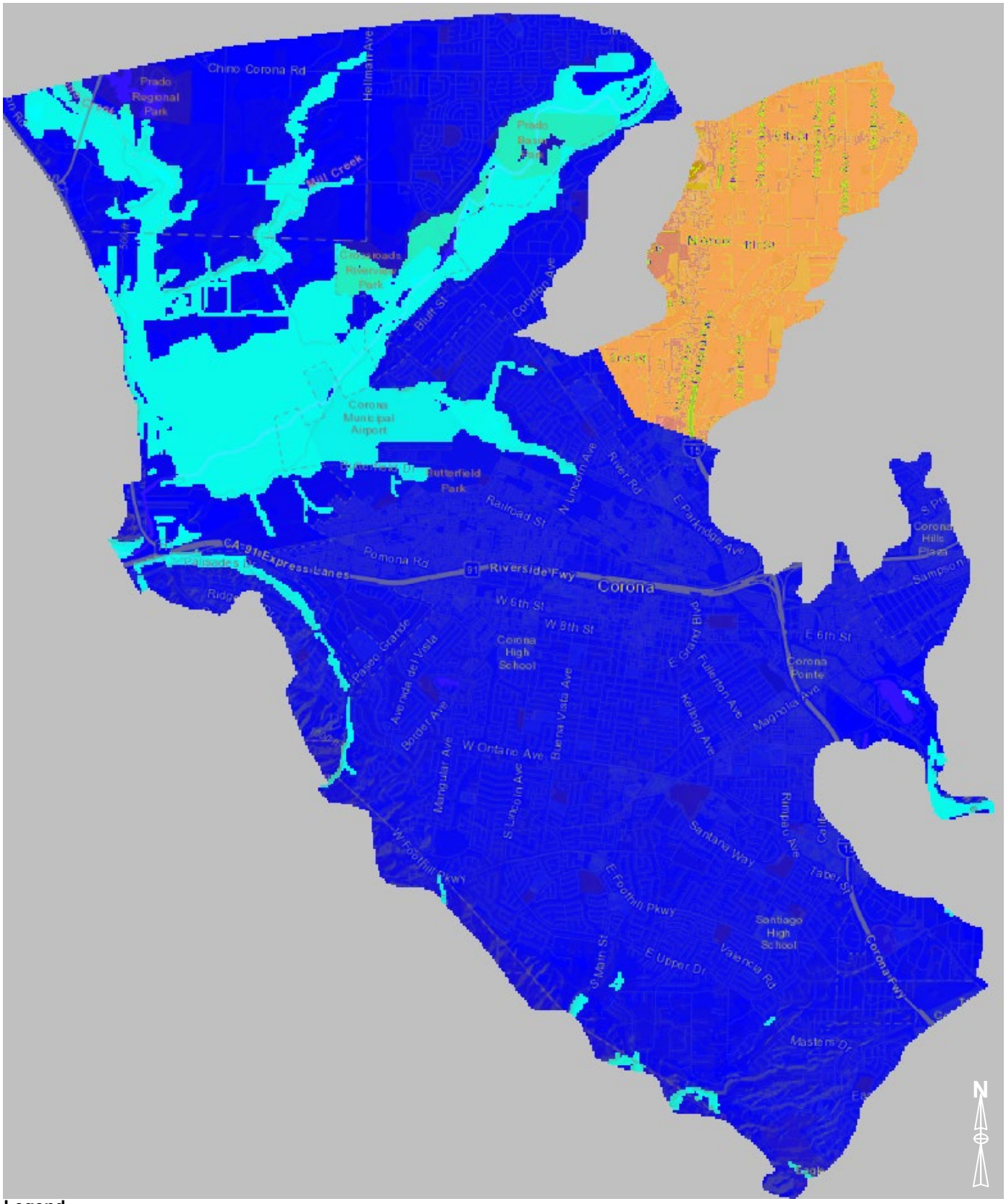
December 2021

TODD GROUNDWATER

Figure 15
Locations of Streams Applied in the MODFLOW Model



December 2021	Figure 16 Distribution of Specified Flux Boundary for Mountain Front Recharge
TODD GROUNDWATER	



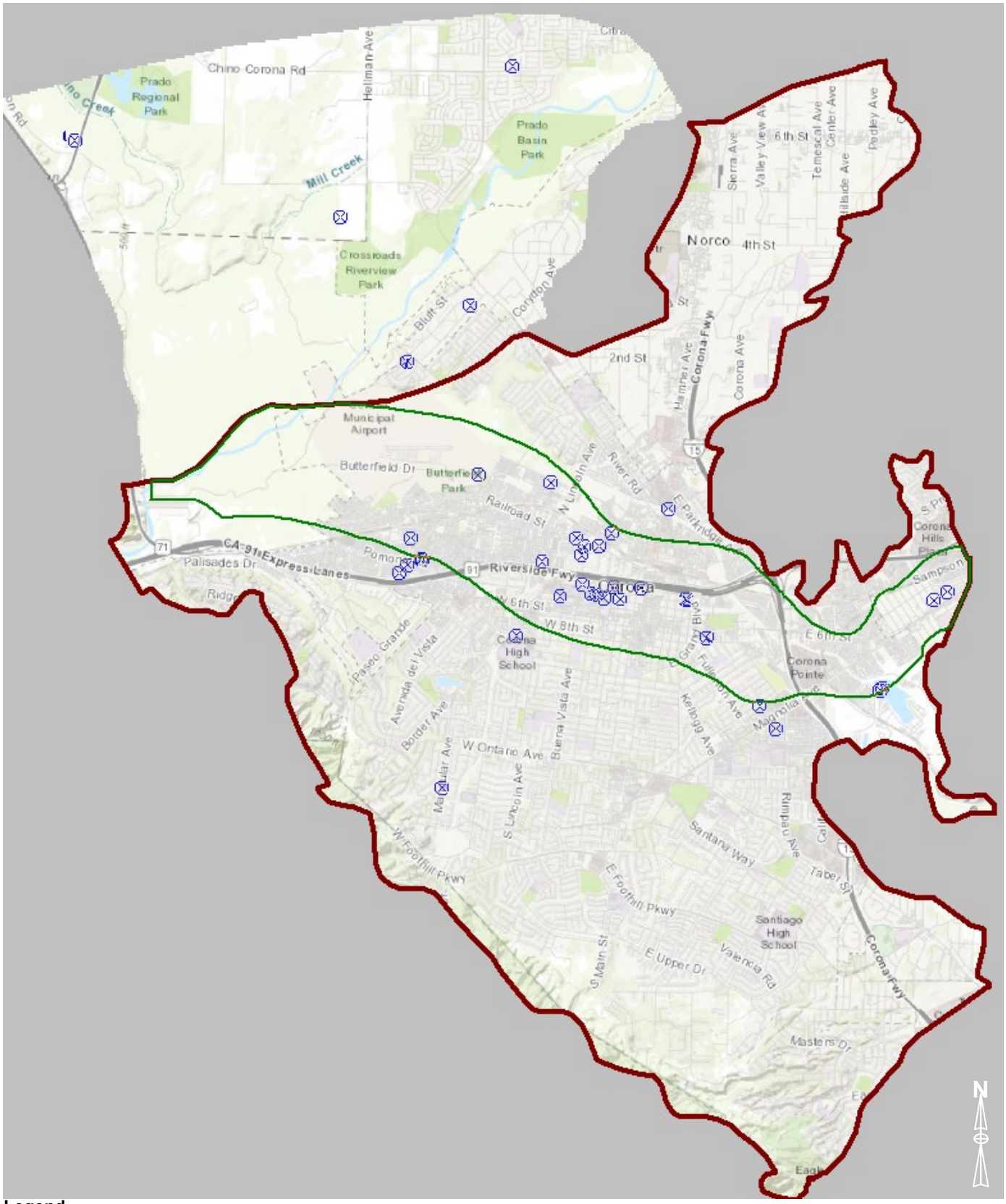
Legend

- Riparian ET Zone
- Basin ET Zone
- Norco ET Zone

December 2021

TODD GROUNDWATER

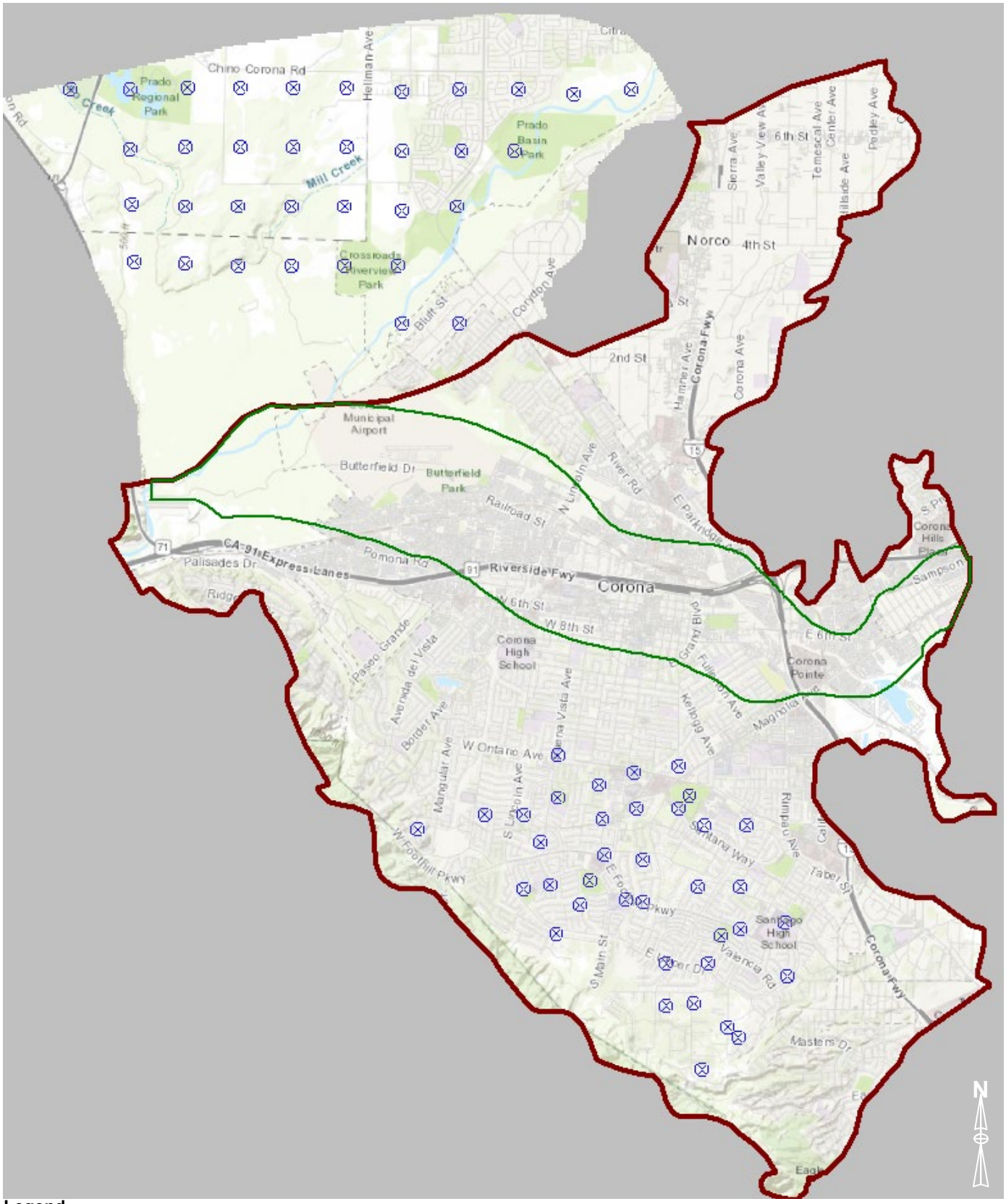
Figure 17
Distribution of Evapotranspiration (ET) Zones



Legend

- Location of Metered Municipal or Industrial Well
- Temescal Subbasin
- Channel Aquifer Outline

December 2021	Figure 18 Locations of Metered Municipal or Industrial Well Applied in MODFLOW Model
TODD GROUNDWATER	

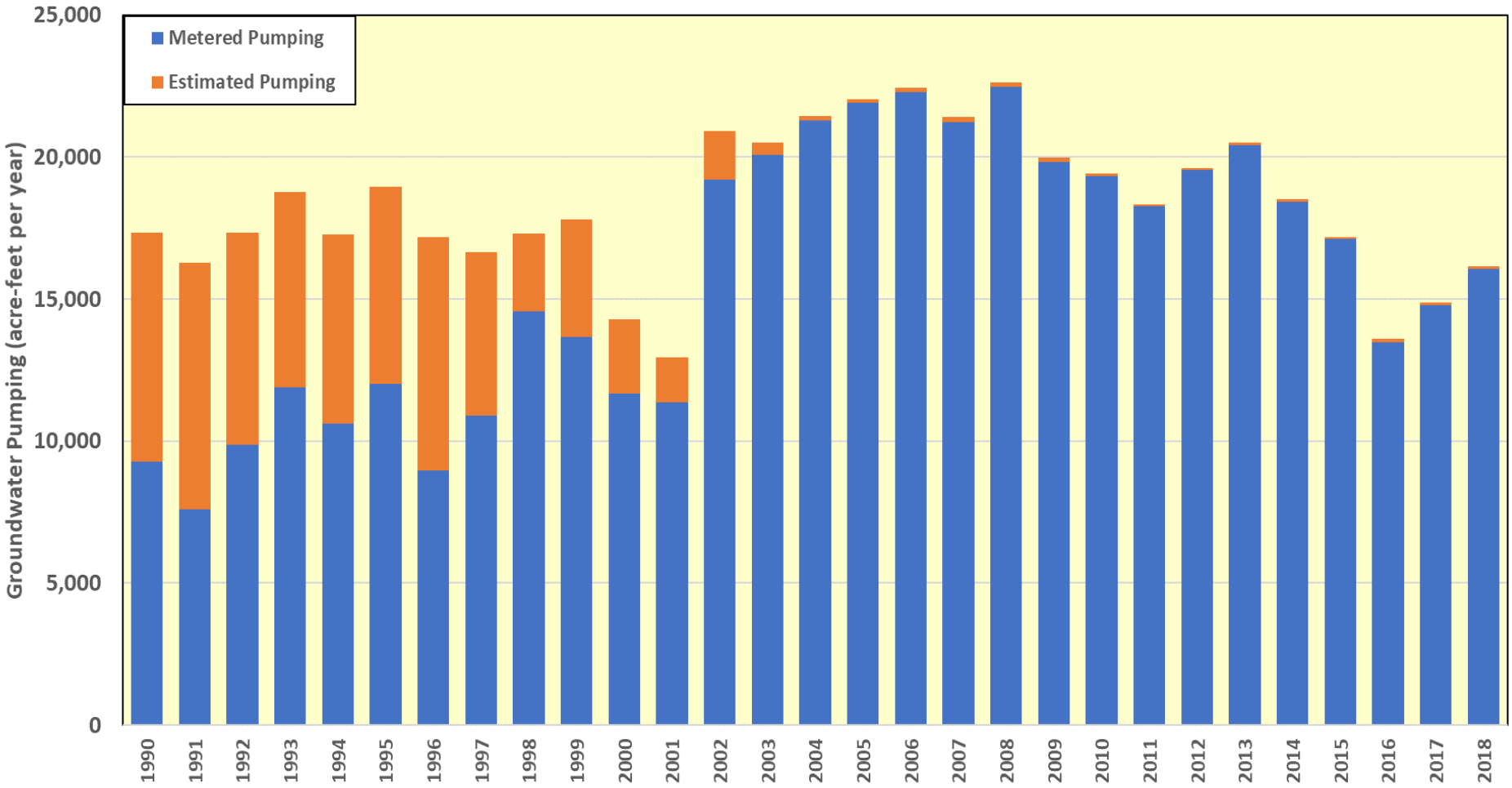


Legend

- Location of Estimated Agricultural Pumping
- Temescal Subbasin
- Channel Aquifer Outline

10000 feet

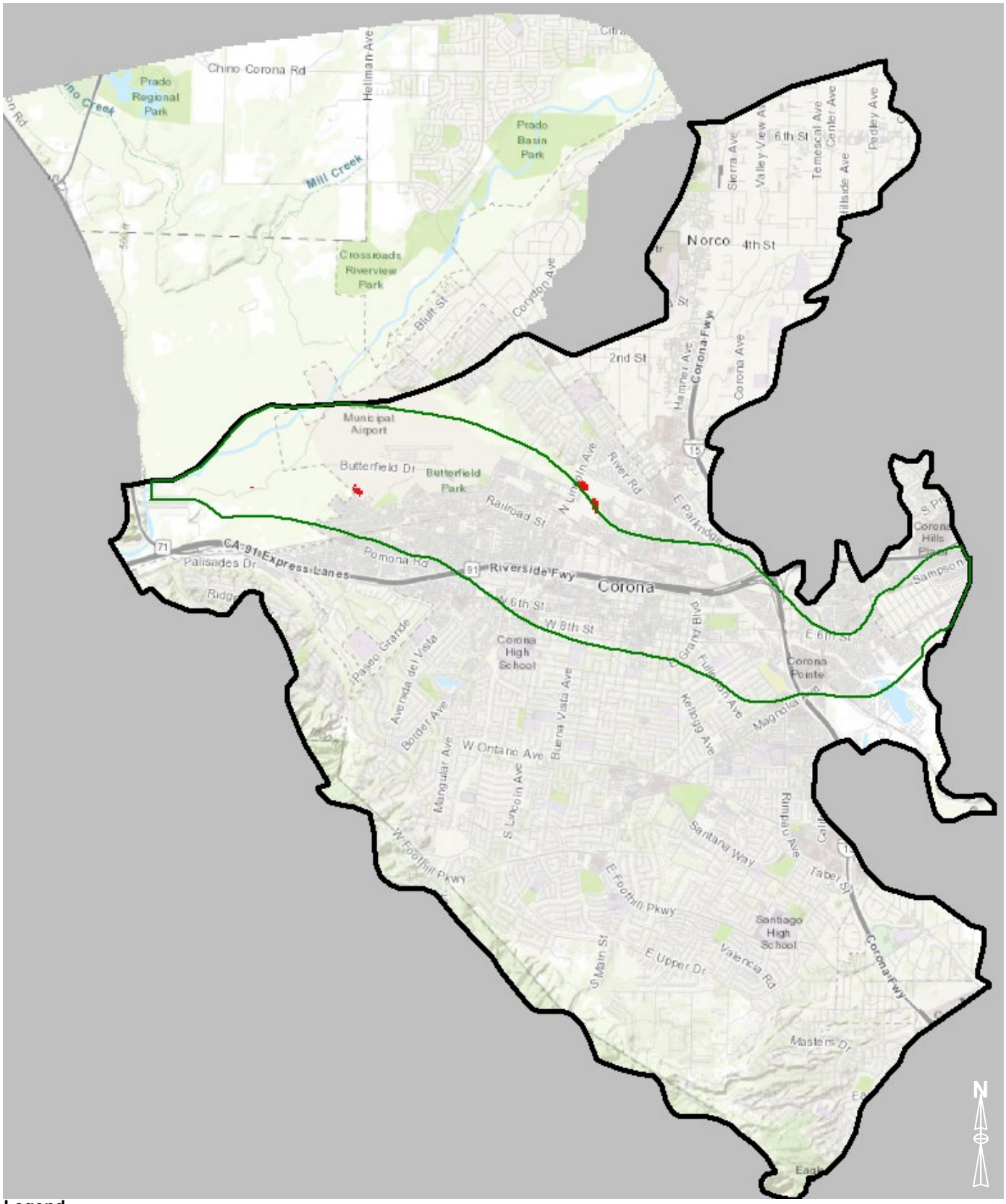
December 2021	Figure 19 Approximated Locations of Agricultural Pumping Wells Applied in MODFLOW Model
TODD GROUNDWATER	



