Elsinore Valley Municipal Water District

ELSINORE VALLEY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

FINAL | December 2021

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Abbreviations

µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
AF	acre-feet
AFY	acre-feet per year
AKM	AKM Consulting Engineers
As	arsenic
ASR	aquifer storage and recovery
AVP	Auld Valley Pipeline
AWTF	advanced water treatment facility
Basin Plan	Water Quality Control Plan for the Santa Ana River Basin
BBPIP	Back Basin Pilot Injection Program
BBWTP	Back Basin Water Treatment Plant
bgs	below ground surface
BMP	best management practice
BTEX	benzene, toluene, ethylene, xylene
CAL FIRE	California Department of Forestry and Fire Protection
Carollo	Carollo Engineers, Inc.
CASGEM	California Statewide Groundwater Elevation Monitoring
CCR	California Code of Regulations
CDEC	California Data Exchange Center
CEQA	California Environmental Quality Act
cfs	cubic foot per second
CII	commercial, industrial, and institutional
CIMIS	California Irrigation Management Information System
CIP	capital improvement program
CLWTP	Canyon Lake Water Treatment Plant
CNDDB	California Natural Diversity Database
COCs	constituents of concern
CRA	Colorado River Aqueduct
CWA	Clean Water Act
DDW	division of drinking water
DMS	data management system
DTF	drought task force
DWR	California Department of Water Resources
DWSAP	drinking water source water assessment program

EDT	electronic data transfer
EIR	environmental impact report
Elsinore Area	Elsinore Hydrologic Area
EMWD	Eastern Municipal Water District
ET	evapotranspiration
EVGSA	Elsinore Valley Groundwater Sustainability Agency
EVMWD/District	Elsinore Valley Municipal Water District
Fe	iron
ft	feet
ft-msl	feet above mean sea level
GAMA	groundwater ambient monitoring and assessment
GDE	groundwater dependent ecosystem
GIS	geographic information system
GMZ	groundwater management zone
gpcd	gallons per capita per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
GPS	global positioning system
GSA	groundwater sustainability agency
GSP	groundwater sustainability plan
GSP Area	Elsinore Valley Subbasin GSP Area
GWMP	groundwater management plan
HAL	health advisory level
I-15	Interstate 15
IEBL	Inland Empire Brine Line
InSAR	interferometric synthetic aperture radar
IPR	indirect potable reuse
IRP	integrated resources plan
IRWM	integrated regional water management
IRWMP	integrated regional water management plan
Lee Lake Area	Lee Lake Hydrologic Area
LESJWA	Lake Elsinore and San Jacinto Watersheds Authority
LEUSD	Lake Elsinore Unified School District
LSCE	Luhdorff & Scalmanini Consulting Engineers

M&I	municipal and industrial
MA	management area
MCL	maximum contaminant level
mgd	million gallons per day
mg/L	milligrams per liter
MHIs	median household incomes
mL	milliliter
MMT	methylcyclopentadienyl manganese tricarbonyl
mm/yr	millimeters per year
MND	mitigated negative declaration
MO	measurable objective
MSHCP	Western Riverside County Multiple Species Habitat Conservation Plan
MT	minimum threshold
MTBE	methyl tert butyl ether
MWDCUP	Metropolitan Water District Conjunctive Use Program
MWDSC	Metropolitan Water District of Southern California
MWH	MWH Global Inc.
MWM	Maddaus Water Management
N	nitrogen
NA	not available
NAVD88	North American Vertical Datum of 1988
NCCAG	natural communities commonly associated with groundwater
ND	negative declaration
NDMI	normalized difference moisture index
NDVI	normalized difference vegetation index
NED	national elevation dataset
NL	notification level
NO_3	nitrate
NOAA	national oceanic and atmospheric administration
NOD	notice of determination
NOE	notice of exemption
NPDES	national pollutant discharge elimination system
NRCS	natural resources conservation service
NTU	nephelometric turbidity units
NWIS	national water information system