December 2021

TODD GROUNDWATER

Figure 20
Annual Groundwater Pumping Applied in MODFLOW Model



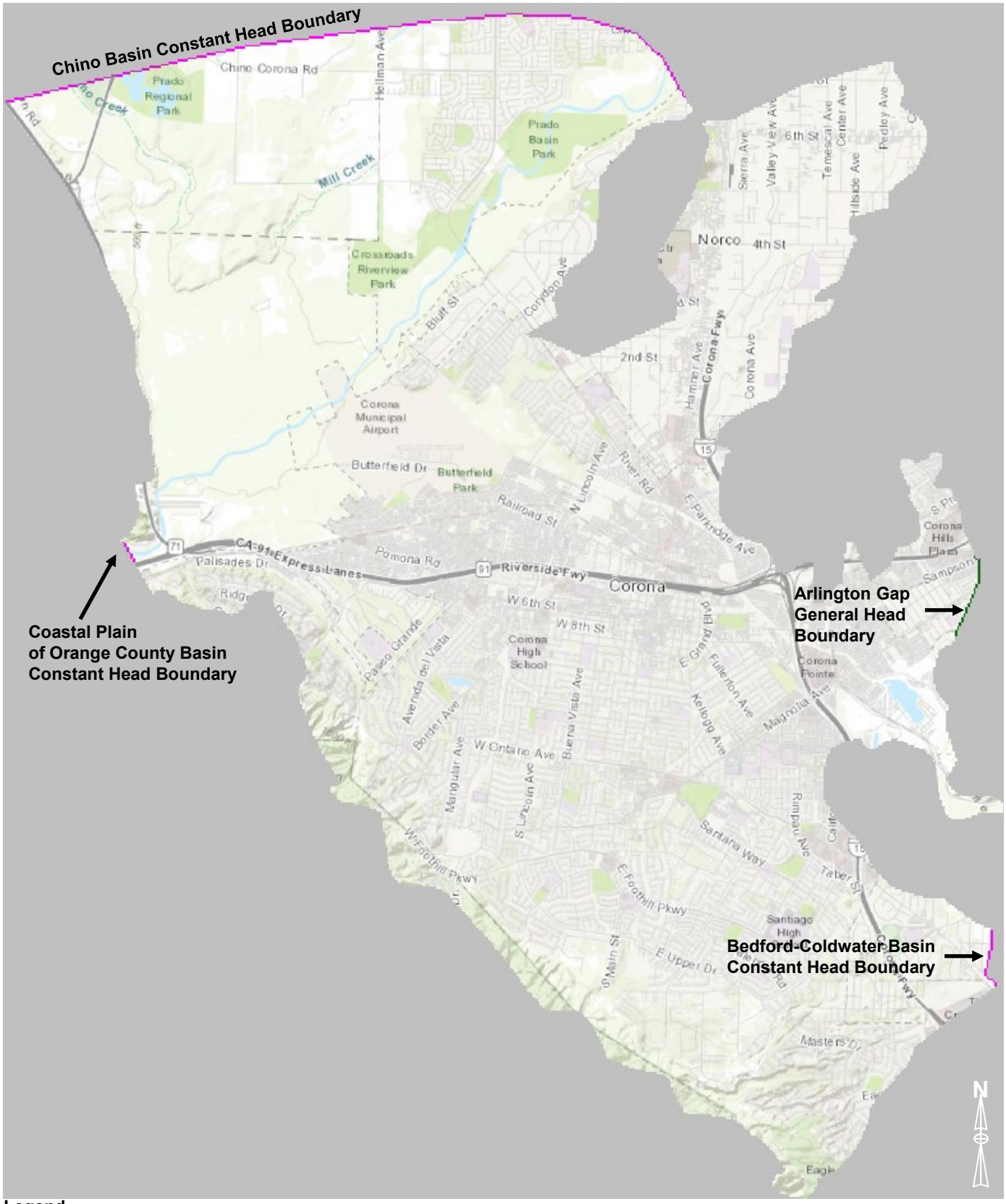
Legend

- Recycled Water Percolation Pond
- Temescal Subbasin
- Channel Aquifer Outline

December 2021

TODD GROUNDWATER

Figure 21
Location of Recycled Water Recharge Ponds

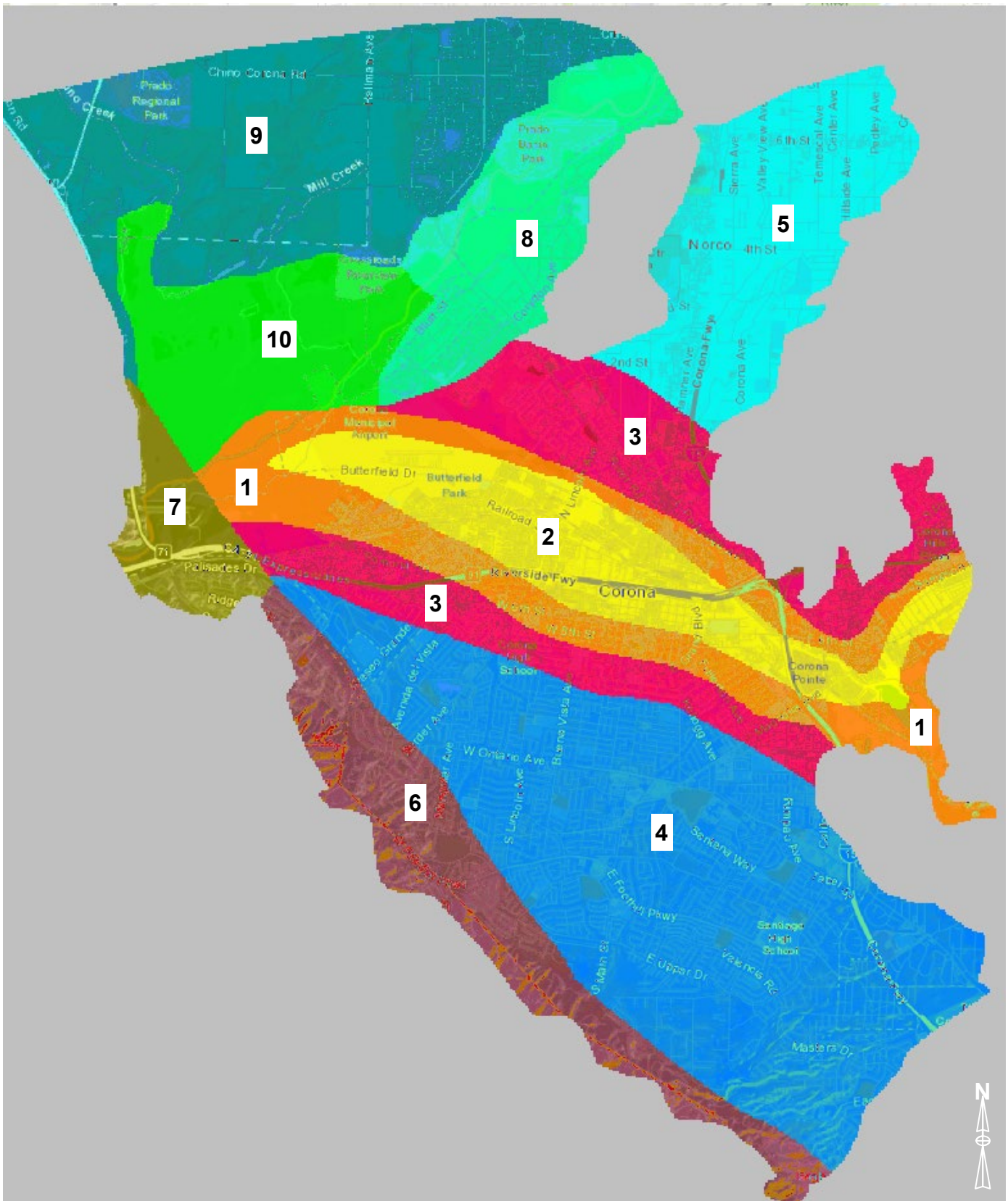


Legend

- Simulated Constant Head Boundary
- Simulated General Head Boundary

10000 feet

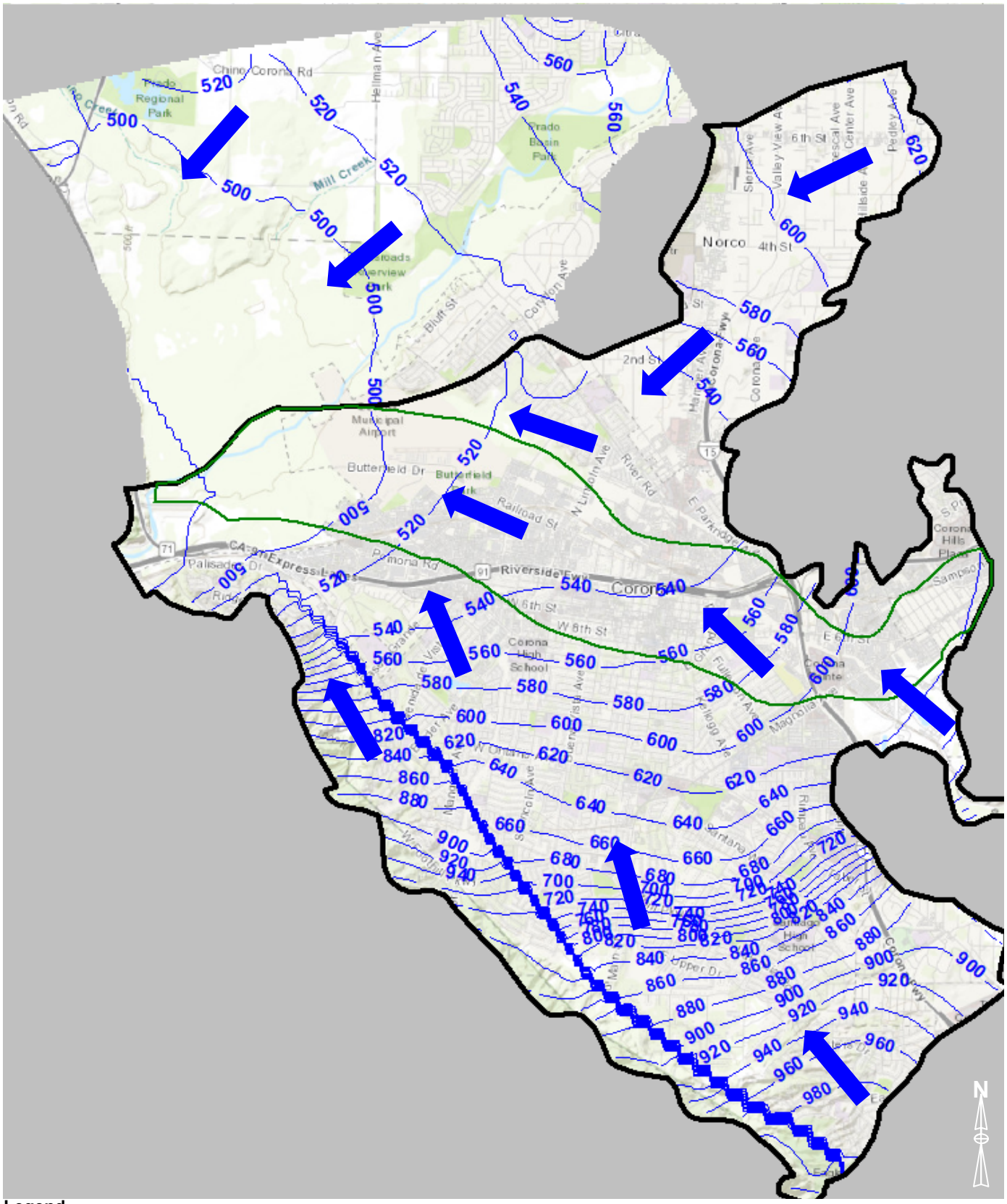
December 2021	Figure 22 Boundary Conditions Applied at the Basin Margins in the MODFLOW Model
TODD GROUNDWATER	



Note: Map Zone numbers relate to Aquifer Property Values on Table 2 in Report

10000 feet

December 2021	Figure 23 Distribution of Aquifer Property Zones for Layers 1, 2 and 3
TODD GROUNDWATER	



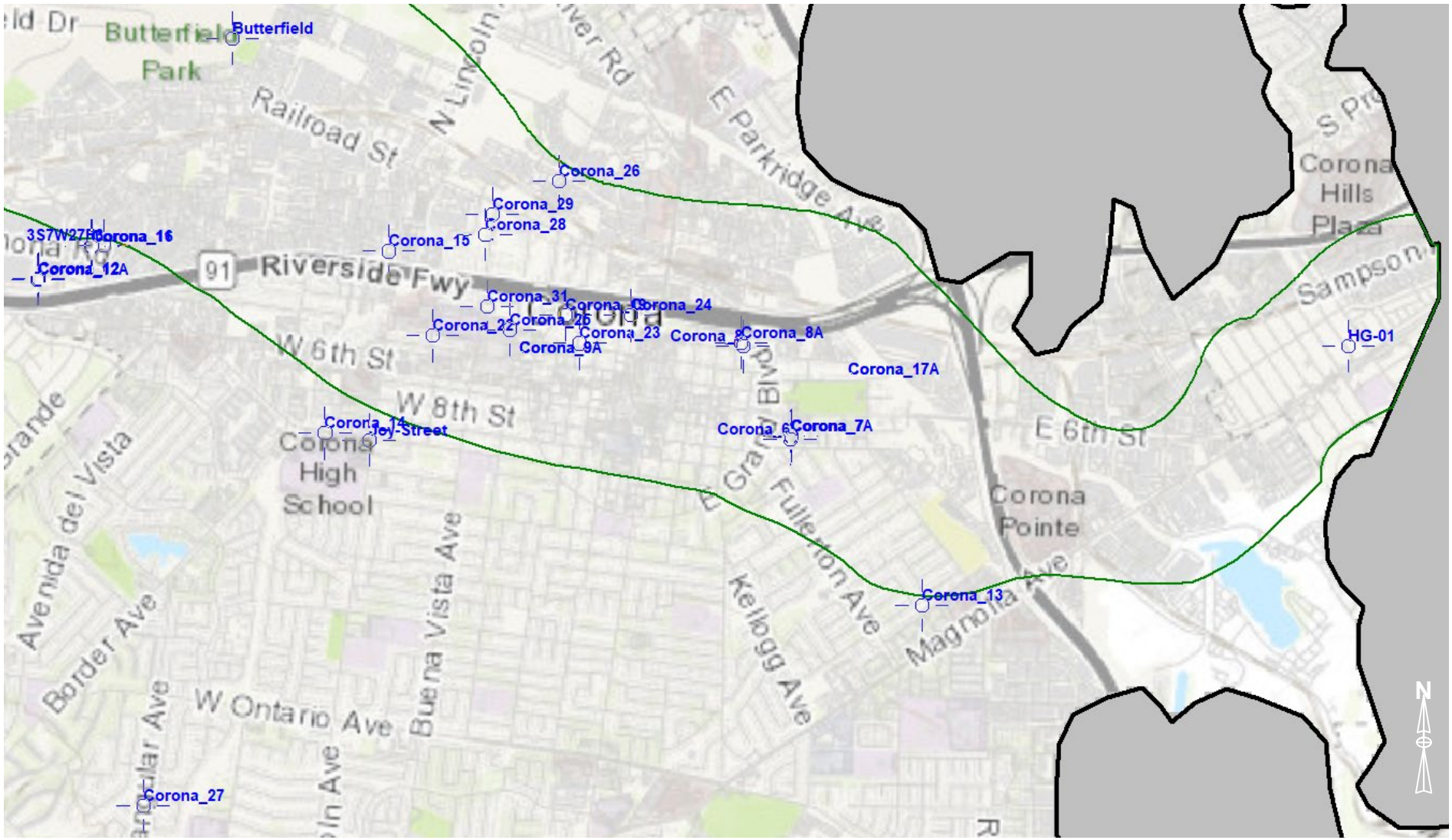
Legend

- Inferred Groundwater Flow Direction
- 900 Simulated Groundwater Elevation
- Temescal Subbasin
- Channel Aquifer Outline

December 2021

TODD GROUNDWATER

Figure 24
Initial Groundwater Elevations Applied in the MODFLOW Model



Legend

- Monitoring Well Location
- Temescal Subbasin
- Channel Aquifer Outline

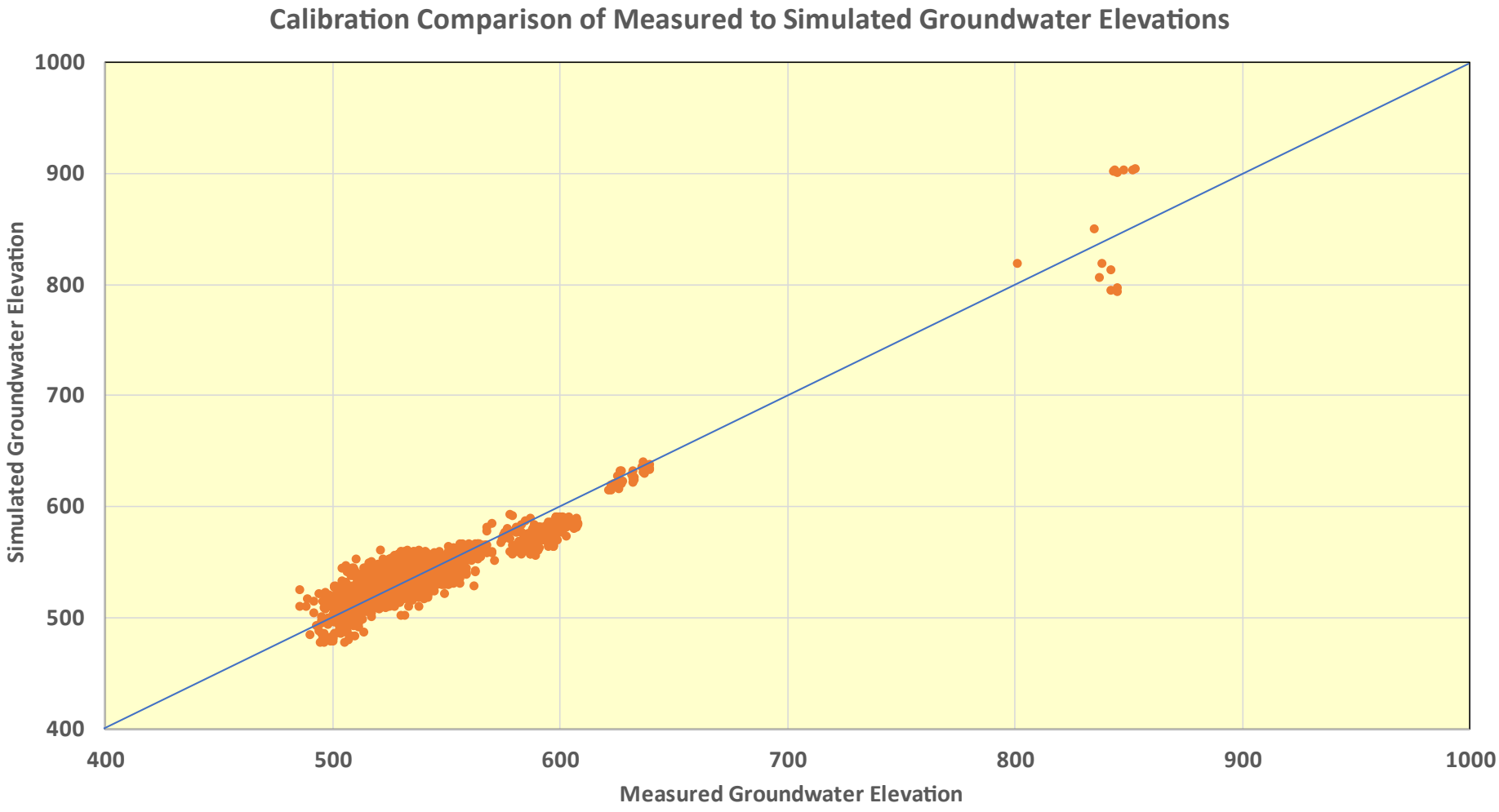
0 0.5 1

Scale: Miles

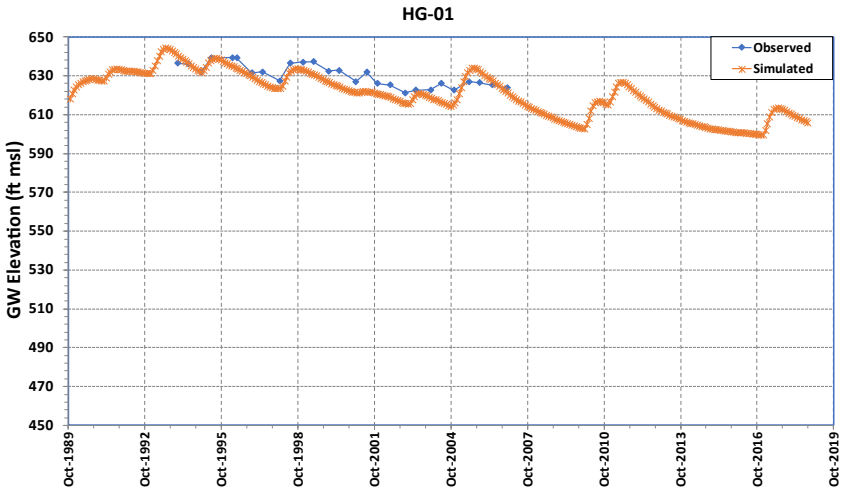
December 2021

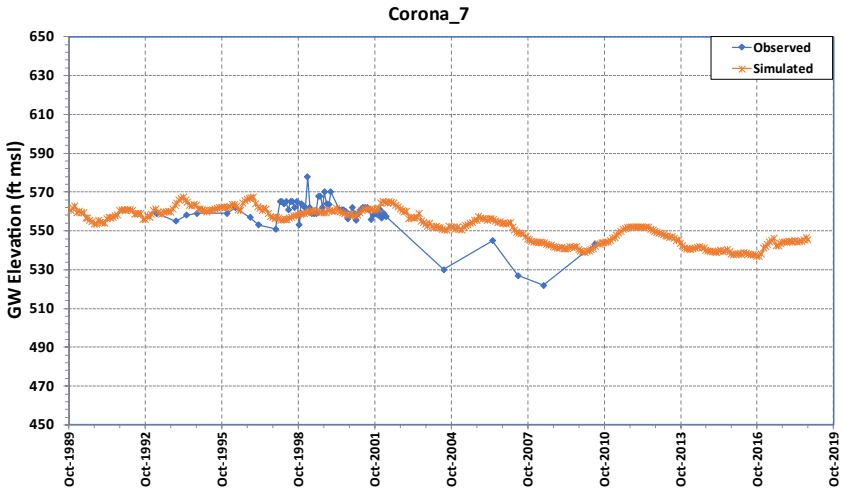
TODD GROUNDWATER

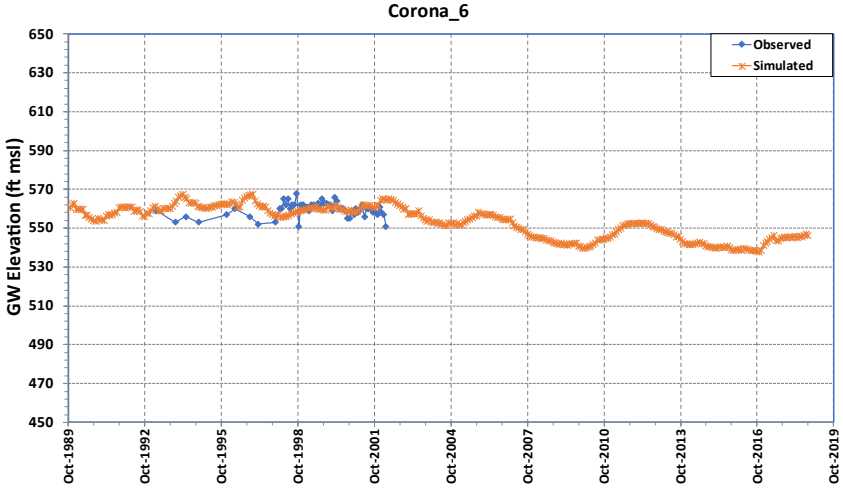
Figure 25
Location of Monitoring Wells Used for Calibration

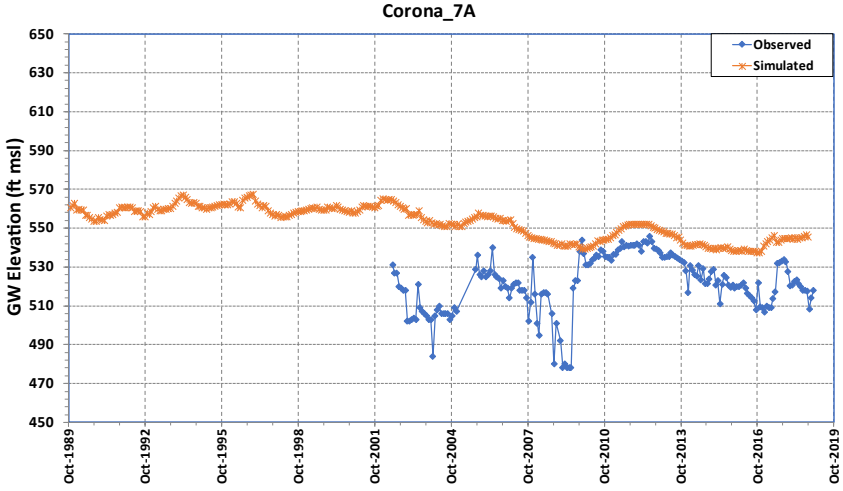


December 2021	Figure 26 Scatter Plot Comparing Simulated to Measured Groundwater Levels
TODD GROUNDWATER	

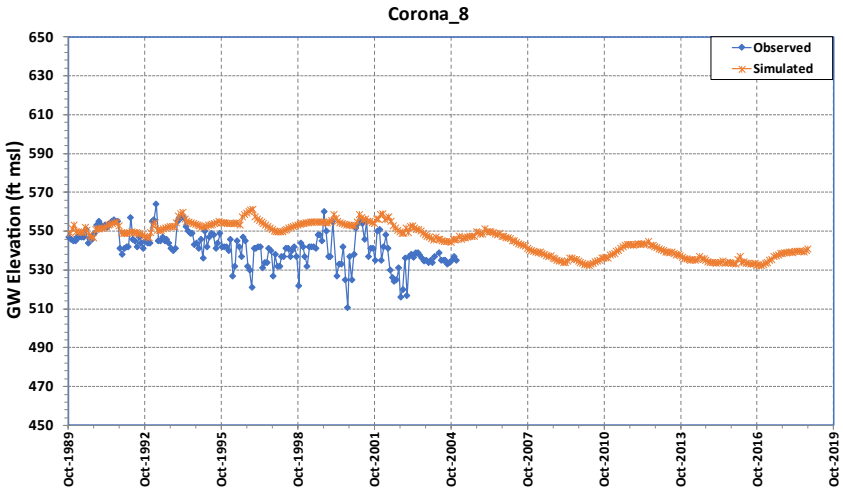


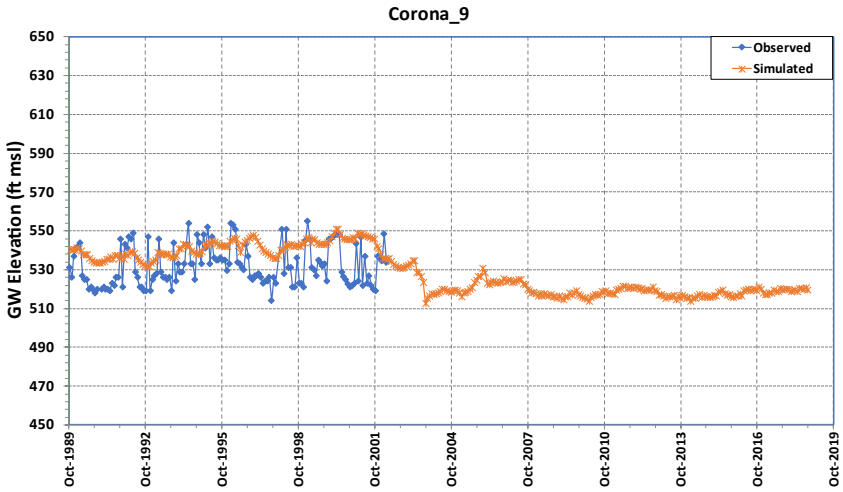


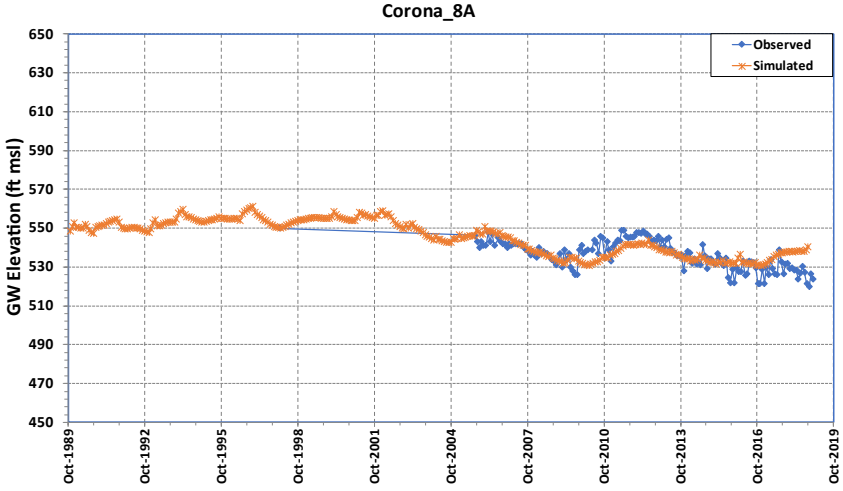


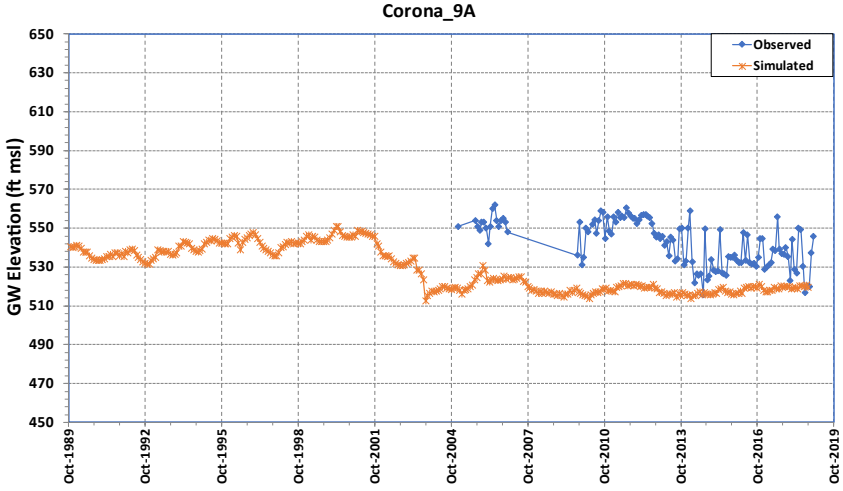


December 2021	Figure 27 Calibration Hydrographs Corona Wells 6, 7 and 7A HG-01
TODD GROUNDWATER	