O&M	operations and maintenance
OWTS	on-site wastewater treatment systems
Outreach Plan	stakeholder outreach plan
oz	ounce
pCi/L	picocuries per liter
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POA	property owner's association
PPE	personal protective equipment
PVC	polyvinyl chloride
RCFCWCD	Riverside County Flood Control and Water Conservation District
RCRCD	Riverside County Resource Conservation District
RfD	reference dose
RP	reference point
SARCCUP	Santa Ana River Conservation and Conjunctive Use Program
SARHCP	Santa Ana River Habitat Conservation Plan
SARWQCB	Santa Ana Regional Water Quality Control Board
SAWPA	Santa Ana Watershed Project Authority
SBBA	San Bernardino Basin Area
SBVMWD	San Bernardino Valley Municipal Water District
SCADA	supervisory control and data acquisition
SCAG	Southern California Association of Governments
SDAC	severely disadvantaged community
SFR	streamflow routing package
SGMA	sustainable groundwater management act
SGPWA	San Gorgonio Pass Water Agency
SMCL	secondary maximum contaminant level
SNMP	salt and nutrient management plan
SSURGO	soil survey geographic database
Station ELS	Lake Elsinore Station
Subbasin	Elsinore Valley Subbasin of the Elsinore Groundwater Basin
SWP	state water project
SWRCB	state water resources control board

TAC	technical advisory committee
TDS	total dissolved solids
TMDL	total maximum daily load
TNC	The Nature Conservancy
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TVP	Temescal Valley Pipeline
TVWD	Temescal Valley Water District
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United State Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UWMP	urban water management plan
VOCs	volatile organic compounds
Warm Springs Area	Warm Springs Hydrologic Area
WDL	water data library
WDR	waste discharge requirements
WEI	Wildermuth Environmental, Inc.
WLA	wasteload allocation
WMWD	Western Municipal Water District
WRF	water reclamation facility
WSC	Water Systems Consulting, Inc.
WSO	water systems optimization
WTP	water treatment plant

EXECUTIVE SUMMARY

ES.1 Introduction

The Sustainable Groundwater Management Act (SGMA) was signed into law in September 2014. SGMA created a statutory framework for groundwater management in California, requiring government and water agencies of high and medium priority basins to bring groundwater basins to a sustainable level of pumping and recharge to mitigate overdraft.

Under SGMA, the identified subbasins must reach sustainability within 20 years of implementing a Groundwater Sustainability Plan (GSP) and must consider the following six 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.
- Significant and unreasonable degraded water quality.
- Significant and unreasonable land subsidence.
- Depletions of interconnected surface water that have unreasonable adverse impacts on beneficial uses of the surface water.

The Elsinore Valley Subbasin is a medium priority basin. The above sustainability indicators were considered in the development of the GSP with the exception of seawater intrusion indicator. The Elsinore Valley Subbasin is located approximately 30 miles from the ocean, and therefore seawater intrusion from the ocean or any other saline bodies of water is not feasible and was not considered in the development of this GSP.

The Elsinore Valley Subbasin is located within the service area of Elsinore Valley Municipal Water District (EVMWD or District). No other agencies overlap the boundaries of this subbasin therefore no inter-agency coordination was required for the development of this GSP. Two outside technical experts participated as the technical advisory committee for the GSP development. EVMWD conducted public outreach throughout the development of the GSP.

ES.2 Plan Area

The Elsinore Valley Subbasin (California Department of Water Resources [DWR] Basin 8-4.1) is located in the Santa Ana River Watershed and underlies a portion of the Elsinore Groundwater Basin (DWR Basin 8.4) in western Riverside County. The location of the Elsinore Valley Subbasin is presented on Figure ES.1.

ES.3 Basin Setting

The Elsinore Valley Subbasin consists of three general hydrologic areas. The characteristics of these three areas are described below:

- Elsinore Hydrologic Area (Elsinore Area) – The Elsinore Area is the main, southern portion of the Subbasin. The Elsinore Area is the largest area of the Subbasin and provides most of the groundwater production. The principal aquifer in the Elsinore Area is the alluvium and the Pauba Formation.
- Lee Lake Hydrologic Area (Lee Lake Area) - The Lee Lake Area is located at the northern downstream portion of the Subbasin and has limited hydraulic connection with the Elsinore Area. The alluvium along Temescal Wash is the principal aquifer in the Lee Lake Area (Harder 2014).
- Warm Springs Hydrologic Area (Warm Springs Area) – The Warm Springs Area is located in the northeastern Subbasin and is connected to both the Elsinore and Lee Lake Areas through the Temescal Wash. The principal aquifer in the Warm Springs Area is alluvium including surficial alluvial fan and fluvial deposits (Geoscience 2017).

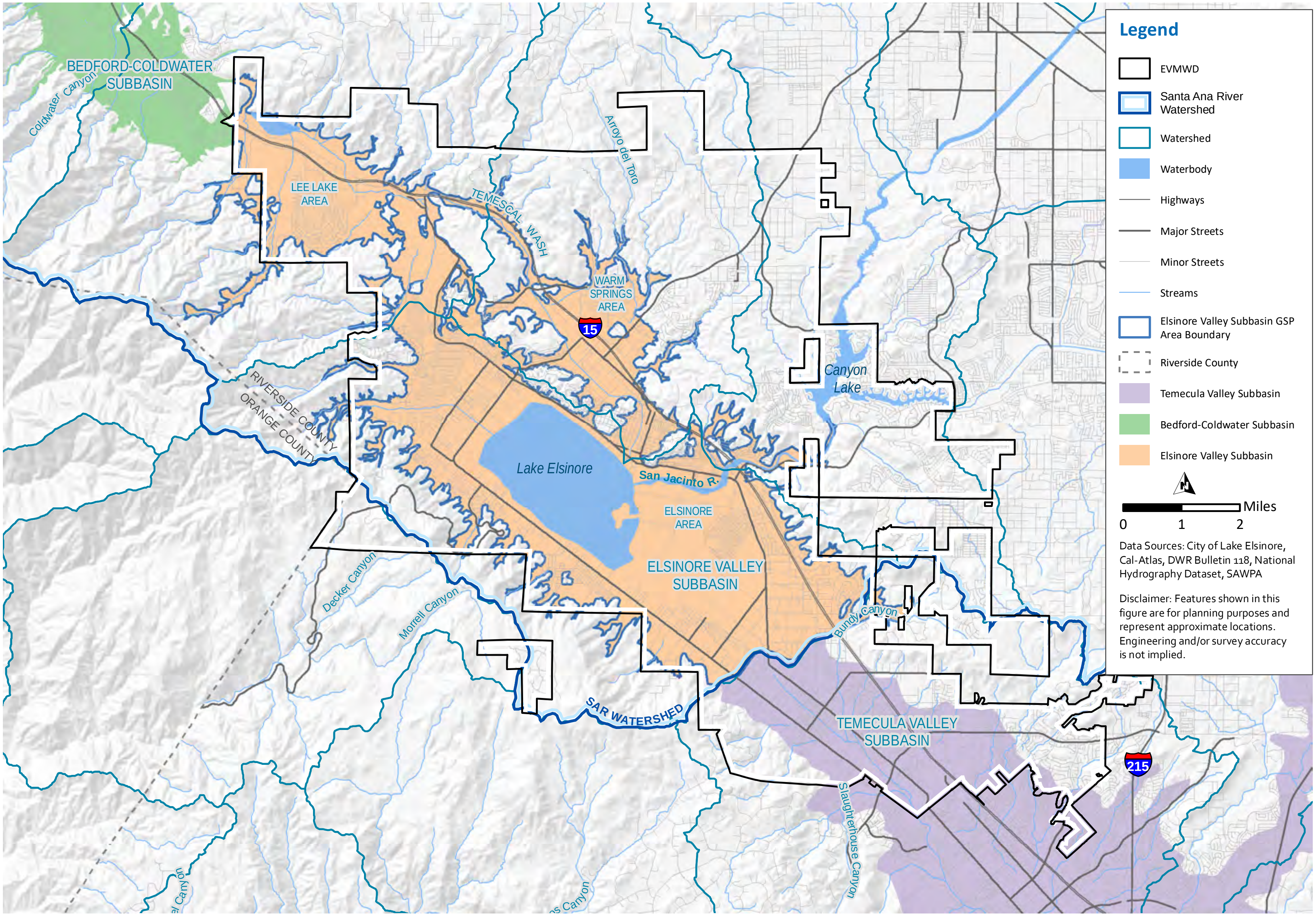
Most Subbasin recharge comes from infiltration of runoff from precipitation on the surrounding hills and mountains, as well as direct precipitation; urban, irrigation, and industrial return flows; wastewater return flows including septic systems; managed aquifer recharge; infiltration from smaller stream channels; and subsurface inflow in the Lee Lake and Warm Springs Areas (Wildermuth Environmental, Inc. [WEI] 2000, MWH Global Inc. [MWH] 2005, DWR 2003 and 2016, Harder 2014, and Geoscience 2017). Discharge from the Subbasin is almost entirely from groundwater pumping (WEI 2000, MWH 2005, DWR 2003 and 2016, Harder 2014, and Geoscience 2017).