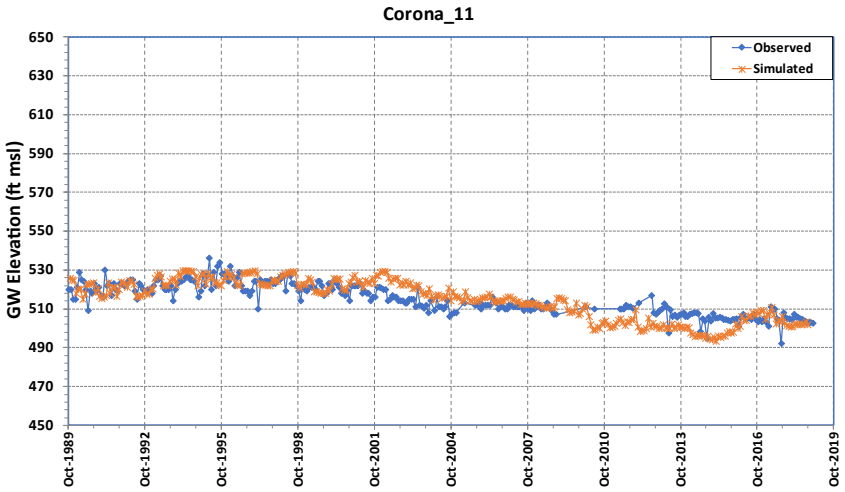


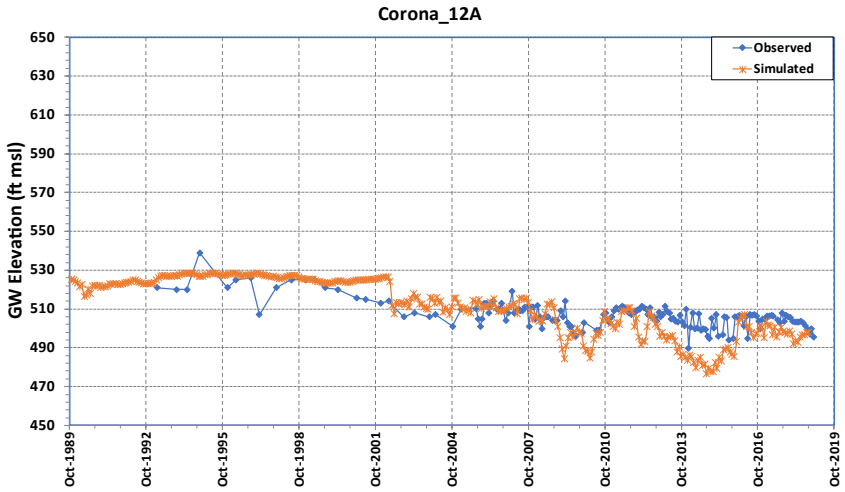


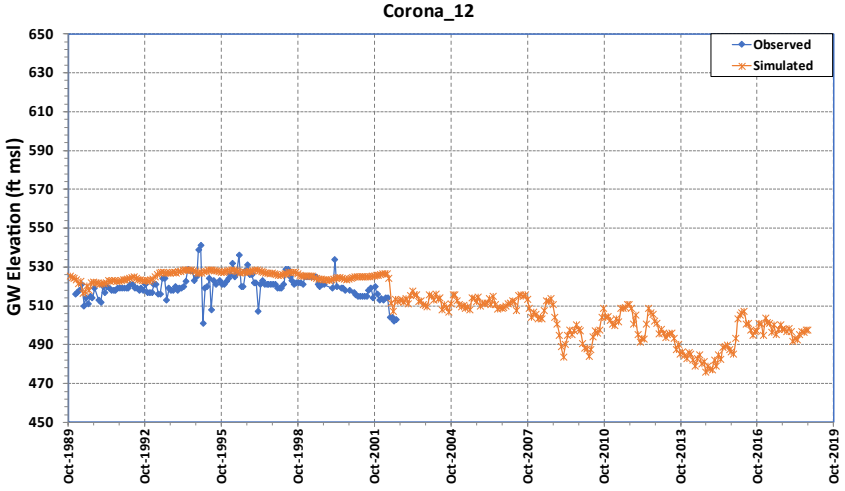
December 2021

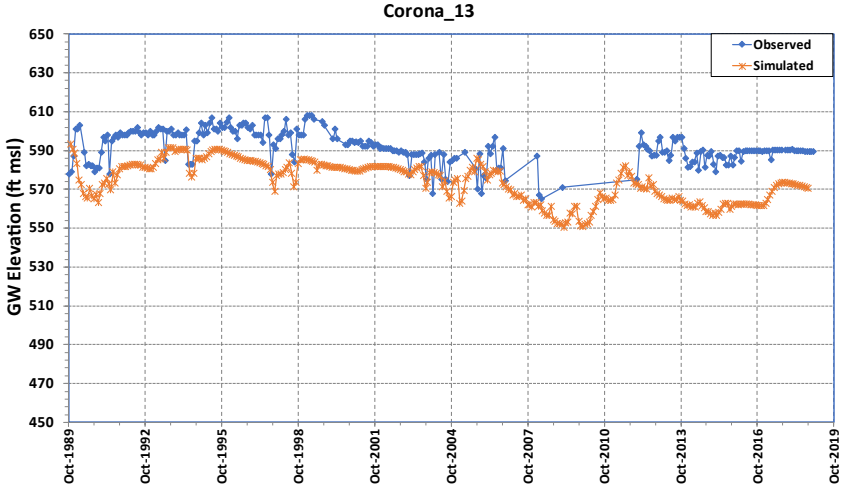
TODD GROUNDWATER

Figure 28
Calibration Hydrographs
Corona Wells 8, 8A, 9, 9A

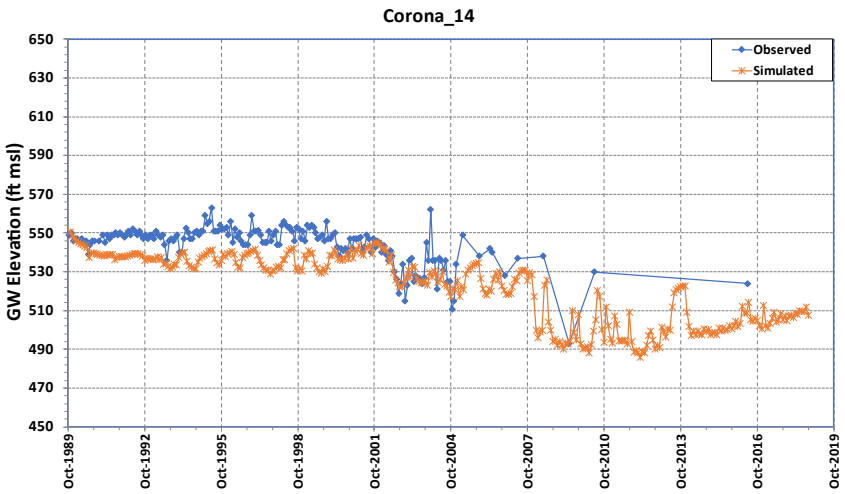


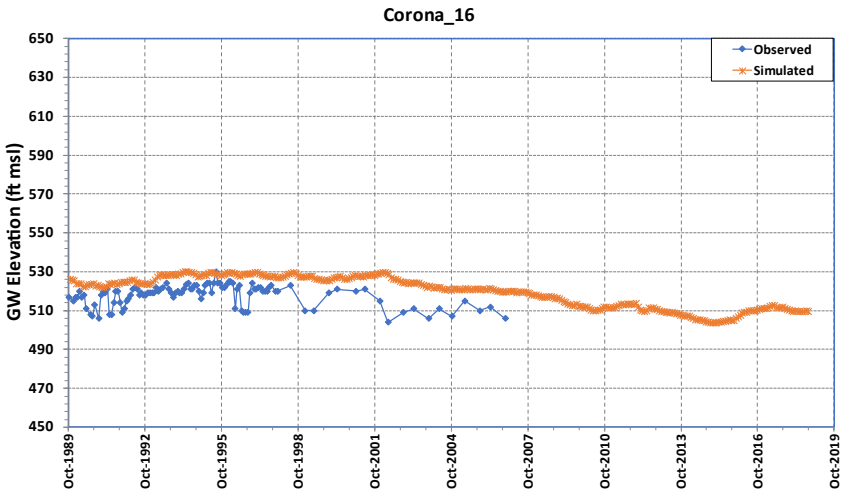


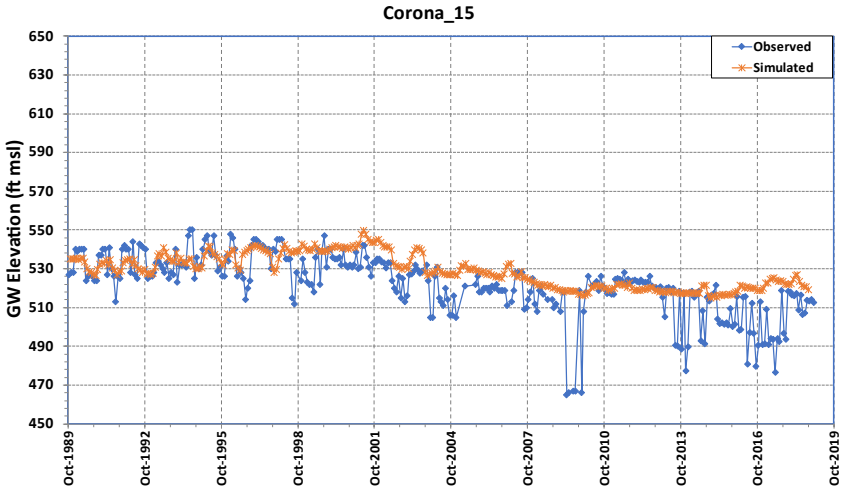


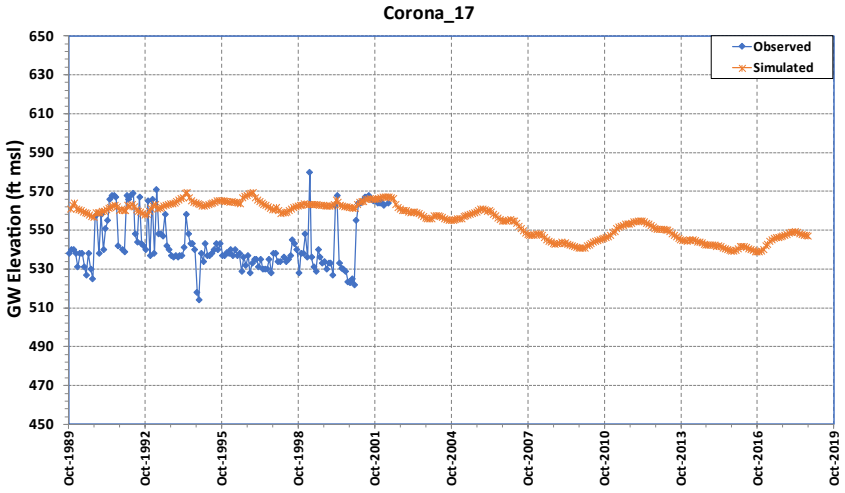


December 2021	Figure 29 Calibration Hydrographs Corona Wells 11, 12, 12A and 13
TODD GROUNDWATER	

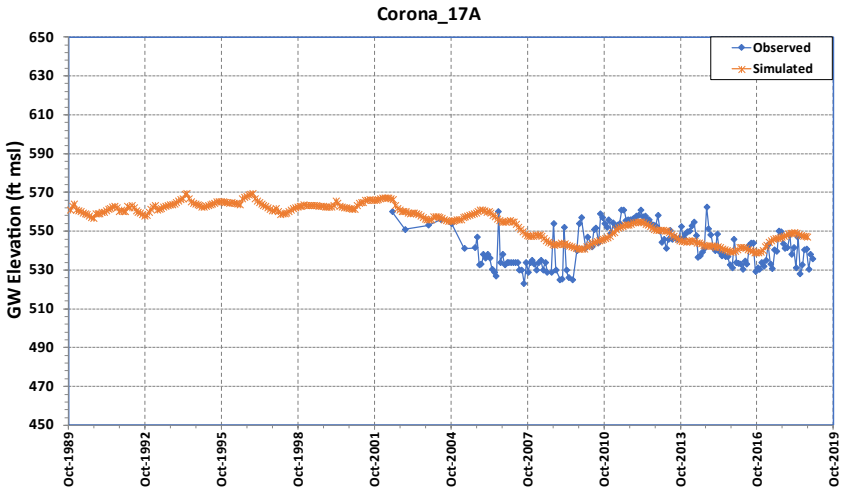


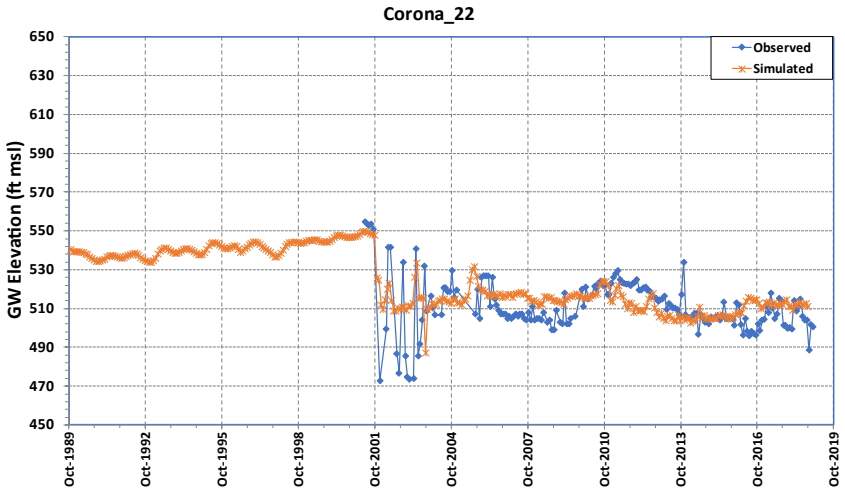


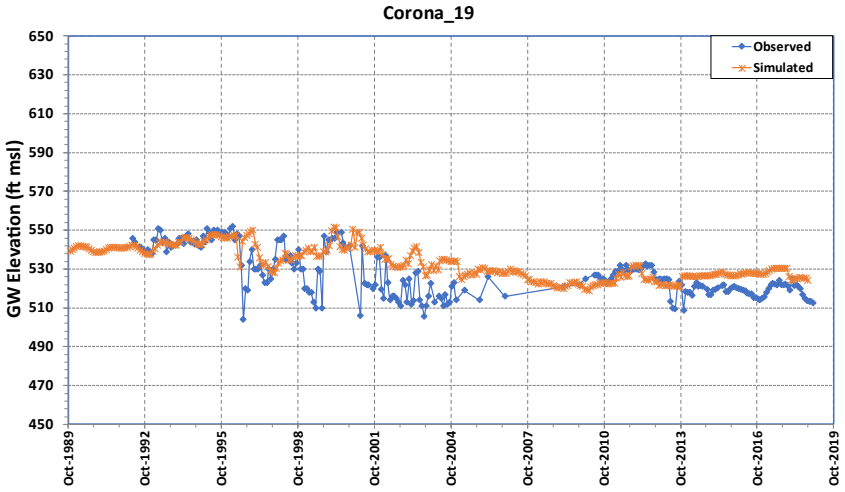


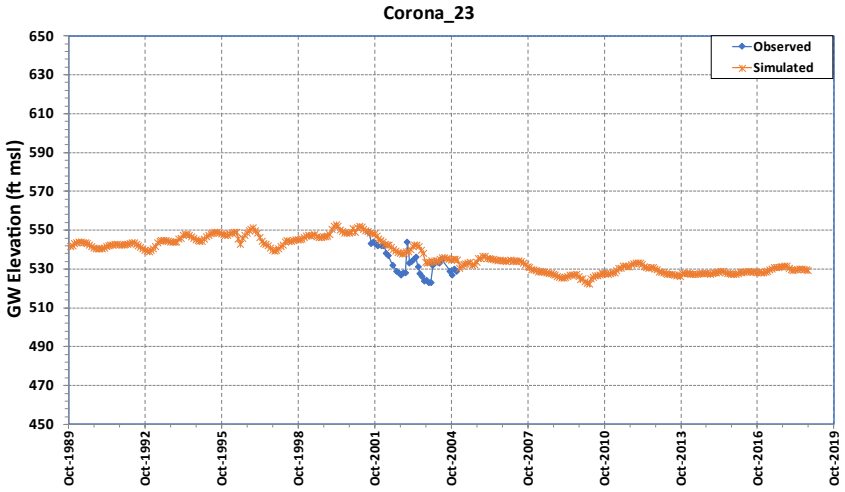


December 2021	Figure 30 Calibration Hydrographs Corona Wells 14, 15, 16 and 17
TODD GROUNDWATER	

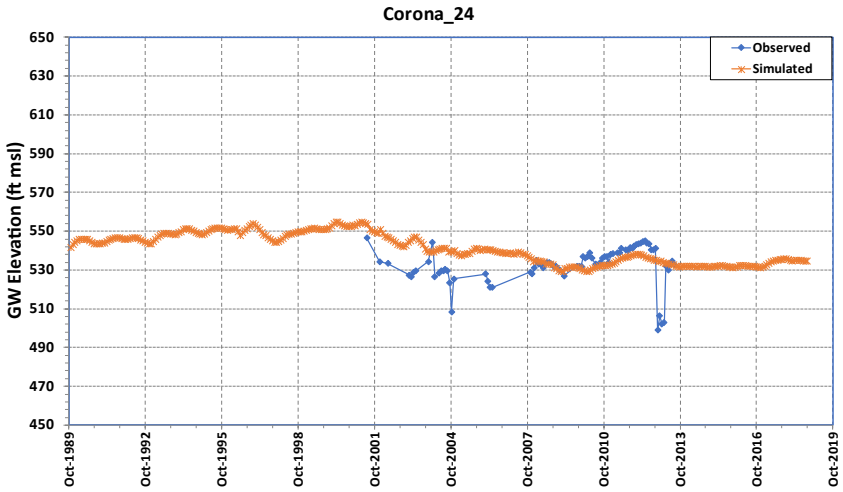


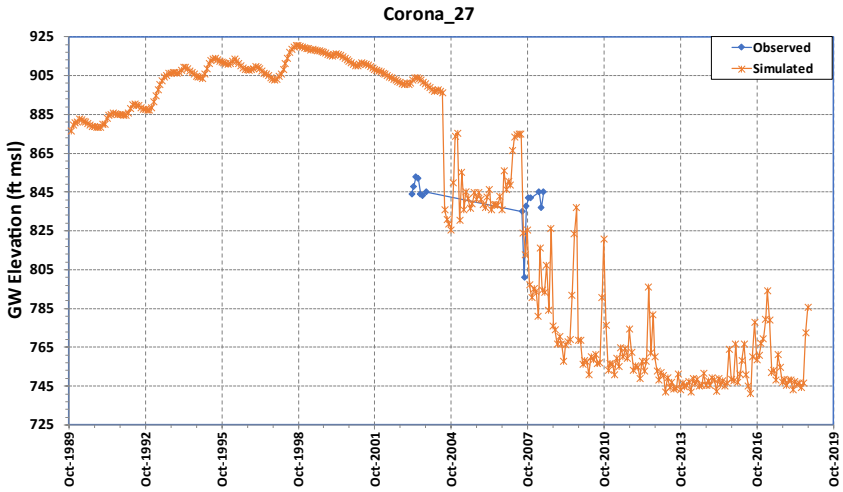


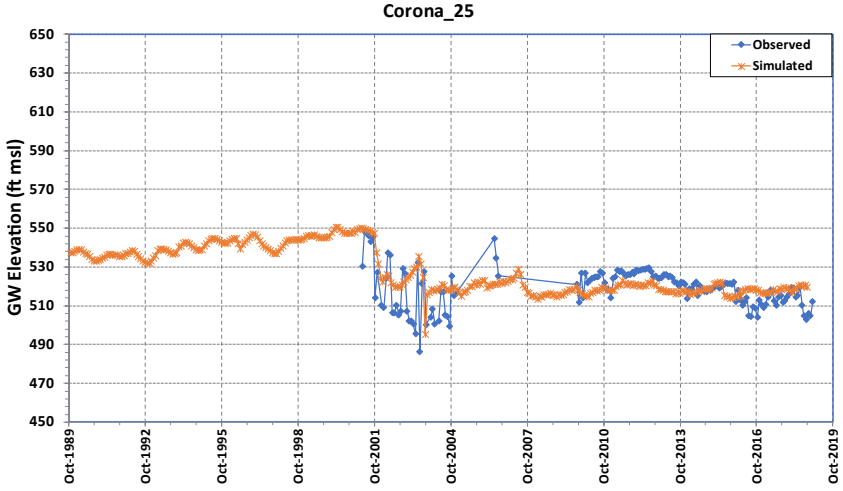


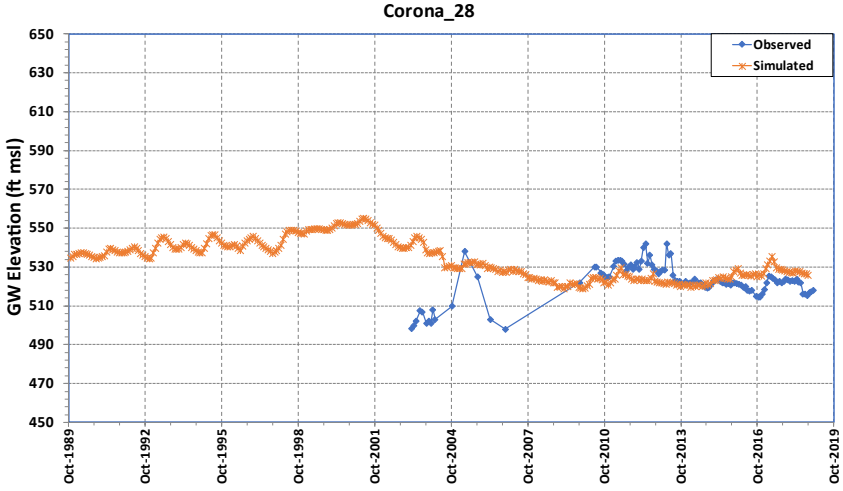


December 2021	Figure 31 Calibration Hydrographs Corona Wells 17A, 19, 22 and 23
TODD GROUNDWATER	

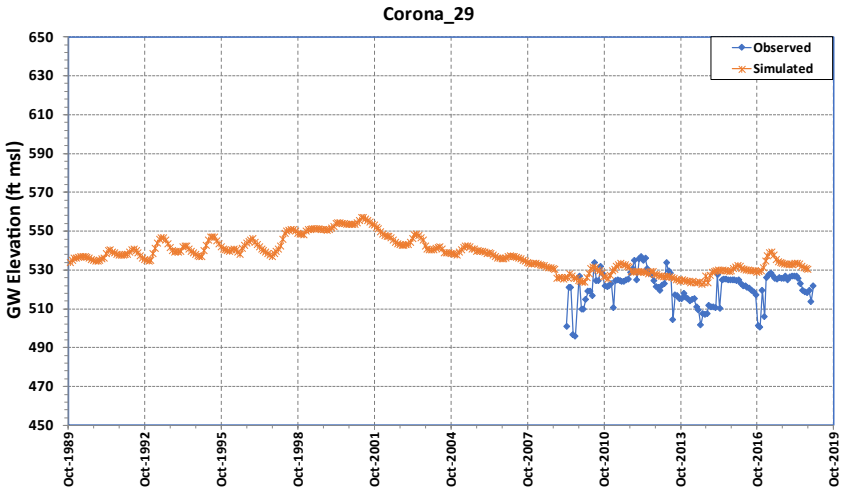


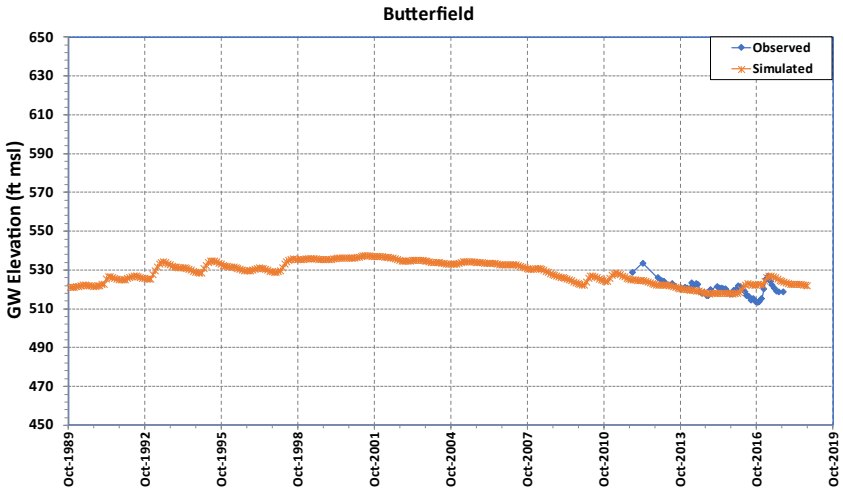


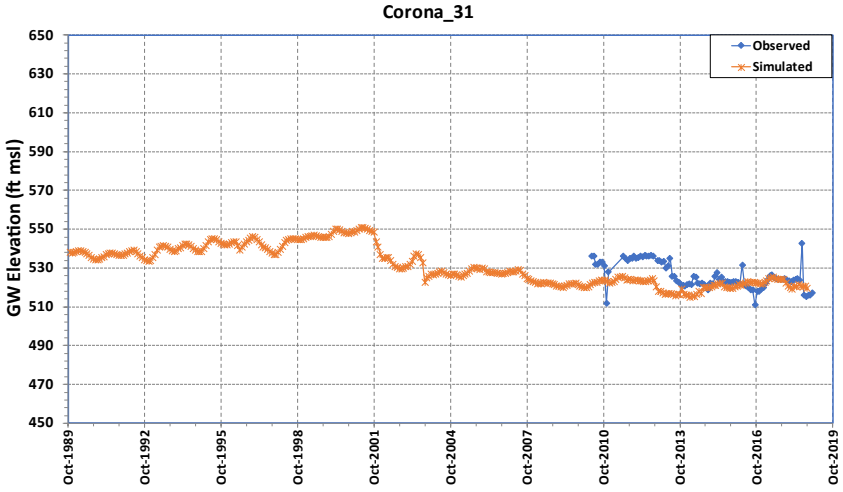


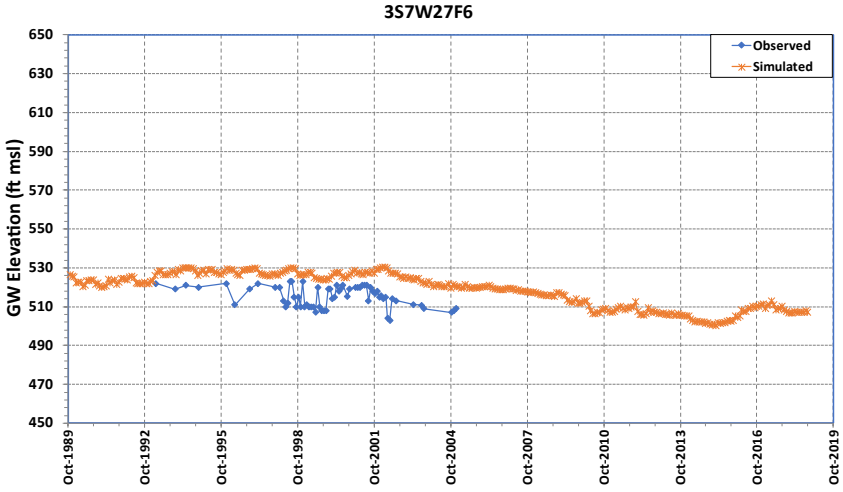


December 2021	Figure 32 Calibration Hydrographs Corona Wells 24, 25, 27 and 28
TODD GROUNDWATER	

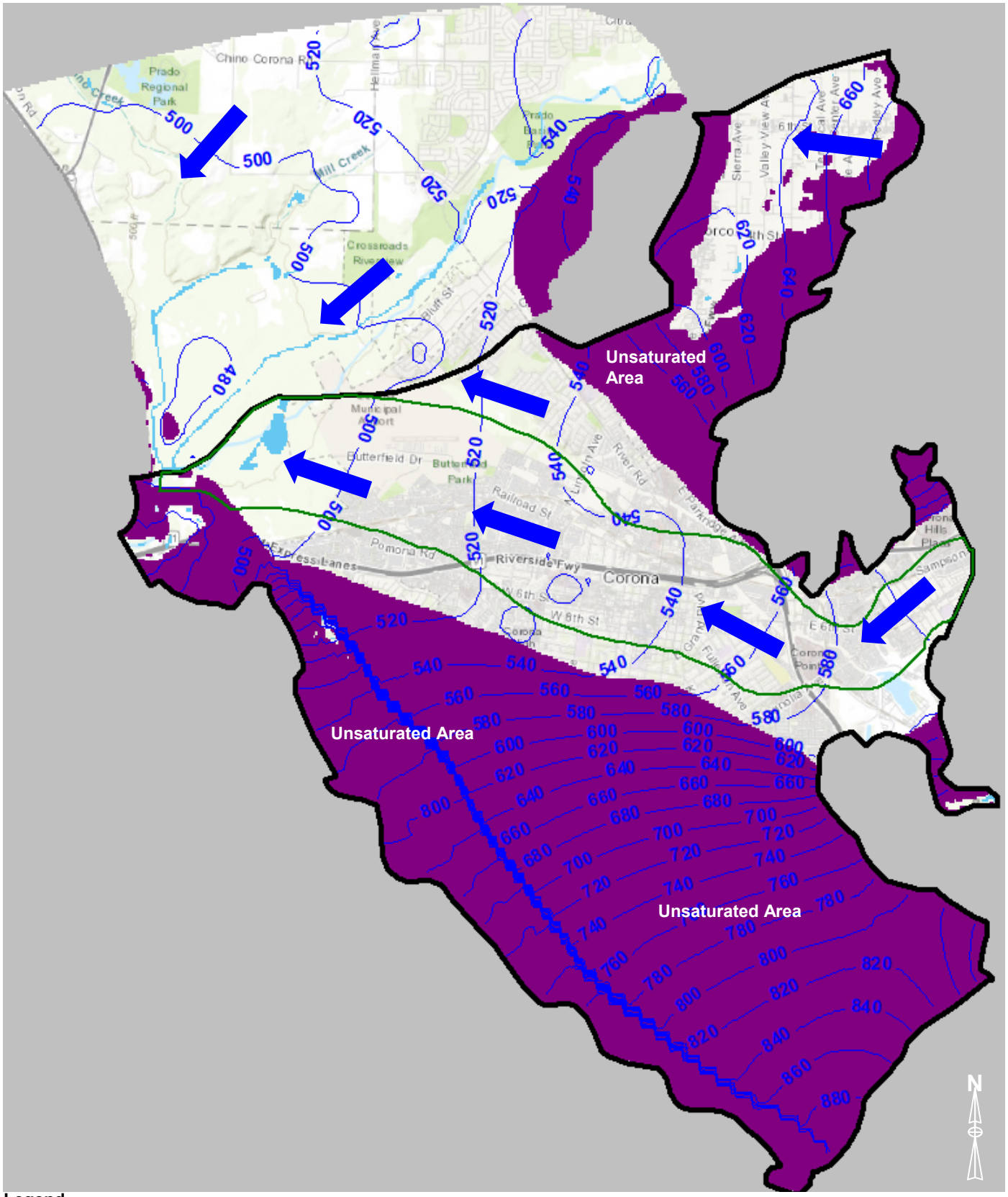








December 2021	Figure 33 Calibration Hydrographs Corona Wells 29 and 31, Butterfield and 3S7W-27F6
TODD GROUNDWATER	



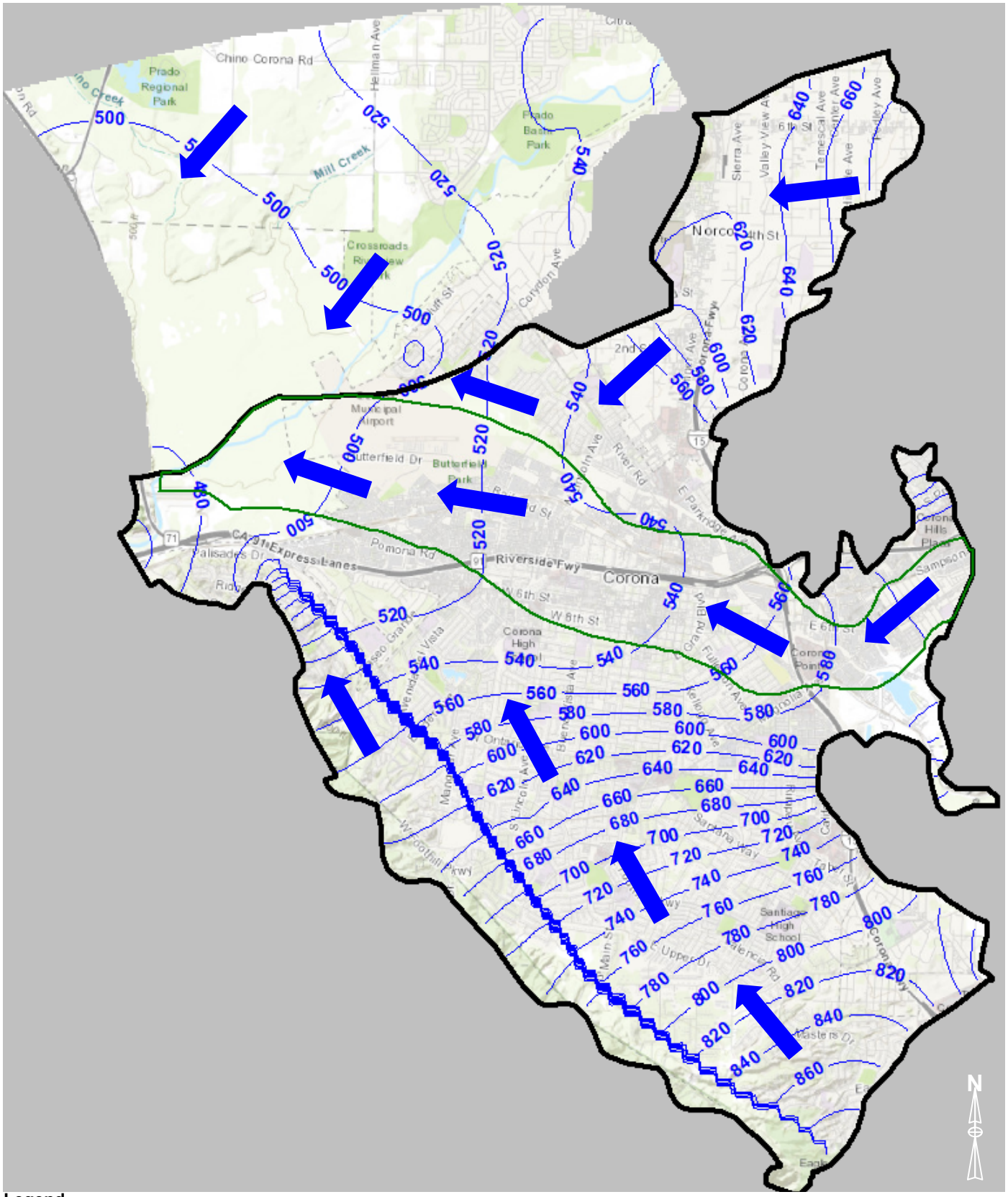
Legend

- Inferred Groundwater Flow Direction
- 900 Simulated Groundwater Elevation
- Temescal Subbasin
- Channel Aquifer Outline
- Unsaturated Areas

December 2021

TODD GROUNDWATER

Figure 34
Groundwater Elevations at End of Simulation in Layer 1
September 2018

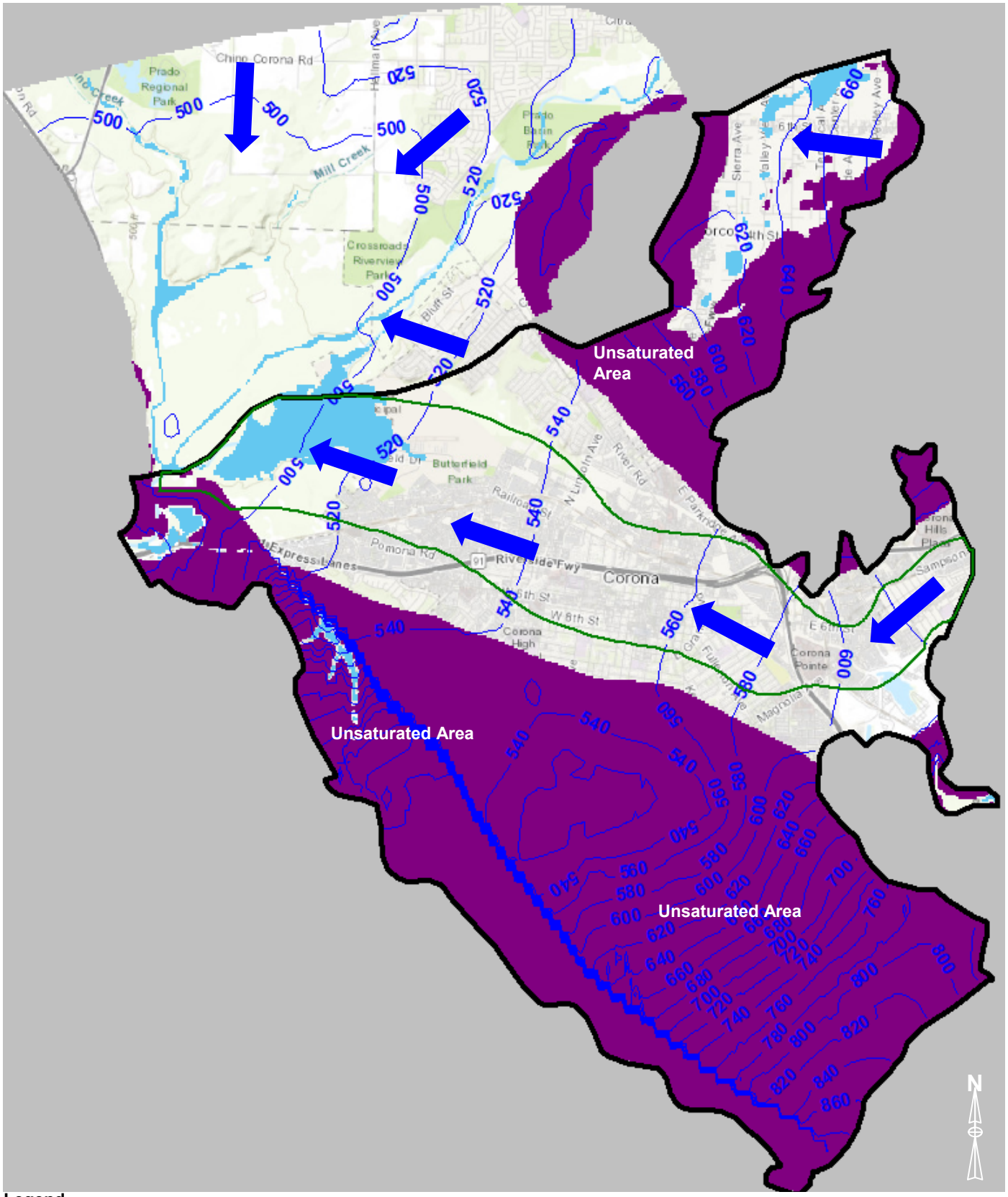


Legend

- Inferred Groundwater Flow Direction
- 900 Simulated Groundwater Elevation
- Temescal Subbasin
- Channel Aquifer Outline

December 2021	Figure 35 Groundwater Elevations at End of Simulation in Layer 3 September 2018

TODD GROUNDWATER

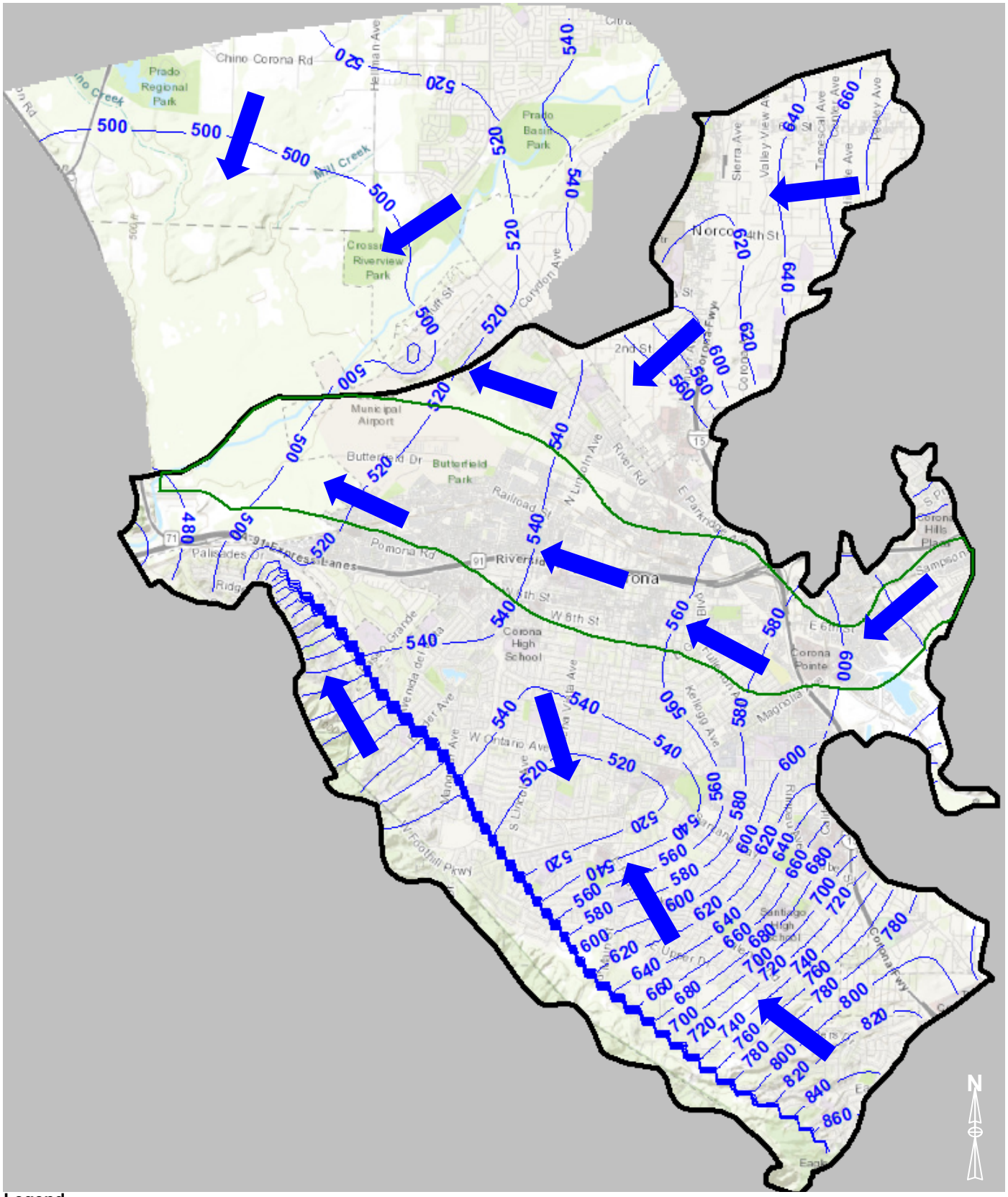


Legend

- Inferred Groundwater Flow Direction
- 900 Simulated Groundwater Elevation
- Temescal Subbasin
- Channel Aquifer Outline
- Unsaturated Areas

December 2021	**Figure 36** **Groundwater Elevations near Highest Levels in Layer 1** **January 1997**

TODD GROUNDWATER



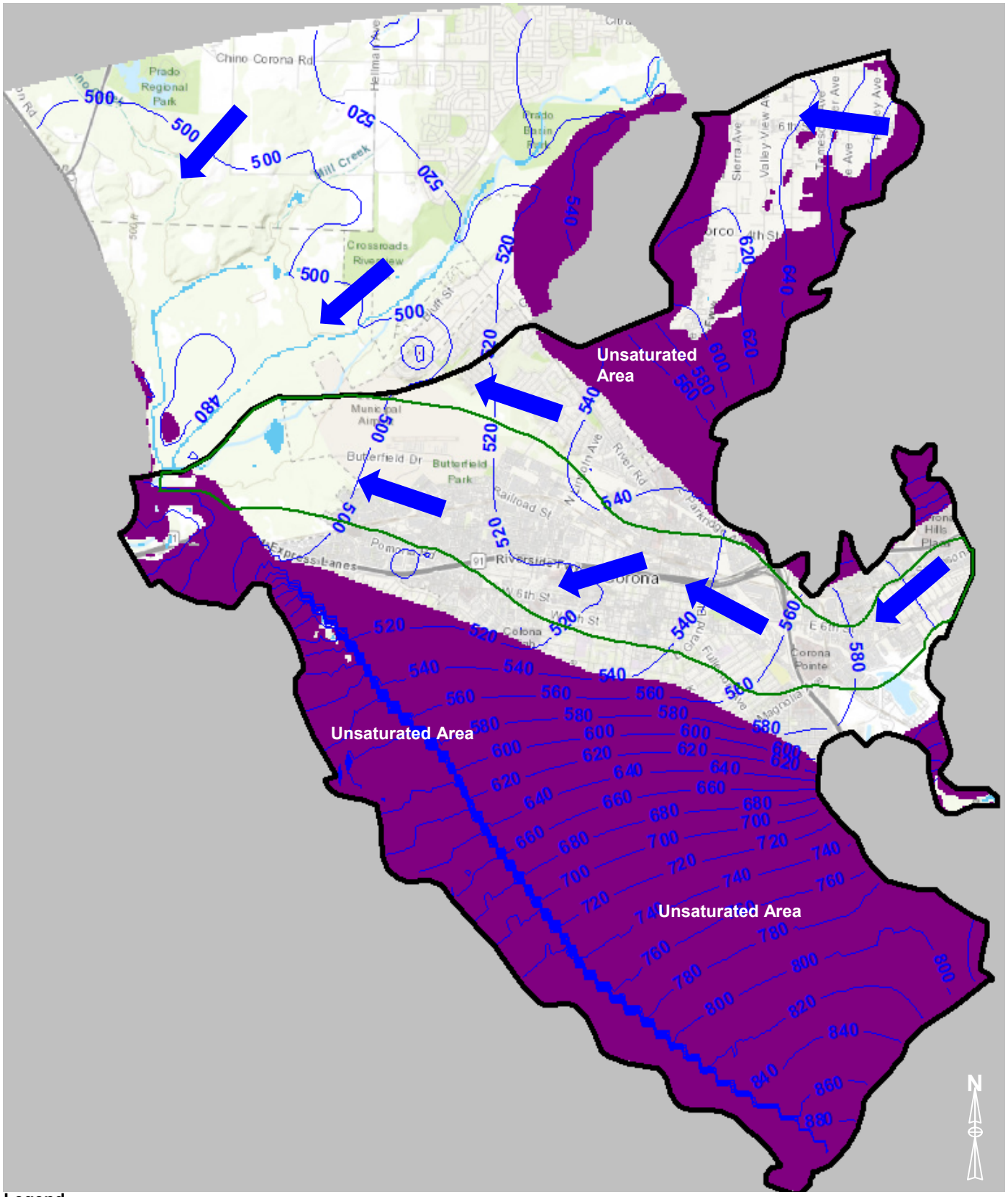
Legend

- Inferred Groundwater Flow Direction
- 900 Simulated Groundwater Elevation
- Temescal Subbasin
- Channel Aquifer Outline

10000 feet

December 2021	Figure 37 Groundwater Elevations near Highest Levels in Layer 3 January 1997

TODD GROUNDWATER



Legend

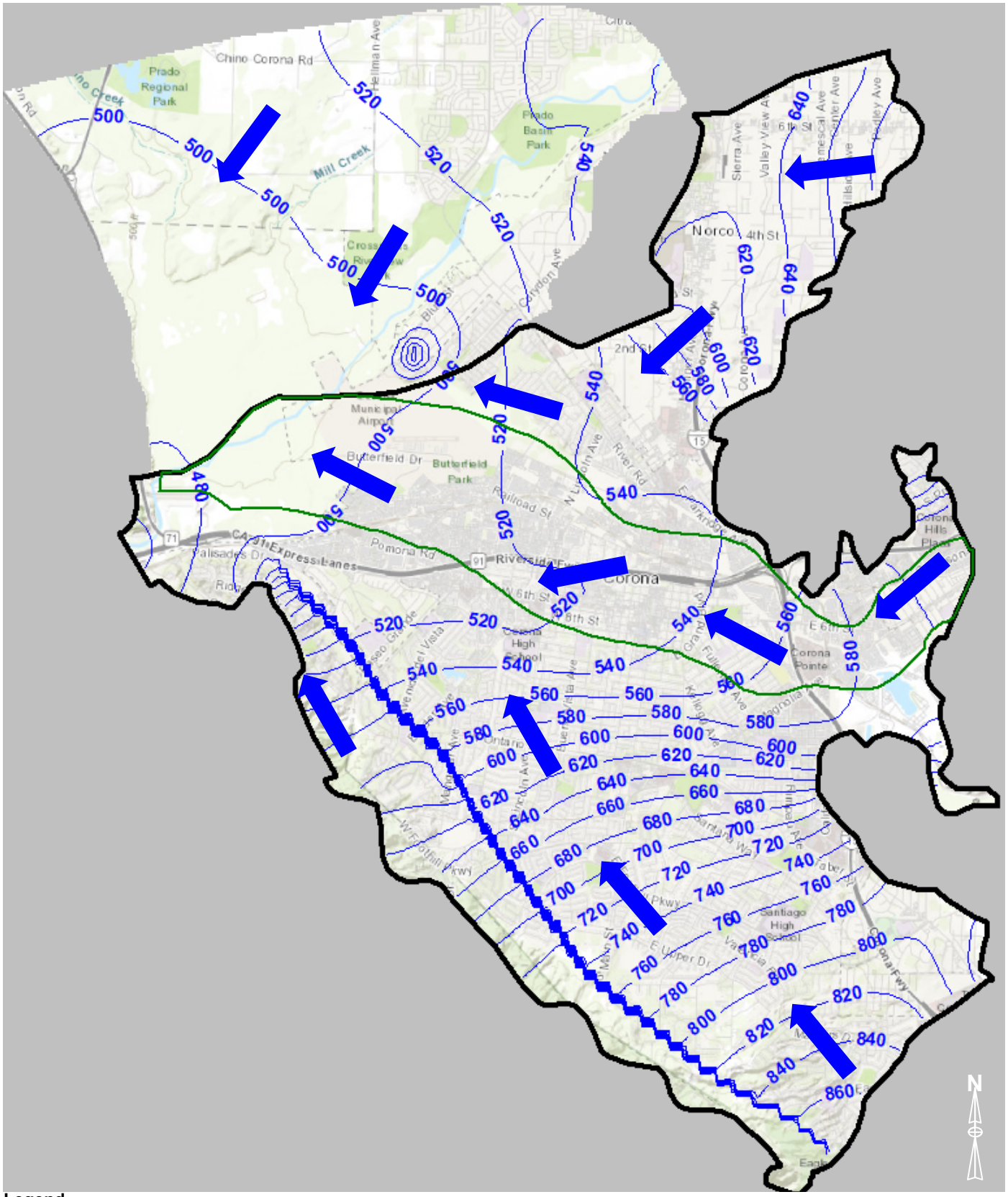
- Inferred Groundwater Flow Direction
- 900 Simulated Groundwater Elevation
- Temescal Subbasin
- Channel Aquifer Outline
- Unsaturated Areas

10000 feet

December 2021

TODD GROUNDWATER

Figure 38
Groundwater Elevations near Lowest Levels in Layer 1
August 2014



Legend

- Inferred Groundwater Flow Direction
- 900 Simulated Groundwater Elevation
- Temescal Subbasin
- Channel Aquifer Outline

December 2021	**Figure 39** **Groundwater Elevations near Lowest Levels in Layer 3** **August 2014**
TODD GROUNDWATER	

APPENDIX K

Detailed Annual Surface and Groundwater Budgets

Temescal Basin Surface Water Budget, Model Calibration Period (1990 to 2018)

Water Year	Temescal Basin (acre-feet per year)						
	Temescal Wash Inflow	Corona WRF-1 Discharge	Tributary and Local Runoff	Stream Percolation to Groundwater	Seepage from Groundwater to Streams	Surface Outflow to Prado Basin	Tributary Runoff below Prado Dam
1990	0	0	26,559	5,247	4,261	25,573	11
1991	10,677	0	13,683	6,480	5,157	23,036	184
1992	989	0	7,589	5,783	5,526	8,321	96
1993	87,158	0	105,205	19,906	6,517	178,974	888
1994	0	0	10,361	7,101	6,682	9,942	23
1995	21,113	0	23,733	11,635	7,247	40,459	515
1996	0	0	5,152	5,225	6,989	6,916	19
1997	0	0	3,779	3,854	7,301	7,226	47
1998	43,113	1,591	41,309	16,326	5,964	75,651	818
1999	0	7,483	7,666	8,330	5,694	12,512	19
2000	0	7,702	4,121	6,155	5,549	11,217	44
2001	2,584	7,091	10,013	9,052	5,718	16,356	120
2002	0	5,756	3,953	6,041	5,490	9,158	18
2003	8,860	5,479	16,787	10,509	5,470	26,087	290
2004	0	4,022	5,825	7,427	5,312	7,732	69
2005	114,670	5,104	101,133	21,715	5,743	204,935	796
2006	895	5,641	30,082	10,472	5,428	31,576	38
2007	0	4,791	15,140	6,947	4,589	17,573	4
2008	0	3,783	11,847	5,713	4,562	14,479	52
2009	0	2,775	10,066	5,237	4,276	11,880	6
2010	28,490	1,975	33,112	13,187	4,561	54,951	401
2011	45,771	3,632	47,065	14,942	5,327	86,853	248
2012	0	3,139	6,884	7,894	5,058	7,188	27
2013	3	2,298	5,003	6,152	4,722	5,874	33
2014	0	1,819	3,504	5,031	4,259	4,551	34
2015	0	1,719	4,129	5,457	4,118	4,510	56
2016	0	6,529	3,526	5,556	4,247	8,746	26
2017	20,353	2,386	25,587	12,611	4,296	40,012	382
2018	0	2,621	4,912	6,294	4,222	5,462	71

Temescal Basin Detailed Annual Water Budget, Model Calibration Period (1990 to 2018)

	Water Year and Type[1]																											
	1990 D	1991 AN	1992 AN	1993 W	1994 BN	1995 W	1996 D	1997 D	1998 W	1999 D	2000 D	2001 N	2002 D	2003 AN	2004 W	2005 W	2006 BN	2007 D	2008 D	2009 BN	2010 AN	2011 W	2012 BN	2013 D	2014 D	2015 BN	2016 D	2017 W	2018 D
Inflows (AFY)																												
Percolation from streams	837	7,936	2,734	18,240	1,332	12,096	947	1,103	15,357	5,316	5,447	6,924	4,696	11,344	5,792	21,433	6,269	5,389	5,036	3,302	15,822	16,100	4,338	3,508	2,969	3,385	7,683	15,585	3,581
Bedrock inflow	998	998	994	1,000	998	1,166	1,257	1,165	1,077	1,068	924	874	951	884	766	992	1,137	1,101	1,044	976	901	931	987	990	998	884	681	751	831
Dispersed recharge: non-irrigated land	834	5,076	3,293	16,079	2,128	8,996	1,654	1,843	13,739	647	1,176	3,131	740	6,099	2,275	13,727	1,372	204	1,371	427	6,711	6,909	2,000	1,901	2,224	3,673	2,246	7,012	1,607
Dispersed recharge: irrigated land	2,310	2,297	2,158	2,056	2,069	2,112	2,180	2,077	1,783	2,274	2,296	2,044	2,068	1,900	2,000	1,610	2,034	2,119	1,992	1,844	1,702	1,586	1,749	1,684	1,705	1,454	1,435	1,526	1,603
Pipe leaks	2,153	2,047	1,997	1,951	1,996	1,989	1,826	2,124	2,350	2,696	3,070	3,000	2,941	2,946	3,025	2,588	2,970	3,302	3,166	2,912	2,629	2,407	2,540	2,504	2,496	2,233	2,101	2,244	2,092
Reclaimed water percolation	5,385	6,063	6,714	7,440	8,094	8,772	9,413	10,919	10,806	6,575	7,763	8,452	8,667	8,629	10,032	10,245	9,449	8,462	7,570	6,679	6,679	5,342	5,928	6,851	6,818	7,666	3,839	6,029	5,529
Inflow from Chino Basin	143	123	120	122	115	115	119	123	114	113	122	123	124	122	123	119	121	129	132	131	129	130	132	132	122	119	120	121	126
Total Inflow	12,660	24,538	18,011	46,888	16,732	35,246	17,394	19,354	45,226	18,688	20,797	24,548	20,186	31,923	24,013	50,713	23,352	20,707	20,312	16,270	34,574	33,404	17,674	17,571	17,332	19,414	18,105	33,268	15,369
Outflows (AFY)																												
Wells - M&I and domestic	-9,713	-7,937	-10,103	-11,998	-10,533	-11,119	-8,757	-9,663	-12,538	-11,141	-9,562	-9,554	-15,831	-16,733	-18,289	-19,481	-19,940	-19,322	-19,917	-17,309	-17,283	-16,243	-17,074	-18,357	-16,163	-14,904	-12,029	-12,948	-14,541
Wells - agricultural	-7,588	-8,392	-7,130	-6,801	-6,686	-6,968	-8,199	-5,795	-2,780	-4,230	-2,617	-1,565	-2,979	-1,668	-1,277	-990	-987	-786	-1,284	-1,589	-1,408	-1,227	-1,634	-1,275	-1,527	-1,482	-1,010	-1,289	-1,148
Groundwater discharge to streams	-1,674	-2,707	-3,661	-5,728	-5,849	-6,530	-6,353	-6,793	-5,469	-2,959	-3,445	-4,491	-3,619	-3,357	-3,279	-4,626	-3,302	-2,381	-2,043	-1,530	-1,430	-1,604	-1,200	-948	-656	-523	-464	-889	-879
Riparian evapotranspiration	-3,213	-3,696	-3,912	-5,182	-4,670	-5,136	-4,947	-5,038	-5,450	-5,160	-4,942	-4,587	-4,808	-5,069	-4,966	-5,589	-4,658	-4,501	-3,860	-3,501	-4,087	-4,175	-3,903	-3,522	-3,399	-3,205	-3,498	-4,196	-3,541
Outflow to Chino Basin	-2,413	-2,461	-2,448	-2,544	-2,520	-2,851	-2,563	-2,956	-3,182	-3,631	-3,555	-3,429	-3,357	-2,971	-2,865	-2,764	-2,720	-2,579	-2,416	-2,187	-2,042	-2,140	-2,112	-2,043	-2,281	-2,224	-2,217	-2,444	-2,209
Total Outflow	-24,600	-25,194	-27,254	-32,253	-30,258	-32,604	-30,819	-30,245	-29,419	-27,121	-24,121	-23,626	-30,594	-29,797	-30,677	-33,451	-31,606	-29,570	-29,521	-26,115	-26,251	-25,389	-25,924	-26,144	-24,027	-22,338	-19,218	-21,765	-22,319
Storage Change (AFY)																												
Total Inflows minus Total Outflows	-11,940	-656	-9,243	14,636	-13,526	2,642	-13,425	-10,891	15,808	-8,433	-3,324	922	-10,408	2,126	-6,664	17,262	-8,254	-8,863	-9,209	-9,845	8,323	8,015	-8,250	-8,574	-6,695	-2,924	-1,113	11,503	-6,949

Notes:

[1]: Water year types are described in Section 5 - Water Budget, and shown on Figure 5-1. Water year types are summarized above as follows D = Dry, Below Normal = BN, N = Normal, AN = Above Normal, W = Wet.

Temescal Basin Detailed Annual Water Budget, Baseline Period

| | Water Year | | |

Temescal Basin Detailed Annual Water Budget, Growth And Climate Change 50-year Period

| | Water Year | | |

APPENDIX L

Temescal Groundwater Sustainability Plan
Data Management System Description

October 18, 2021

MEMORANDUM

To: Melissa Estrada-Maravilla, City of Corona

From: Maureen Reilly, PE and Chad Taylor, PG, CHG

Re: Temescal Basin Groundwater Sustainability Plan Data Management System

1. INTRODUCTION

The Groundwater Sustainable Agency (GSA)was formed by the City of Corona (Corona), City of Norco (Norco, and Home Gardens County Water District (HGCWD)) to fulfill the role and legal obligations of a GSA for the Temescal Subbasin (Basin) in accordance with the Sustainable Groundwater Management Act (SGMA). Foremost among the responsibilities is to develop, adopt, and implement a Groundwater Sustainability Plan (GSP) for the Basin.

As part of GSP development, the Temescal Basin GSA (TBGSA) retained Todd Groundwater to prepare the GSP and compile all relevant data for the Basin. This compilation is to focus on those data and information that may be required or useful for the preparation of the GSP and for the evaluation and identification of possible gaps in the available data. The purpose of this memorandum is to document the Data Management System (DMS) developed as part of the GSP.

The TBGSA has been collecting and compiling groundwater data annually including water levels, water quality, and water use. These data have been used in the GSP and will be used in future Annual Groundwater Reports. As part of the GSP, the DMS has been designed to be practicable, usable, intuitive, and cost effective. The data compiled for the GSP have been compiled in a set of databases and other related files. This includes an Access database, a GIS geodatabase, and Excel workbooks. The DMS has been prepared to include related tables in the databases other files that can be efficiently updated, reviewed for quality, and queried to produce new data reports and tables. A summary of the data within and the structure of the DMS is presented below.

2. DMS TYPES AND SOURCES

Data collected and compiled for the GSP have been stored in a variety of formats based on the type of data collected. Spatial information such as ArcGIS files, aerial imagery, and or other map sources, is stored in a Geodatabase. Tabular data are stored in subject-specific

relational databases. Additional datasets are stored in files best suited for analysis. To be specific, climate data are stored in an Excel workbook to allow for cumulative departure calculations, scanned well documents are stored as images to preserve the detail on the hardcopy forms, and online datasets updated by other agencies are included by reference. Discussed below are the data formats and the type of data available within that format.

3. GEODATABASE

Spatial data are stored in geodatabase that allows spatial files to be easily accessed and transferred with all appropriate spatial information. Within the Temescal Geodatabase, consistent and feature dataset structures have been constructed to group associated data sets and maintain coordinate system assignments.

3.1 Jurisdiction Boundaries

The boundaries for the Basin and neighboring basins are available as spatial coverages in the geodatabase. State, local, and federal boundaries within and surrounding the Basin were compiled from state and federal sources. These boundaries include all water districts and other local agencies near the Basin as well as federally owned land. These boundaries are included in the project geodatabase.

3.2 Surface Water Body Location and Watershed Mapping

Mapping data for surface water features have been provided from publicly available sources. These mapped data include locations of aqueducts, reservoirs, rivers, streams, drainages, lakes, and ponds. These data are presented in the project geodatabase in feature classes. DWR defined watershed coverages are also stored in the geodatabase as a feature class.

3.3 Mapping of Natural Communities Commonly Associated with Groundwater

GSP Regulations require identification of Groundwater Dependent Ecosystems (GDEs), which are defined as ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. A statewide database and mapping tool, developed by DWR, provides geographic information on Natural Communities Commonly Associated with Groundwater (NCAAG). While these do not necessarily represent GDEs, the dataset is a starting point in identifying GDEs. The mapping data for watersheds surrounding the Basin are included in the project geodatabase

3.4 Ground Surface Elevation Data

Ground surface elevation data are available from the USGS in the form of National Elevation Dataset (NED) GIS grid files (rasters) and raster and vector topographic map datasets. Both datasets have been compiled for the area surrounding and including the Basin. The 10-meter resolution NED data have been combined into a single raster.

3.5 Aerial Photographs

Aerial photographs of the area surrounding the Basin have been downloaded from the USGS National Aerial Imagery Program (NAIP) for 2004, 2005, 2006, 2009, 2010, 2012, 2014, and 2016. These aerial photographs are all rectified GIS raster datasets and included in the project geodatabase. Additional aerial photographs from Google Earth were also reviewed, but these are stored online and accessible through Google Earth.

3.6 Soil Maps

Soil information for the Basin and surrounding areas have been downloaded from the Natural Resources Conservation Service (NRCS). Soil data are mapped and maintained by NRCS in a standardized format that is compatible with tools that NRCS makes freely available to the public. The soils data for the area surrounding the basin have been maintained in the standard NRCS formats to facilitate future use. These raw data are available for preparation of a various soil data presentations and analyses. The hydrologic soil group data from these datasets have been also mapped using the NRCS *Soil Data Development Toolbox.* These data are in the project geodatabase.

3.7 Land Use Maps

Land use map data have been collected from DWR, the California Department of Conservation Farmland Mapping and Monitoring Program (FMMP), and Riverside County. The available land use maps are indicated below:

- DWR: 2014 and 2106 statewide land use mapping specifically developed for SGMA and GSPs.
- FMMP: 1984, 1986, 1988, 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014, and 2016
- Riverside County: 1993 and 2000

3.8 Geologic Mapping of Surficial Geology and Faults

Surficial geology in the area of the Temescal Basin has been mapped by the United States Geological Survey (USGS) in the 2004 *Preliminary Digital Geologic Map of the Santa Ana 30' x 60' Quadrangle* and the 2006 *Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangles*. This mapped geology has been digitized into GIS formats available from the USGS, and these complete datasets are included in the project geodatabase.

3.9 Subsidence - NASA JPL InSAR Dataset

Vertical ground surface displacement rates are derived from Interferometric Synthetic Aperture Radar (InSAR) data collected by the European Space Agency (ESA) Sentinel-1A satellite and processed by the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL), under contract with DWR. Changes in vertical displacement can

be viewed through the DWR SGMA mapping tool. Data have been downloaded from the SGMA data viewer and stored in the project geodatabase.

3.10 Water Infrastructure

3.10.1 Imported Water

Available imported water delivery pipelines and tie-in locations available from Corona, Norco, and HGCWD are included in the project geodatabase and relate to imported water delivery data in the project database.

3.10.2 Recycled Water and Wastewater

Corona waste discharge and recycled water distribution and use locations are included in the GIS datasets in the project geodatabase. Corona discharges wastewater to ponds adjacent to their wastewater treatment facility and they provide recycled water within the Basin. Recycled water use and wastewater discharge data are included in the project database.

3.11 Climate Data

The CIMIS stations, NOAA stations, and other climate locations are available in the geodatabase as a point coverage.

3.12 Surface Water Gage Locations

The locations of USGS surface water gages are also stored in the Geodatabase. Three streamflow gage stations near the Temescal Basin that are maintained by the USGS were identified. These stations are located on Temescal Creek at about Main Street in Corona (USGS 11072100), Temescal Creek at Corona Lake (USGS 11071900), and San Jacinto River near Elsinore (USGS 11070500). Up to date surface water measurements are available from the USGS NWIS data repository.

3.13 Well Records

Well location and other records are included in the GIS datasets in the project geodatabases. This includes location and other information as available for known and locatable wells in the Basin.

4. ACCESS DATABASES

Tabular data are linked in relational databases by subject. The DMS include one access database with stand-alone tables that pull together data from all sources for groundwater elevation, groundwater quality, and groundwater pumping. In addition, a table containing all know wells in the Basin links to the subject specific tables. The well table includes locational information as State Plane coordinates.

The types of data stored in the Access database are described below.

4.1 Well Information Table

Well locations and available information were collected from multiple sources, including previous investigations, USGS National Water Information System (NWIS), DWR California Groundwater Elevation Monitoring (CASGEM) program, and others. This data collection effort included available well locations, well construction information, and aquifer parameter information. Data from all the available sources for the Basin and surrounding area were collected and reviewed and then the data were combined into a single unified dataset. The unified dataset retains detailed information from the source files. Well data from individual sources often use agency-specific identification numbers or names. This variation in identification number by source is problematic for organizing, relating, and querying data. A *UniqueID* field was added to the unified well dataset and assigned integer identification numbers for each well to serve as the primary field for joins, relating, and querying data. The unified well dataset includes wells with and without location data. In compiling these data, attempts were made to remove duplicate wells while compiling these data. The unified well information dataset is included in the project database. A separate table with additional information about active Corona wells is included as *Well Corona Information*.

4.2 Groundwater Elevation Table

As with well locations, groundwater elevation records were collected from multiple sources, including previous investigations, the TBGSA agencies, USGS NWIS, DWR CASGEM, and others. Data from these sources were collected, reviewed, and compiled into a single unified groundwater elevation dataset. The dataset includes all information from each source and uses the *UniqueID* field for linking, joining, or relating tables with information from wells. Groundwater elevation data were not calculated for wells without reference elevation data; records for these wells include only depth to water measurements. In addition, there are temporal gaps in some of the data records between the completion of previous investigations and the start of data collection for publicly available records.

Groundwater elevation data has been structured according to the requirements of the CASGEM program in accordance with DWR's grant funding agreement with the TBGSA.

The Groundwater Elevation Database includes relevant information about the wells and elevation data. The database is structured into tables with information on well location, well construction, and monitoring data.

4.3 Groundwater Quality Table

The groundwater quality tables combine water quality data from a variety of sources for a comprehensive repository of regional water quality data. The relational tables include locations for all wells with water quality data, a table of water quality data, a table with information on the water system that was sampled, and a table of constituents monitored with agency codes, reporting levels, and applicable water quality goals. Queries are included to extract data on the key constituents of concern. Data from the TBGSA agencies, regional

monitoring (Regional Water Quality Control Board and the Division of Drinking Water), and special studies are included. The wells are linked to the Well Information table by the *UniqueID* field, and the source recorded in the dataset attribute field. Groundwater Pumping Table

Groundwater production in the Basin was compiled from all available sources and includes annual groundwater pumping for all wells is tracked by the Santa Ana River Watermaster, along with production in the rest of the watershed. Western Municipal Water District (WMWD) currently coordinates groundwater use data collection. Complete records of historical groundwater use were requested from and provided by WMWD. The groundwater production data for all wells were reviewed and organized for inclusion in the project database. Monthly pumping totals from the City of Corona wells are included separately. All production records are related to well locations by the *UniqueID* field.

4.4 Imported Water

Imported water delivery data were collected from the TBGSA agencies and are included in the project database.

4.5 Recycled Water and Wastewater

Wastewater information and reclaimed water production from the TBGSA agencies was compiled and included in the database.

5. OTHER FORMATS

5.1 Climate Data (precipitation, evaporation, temperature) - Excel

Climate data are compiled and stored as an Excel file. The workbook also calculates the cumulative departure of precipitation and local water year type by quintiles. This record set includes all available local climate and weather data.

6. DATA MANAGEMENT STORAGE

The DMS will continue to be updated with more recent data for annual reports and the GSP 5-year update. It is expected that new datasets will be added as projects and management actions are undertaken. For example, shallow monitoring wells in the Prado wetlands area may be added to the project database.

The datasets that were created for the groundwater model of the Basin and the simulations of future conditions are documented separately, including model outputs, surface water budgets, and groundwater budgets. While these data are valuable to understanding the basin, they represent simulated conditions and are stored separately from the observed data documented here.

Appendix R – WMWD Resolution 3166

Attachment 4

RESOLUTION 3166

RESOLUTION OF THE BOARD OF DIRECTORS OF WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY DETERMINING WATER RATES AND CHARGES FOR WATER USER AGENCIES

WHEREAS, the Metropolitan Water District of Southern California (MWD) at the April 14, 2020, Board of Directors meeting adopted water rates to be effective January 1, 2022, as follows:

Tier 1 Supply Rate	$243 per acre foot
Tier 2 Supply Rate	$285 per acre foot
System Access Rate	$389 per acre foot
Water Stewardship Rate	$ 0 per acre foot
System Power Rate	$167 per acre foot
Treatment Surcharge	$344 per acre foot
Capacity Charge	$12,200 per cfs
Readiness-to-Serve Charge	$140 million

Note: the Readiness-to-Serve Charge is allocated based on each member agency's ten-year rolling average of firm water demands. Standby Charge revenues will continue to be credited against each MWD member agency's Readiness-to-Serve Charge.

Based on the rates above, the MWD Full Service Untreated Tier 1 and Tier 2 rates are $799 and $841 per acre foot, respectively, and the MWD Full Service Treated Tier 1 and Tier 2 rates are $1,143 and $1,185 per acre foot, respectively, and;

WHEREAS, the Western Municipal Water District (Western) Board of Directors at a special Board meeting on October 9, 2002, after receiving input and comments from a majority of Western's retail agency customers, adopted a method of passing through MWD charges to user agencies, and;

WHEREAS, the Western Board of Directors at a regular Board meeting on December 3, 2014, authorized a ten-year purchase order with MWD, resulting in an Initial Base Period Demand of 117,537 acre feet for Western, and consequently a Tier 1 Annual Maximum of 105,783 acre feet beginning with calendar year 2015;

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of Western that, effective July 1, 2021, a charge of $24.06 per acre foot is hereby added to the cost of water charged by MWD to all of the retail agencies to whom water is made available by Western. Such charge will be used by Western in the administration of the supply and delivery of water to retail agencies;

BE IT FURTHER RESOLVED that, effective July 1, 2021, a charge of $16.26 per acre foot is hereby added to the cost of treated water delivered from the Mills Gravity Line to all retail agencies to whom water is made available by Western. Such charge will be used by Western to recover the cost of day-to-day maintenance of the Mills Gravity Line.

BE IT FURTHER RESOLVED that all water delivered from MWD to retail agencies of Western shall be in accordance with the Administrative Code and the rules, regulations and policies of MWD and Western. The charges for such water deliveries shall be as follows:

(a.) For all MWD water that is not delivered through the Mills Gravity Line.

Rates for Full Service Water Deliveries, Per Acre Foot, effective January 1, 2022:

	Tier 1	Tier 2
Untreated Water Deliveries	$799.00	$841.00
Western Administrative Charge	24.06	24.06
Total for Untreated Water Deliveries	$823.06	$865.06

	Tier 1	Tier 2
Treated Water Deliveries	$1,143.00	$1,185.00
Western Administrative Charge	24.06	24.06
Total for Treated Water Deliveries	$1,167.06	$1,209.06

(b.) For all MWD water that is delivered through the Mills Gravity Line.

Rates for Full Service Water Deliveries, Per Acre Foot, effective January 1, 2022:

	Tier 1	Tier 2
Untreated Water Deliveries	$799.00	$841.00
Western Administrative Charge	24.06	24.06
Mills Gravity Line Maint. Charge	16.26	16.26
Total for Untreated Water Deliveries	$839.32	$881.32
Treated Water Deliveries	$1,143.00	$1,185.00
Western Administrative Charge	24.06	24.06
Mills Gravity Line Maint. Charge	16.26	16.26
Total for Treated Water Deliveries	$1,183.32	$1,225.32

BE IT FURTHER RESOLVED that the maximum quantity of MWD full service water to be delivered at Tier 1 rates (Tier 1 Annual Maximum) to each retail agency for Calendar Year 2022 is:

Retail Agency	CY 2022 AF
City of Corona	21,110.0
City of Norco	1,223.0
Metropolitan Water District	3.5
Elsinore Valley MWD	21,037.1
Temescal Valley Water District	3,458.5
City of Riverside	1,912.9
Rancho California Water District	27,312.1
Eagle Valley Mutual Water Company	948.2
Western Retail	28,777.7
Total Acre Feet	105,783.0

The allocation of the Tier 1 Annual Maximum above is set at 90% of each retail agency's total MWD deliveries during Fiscal Year 2006-2007, utilizing the same method used by MWD to set Western's Tier 1 Annual Maximum.

All quantities of MWD full service water delivered to a retail agency in excess of their Tier 1 Annual Maximum listed above will be charged at the Tier 2 rate. The exception to this is (a) MWD has not assessed Western any Tier 2 charges for the year, or (b) there are agencies listed above that do not use their full Tier 1 Annual Maximum during the calendar year (unused Tier 1). In this latter case, the unused Tier 1 will be allocated to each agency that exceeded their Tier 1 Annual Maximum during the calendar year based on the proportion of their excess to the total of all agencies' excess (unused Tier 1 allocation). After the allocation of unused Tier 1, if available, any full service water delivered to a retail agency in excess of their Tier 1 Annual Maximum plus their unused Tier 1 allocation will be charged at the Tier 2 rate. This is the method used in prior years.

BE IT FURTHER RESOLVED that each retail agency will pay the MWD Capacity Charge based on the capacity used on Western's maximum summer day demand placed on the MWD system between May 1 and September 30 for the three-calendar-year period ending December 31, 2020, which was September 12, 2018. The peak demands used for Calendar Year 2021's calculations are:

Elsinore Valley Municipal Water District	70.8 cfs
City of Corona	40.6 cfs
Rancho California Water District	42.9 cfs
City of Norco	0.0 cfs
Temescal Valley Water District	5.0 cfs
City of Riverside	0.0 cfs
Eagle Valley Mutual Water Company	0.0 cfs
Metropolitan Water District	0.0 cfs
Western Retail	35.4 cfs
Total	194.7 cfs

BE IT FURTHER RESOLVED that effective January 1, 2022, Western's Capacity Charge rate shall be the MWD rate of $12,200 per cfs. Each retail agency will be billed each calendar month an amount equal to the capacity used on the peak demand day multiplied by the Western Capacity Charge rate and divided by twelve as follows:

	Monthly Amount
Elsinore Valley Municipal Water District	$ 71,980.00
City of Corona	$ 41,276.67
Rancho California Water District	$ 43,615.00
City of Norco	$ 0.00
Temescal Valley Water District	$ 5,083.33
City of Riverside	$ 0.00
Eagle Valley Mutual Water Company	$ 0.00
Metropolitan Water District	$ 0.00
Western Retail	$ 35,990.00
Total	$197,945.00

BE IT FURTHER RESOLVED that effective July 1, 2021, each agency will be billed each calendar month an amount equal to their share of the MWD net Readiness-to-Serve Charge (RTS Charge). The monthly amounts for July through December 2021 and January through June 2022 are as follows:

	Monthly Amount July – Dec 2021	Monthly Amount Jan – June 2022
City of Corona	$ 51,933.83	$ 65,113.67
City of Norco	$ 0.00	$ 0.00
Metropolitan WD	$ 19.50	$ 22.50
Elsinore Valley MWD	$ 46,183.50	$ 58,392.83
Temescal Valley WD	$ 9,802.50	$ 12,468.50
City of Riverside	$ 0.00	$ 0.00
Rancho California WD	$ 59,332.50	$ 78,337.50
Eagle Valley MWC	$ 0.00	$ 41.00
Western Retail	$ 51,769.50	$ 60,016.67
Total	$ 219,041.33	$ 274,392.67

The RTS Charge assessed to Western by MWD is allocated to each retail agency and to Western's retail customers based on the same method MWD uses to assess it, the ten-year rolling average of firm deliveries (for calendar year 2022's allocation, the ten fiscal years are 2010-2011 through 2019-2020). The Standby Charge placed on the County tax rolls by MWD applicable to the parcels within the boundaries of each agency's service area (less an MWD administrative charge and estimated delinquencies) is used as an offset to each agency's share of the RTS Charge, resulting in an Adjusted RTS Charge / Credit.

For some agencies, netting their RTS Charge with their Standby Charge revenue results in a credit instead of a charge. The sum of credits from these agencies is then allocated to the remaining agencies that have a charge. The allocation of the credits is

based on the proportion of each agency's Adjusted RTS Charge to the total Adjusted RTS Charge. The result is a net RTS Charge.

BE IT FURTHER RESOLVED that effective July 1, 2021, each agency will be billed annually to fund a Mills Gravity Line Fixed Major Maintenance and Repair Reserve (Maintenance Reserve). The total amount to be funded will be allocated to each agency based on their proportion of service rights owned in the Mills Gravity Line as follows:

	Total Service Rights	Percent Ownership	10 Years Maintenance Reserve	Purchase Option	Maintenance Reserve Annual Funding
City of Corona	61.50	10.89%	$ 1,265,068		$ 126,507
Temescal Valley Water District	87.96	15.57%	$ 1,809,356		$ 180,936
City of Riverside	30.00	5.31%	$ 617,107		$ 61,711
Metropolitan Water District	17.50	3.10%	$359,979		$ 35,998
Elsinore Valley Municipal Water District	54.00	9.56%	$1,110,792	$37,027	
Western Retail	313.94	55.57%	$ 6,457,814	$(37,027)	$ 756,860
Total	564.90	100.00%	$ 11,620,116	$0	$ 1,162,012

The Maintenance Reserve was established to fund inspections of the Mills Gravity Line and to fund major maintenance and repair work necessary to keep the pipeline in good working condition. The Maintenance Reserve budget amount was established by HDR, a third-party engineering consultant, who completed a condition assessment of the Mills Gravity Line. Western plans to annually fund the Maintenance Reserve based on the next 10 years of HDR's budget, totaling $11,620,116.

BE IT FURTHER RESOLVED that invoices for rates and charges shall be issued by the 15th of the month following the month for which service was provided, and invoices which are not paid before the next billing cycle (30 days) shall be subject to interest charges. Interest will be calculated at a rate of one percent (1%) per month on all amounts that remain unpaid at each billing cycle. The minimum amount of an invoice will be twenty-five dollars ($25.00) per water connection, with the minimum amount charged even if there are no water deliveries.

BE IT FURTHER RESOLVED that this resolution will be effective upon adoption, with the effective dates of various rates and charges described herein, and shall supersede Resolution 3116 of the Board of Directors of Western.

ADOPTED this 16th day of June, 2021

_____
BRENDA DENNSTEDT
President

June 16, 2021

I HEREBY CERTIFY that the foregoing is a full, true and correct copy of Resolution 3166 adopted by the Board of Directors of Western Municipal Water District of Riverside County at its Regular Meeting held June 16, 2021.

_____
MIKE GARDNER
Secretary-Treasurer

Appendix S – Public Notifications and Newspaper Notices

Docusign Envelope ID: 175448DA-D976-42DD-BFDB-F5F45503BACF

March 17th, 2026

City of Eastvale
12353 Limonite Avenue, Suite 910
Eastvale, CA 91752

ATTN: Mark Orme | City Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Orme,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the City of Eastvale of the opportunity to consult with and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 175448DA-D976-42DD-BFDB-F5F45503BACF

March 17th, 2026

City of Jurupa Valley
8930 Limonite Avenue
Jurupa Valley, CA 92509

ATTN: Rod Butler | City Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Butler,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the City of Jurupa Valley of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 175448DA-D976-42DD-BFDB-F5F45503BACF

March 17th, 2026

City of Lake Elsinore
130 S Main Street
Lake Elsinore, CA 92530

ATTN: Jason Simpson | City Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Simpson,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the City of Lake Elsinore of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 175448DA-D976-42DD-BFDB-F5F45503BACF

March 12th, 2026

City of Norco
2870 Clark Avenue
Norco, CA 92860

ATTN: Sam Nelson | Public Works Director

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Nelson,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the City of Norco of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 175448DA-D976-42DD-BFDB-F5F45503BACF

March 12th, 2026

City of Riverside
3900 Main Street, 3rd Floor
Riverside, CA 92501

ATTN: Mike Futrell | City Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Futrell,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the City of Riverside of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 175448DA-D976-42DD-BFDB-F5F45503BACF

March 17th, 2026

County of Riverside
4080 Lemon Street
Riverside, CA 92501

ATTN: Ken Baez | Principal Planner

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Baez,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the County of Riverside of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Elsinore Valley Municipal Water District
31315 Chaney Street
Lake Elsinore, CA 92530

ATTN: Greg Thomas | General Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Thomas,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Elsinore Valley Municipal Water District of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008ERB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Home Gardens County Water District
3832 Grant Street
Corona, CA 92879

ATTN: David F. Vigil | General Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Vigil,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Home Gardens County Water District of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Home Gardens Sanitary District
13538 Magnolia Avenue
Corona, CA 92879

ATTN: Tracey LaBonte | General Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Ms. LaBonte,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Home Gardens Sanitary District of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A81008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Jurupa Community Services District
11201 Harrel St,
Jurupa Valley, CA 91752

ATTN: Chris Berch | General Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Berch,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Jurupa Community Services District of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008EBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Metropolitan Water District
P.O. Box 54153
Los Angeles, CA 90054-0153

ATTN: Shivaji Deshmukh | General Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Deshmukh,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Metropolitan Water District of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Orange County Sanitation District
18480 Bandilier Cir
Fountain Valley, CA 92708

ATTN: Rob Thompson | General Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Thompson,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Orange County Sanitation District of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A811008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Rancho California Water District
42135 Winchester Rd,
Temecula, CA 92590

ATTN: Jason Martin | General Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Martin,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Rancho California Water District of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A81008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Riverside Public Utilities
3901 Orange St,
Riverside, CA 92501

ATTN: David A. Garcia | General Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Garcia,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Riverside Public Utilities of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Temescal Valley Water District
22646 Temescal Canyon Road
Temescal Valley, CA 92883

ATTN: Jeff Pape | General Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Pape,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Temescal Valley Water District of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Western Municipal Water District
14205 Meridian Parkway
Riverside, CA 92518

ATTN: Joshua Aguilar | Deputy Director of Water Resources

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Aguilar,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Western Municipal Water District of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A811008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 11D86D1A-5CEB-4C01-B0C8-BB88C4CDC3BF

March 18th, 2026

Yorba Linda Water District
P.O. Box 309
Yorba Linda, CA 92885

ATTN: Mark Toy, P.E. | General Manager

RE: Notification of the Preparation of a 2025 Urban Water Management Plan for the City of Corona

Dear Mr. Toy,

Civiltec engineering, inc. (Civiltec) is in the process of preparing the 2025 Urban Water Management Plan (UWMP) for City of Corona (Corona), in compliance with the Urban Water Management Planning Act.

This notice is intended to inform the Yorba Linda Water District of the opportunity to consult with, and submit comments for consideration regarding the Corona 2025 UWMP during the review process (Water Code Section 10621(b)).

> (*Water Code Section 10621(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan*).

If you require any additional further information is needed or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

City of Eastvale
12353 Limonite Avenue, Suite 910
Eastvale, CA 91752

ATTN: Mark Orme | City Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Orme,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

City of Jurupa Valley
8930 Limonite Avenue
Jurupa Valley, CA 92509

ATTN: Rod Butler | City Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Butler,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

City of Lake Elsinore
130 S Main Street
Lake Elsinore, CA 92530

ATTN: Jason Simpson | City Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Simpson,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

City of Norco
2870 Clark Avenue
Norco, CA 92860

ATTN: Sam Nelson | Public Works Director

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Nelson,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

City of Riverside
3900 Main Street, 3rd Floor
Riverside, CA 92501

ATTN: Mike Futrell | City Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Futrell,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

County of Riverside
4080 Lemon Street
Riverside, CA 92501

ATTN: Ken Baez | Principal Planner

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Baez,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A31008EBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Elsinore Valley Municipal Water District
31315 Chaney Street
Lake Elsinore, CA 92530

ATTN: Greg Thomas | General Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Thomas,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Home Gardens County Water District
3832 Grant Street
Corona, CA 92879

ATTN: David F. Vigil | General Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Vigil,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Home Gardens Sanitary District
13538 Magnolia Avenue
Corona, CA 92879

ATTN: Tracey LaBonte | General Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Ms. LaBonte,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Jurupa Community Services District
11201 Harrel St,
Jurupa Valley, CA 91752

ATTN: Chris Berch | General Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Berch,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Metropolitan Water District
P.O. Box 54153
Los Angeles, CA 90054-0153

ATTN: Shivaji Deshmukh | General Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Deshmukh,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A31008EBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Orange County Sanitation District
18480 Bandilier Cir
Fountain Valley, CA 92708

ATTN: Rob Thompson | General Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Thompson,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Rancho California Water District
42135 Winchester Rd,
Temecula, CA 92590

ATTN: Jason Martin | General Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Martin,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Riverside Public Utilities
3901 Orange St,
Riverside, CA 92501

ATTN: David A. Garcia | General Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Garcia,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Temescal Valley Water District
22646 Temescal Canyon Road
Temescal Valley, CA 92883

ATTN: Jeff Pape | General Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Pape,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Western Municipal Water District
14205 Meridian Parkway
Riverside, CA 92518

ATTN: Joshua Aguilar | Deputy Director of Water Resources

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Aguilar,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

Docusign Envelope ID: 2E14AA94-C3E5-4D77-A257-143B623206B8

May 6, 2026

Yorba Linda Water District
P.O. Box 309
Yorba Linda, CA 92885

ATTN: Mark Toy, P.E. | General Manager

RE: Notification of the Public Hearing for the 2025 Urban Water Management Plan and Water Shortage Contingency Plan for the City of Corona

Dear Mr. Toy,

The City of Corona has directed the preparation of a 2025 Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code. The Act requires, pursuant to California Water Code §10642, that an urban water supplier hold a public hearing to consider and receive comments and input from the community and other public agencies before adopting the Plan.

A copy of the draft 2025 Urban Water Management Plan is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future.

The public hearing is scheduled for June 3rd at 6:00 PM and will take place at the City of Corona's Open Council Chambers, located at 400 S. Vicentia Avenue, Corona, CA 92882. For additional information regarding the public hearing, please contact the City of Corona Public Works Department at (951) 736-2400.

If you require any additional information or wish to provide comments, please contact Gretel Ochoa-Nhac at gochoa@civiltec.com.

Signed by:
Tom Moody
47A311008FBB436...

Tom Moody
Utilities Director

CITY OF CORONA
OFFICE OF THE CITY CLERK
NOTICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN that the City of Corona Board of Directors will conduct a public hearing in the City Council Chambers at 400 S. Vicentia Ave., on Wednesday, June 3, 2026, at 6:00 p.m. or thereafter upon the following:

Adoption of the City of Corona's 2025 Urban Water Management Plan and Water Shortage Continency Plan

A copy of the 2025 draft Urban Water Management Plan, which includes the Water Shortage Contingency Plan in Chapter 8 in accordance with the Urban Water Management Planning Act of the California Code, is available for public review in the office of the City of Corona during regular business hours and online at https://www.coronaca.gov/departments/utilities/about-dwp/planning-for-our-future . Any person interested in the above proceedings may appear at the time and place indicated to testify in support of, or in opposition to, the item. Written comments will be accepted and should be received no later than June 3rd, 2026 and be addressed to the individual noted below. If you desire additional information or have any questions, please contact the City of Corona Public Works Department at (951) 736-2400.

Tom Moody
Utilities Director
400 S. Vicentia Avenue
Corona, CA 92882
The Press-Enterprise
Published: 5/13/26

Appendix T – Resolution No. 2026-071

RESOLUTION NO. 2026-071

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF CORONA, CALIFORNIA, ADOPTING THE CITY OF CORONA 2025 URBAN WATER MANAGEMENT PLAN UPDATE

WHEREAS, the California Legislature enacted Assembly Bill 797 (Water Code Section 10610, et seq., known as the Urban Water Management Planning Act) during the 1983-1984 Regular Session, and as amended subsequently, which mandates that every supplier providing water for municipal purposes to more than 3,000 customers, prepare an Urban Water Management Plan ("UWMP"), the primary objective of which is to plan for the conservation and efficient use of water, ensuring sufficient water supplies and providing a mechanism for a response during drought conditions; and

WHEREAS, the UWMP shall be updated at least once every five years on or before July 1, in year ending in six and one; and

WHEREAS, after public review and hearing, the City Council shall adopt the 2025 UWMP, which shall be filed with the California Department of Water Resources and at the California State Library within thirty days of adoption; and

WHEREAS, the City previously adopted a 2020 UWMP on June 16, 2021, and has provided a sixty-day notice to appropriate agencies in accordance with Section 10642 of the California Water Code providing notice of the City's intent to review and update the 2025 Urban Water Management Plan Update; and

WHEREAS, on June 3, 2026, the City Council held a duly noticed public hearing at which all persons wishing to testify in connection with the 2025 UWMP were heard and the 2025 UWMP was comprehensively.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF CORONA, CALIFORNIA, AS FOLLOWS:

SECTION 1. The City Council hereby adopts the 2025 Urban Water Management Plan Update and orders it filed with the City Clerk, the California Department of Water Resources, and the California State Library within 30 days after this date.

SECTION 2. The City Council hereby authorizes and directs the implementation of the water conservation programs and recommendations as set forth in the 2025 Urban Water Management Plan Update, which includes water shortage contingency analysis and recommendations regarding necessary procedures, rules, and regulations to carry out effective and equitable water conservation and water reclamation programs.

SECTION 3. In a water shortage, the Utilities Director is hereby authorized to declare a Water Shortage Emergency and implement necessary elements of the 2025 Urban Water Management Plan Update.

SECTION 4. The City Council shall recommend additional regulations to carry out effective and equitable allocation of water resources.

PASSED, APPROVED AND ADOPTED this 3rd day of June 2026.

Mayor of the City of Corona, California

ATTEST:

Sylvia G. Edwards

City Clerk of the City of Corona, California

CERTIFICATION

I, Sylvia Edwards, City Clerk of the City of Corona, California, do hereby certify that the foregoing Resolution was regularly passed and adopted by the City Council of the City of Corona, California, at a regular meeting thereof held on the 3rd day of June 2026, by the following vote:

AYES: CASILLAS, DADDARIO, RICHINS, SPEAKE, STEINER

NOES: NONE

ABSTAINED: NONE

ABSENT: NONE

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the City of Corona, California, this 3rd day of June 2026.

Sylvia G. Edwards

City Clerk of the City of Corona, California

(SEAL)

EXHIBIT "A"

2025 URBAN WATER MANAGEMENT PLAN UPDATE

[ON FILE IN THE CITY CLERK'S OFFICE FOR REVIEW]


CITY OF CORONA
EST. 1886