ES.4 Sustainability Criteria

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 basin. SGMA identifies six sustainability indicators that require definition of associated undesirable results. As discussed previously, five sustainability indicators are applicable for the Elsinore Valley Subbasin.

The basin has been and is being managed sustainably relative to all criteria. Accordingly, sustainability does not need to be achieved, but it does need to be maintained through the planning and implementation horizon. The following minimum thresholds (MTs) are defined for each of the three management areas (MAs) of the Elsinore Valley Subbasin.

Chronic Lowering of Groundwater Levels: The MT for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well. In the central portion of the Elsinore MA the threshold value in each Key Well is defined by operational considerations to maintain static water levels above current pump intakes in municipal water supply wells to avoid the cost of lowering pump bowls, adding pump stages, and increasing pumping energy usage. In the peripheral portions of the Elsinore MAs and all of the Warm Springs and Lee Lake MAs, MTs are defined by historical low groundwater levels rounded up to the nearest 5 feet (ft). Undesirable results are indicated when four consecutive exceedances occur in each of three consecutive years, in three-quarters or more of the Key Wells in each MA.



Data Sources: City of Lake Elsinore, 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.

Figure ES.1 Elsinore Valley Groundwater Subbasin GSP Area

Reduction of Groundwater Storage: The MT for reduction of storage for all MAs is fulfilled by the MT for groundwater levels as proxy. The Measurable Objective (MO) for storage is fulfilled by the MT for groundwater levels, which maintains groundwater levels within the historical operating range.

Degraded Water Quality: The MT for degradation of water quality address nitrate and TDS for each MA as defined in the Basin Plan Amendment associated with the Elsinore Basin Salt and Nutrient Management Plan (SNMP) and Upper Temescal Valley SNMP submitted to the Santa Ana Regional Water Quality Control Board (SARWQCB). The groundwater sustainability agency (GSA) will use the triennial calculations performed by the SAWPA Basin Monitoring Task Force rather than performing their own calculations.

- **Nitrate**: The MT for Nitrate is established at 5 milligrams per liter (mg/L) as N in the Elsinore MA, consistent with the Maximum Benefit Objectives, while the MT for nitrate in the Warm Springs and Lee Lake MAs is established at 7.9 mg/L as N, consistent with the Upper Temescal Valley SNMP water quality objectives.
- **Total Dissolved Solids (TDS)**: The MT for TDS is established at 530 mg/L in the Elsinore MA, consistent with the Elsinore Basin Plan water quality objectives, while the MT for TDS in the Warm Springs and Lee Lake MAs is established at 820 mg/L, consistent with the Upper Temescal Valley Salt and Nutrient Management Plan water quality objectives.

Undesirable results occur when the estimates of nitrate and/or TDS concentrations calculated by the Santa Ana Watershed Project Authority (SAWPA) Basin Monitoring Task Force on a triennial basis do not meet exceed the MT. The MO is to maintain calculated basin-wide TDS and nitrate concentrations below the MTs.

Land Subsidence: The MT for this indicator is a change in ground surface elevation of more than 1 ft in 50 years, with a minimum change of 6 inches to trigger action, using maximum displacement in the service area as estimated by Interferometric Synthetic Aperture Radar (InSAR) satellite measurements and compared to the earliest InSAR data (May 2015).

Depletion of Interconnected Surface Water: The MT for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian trees is greater than 35 ft for a period exceeding one year.

ES.5 Monitoring Network Implementation

The GSA will implement a monitoring network to meet the MOs of this GSP, including temporal and representative monitoring of the three MAs: Lee Lake, Warm Springs, and Elsinore. The network consists of 27 key wells. Key wells include two new monitoring wells drilled in the Lee Lake and Warm Springs MAs as part of this GSP effort.

The monitoring activities include monitoring of groundwater level, groundwater storage monitoring, water quality, subsidence, and interconnected surface water.

To obtain additional information, the following future studies are recommended:

- Synoptic Study on Groundwater Dependent Ecosystems (GDEs) in Temescal Wash.
- Arsenic Leaching Study.

ES.6 Projects and Management Actions to Achieve Sustainability Goal

SGMA requires identification of projects and management actions to achieve basin sustainability goals and mitigate changing conditions in the Subbasin. Projects and management actions are categorized into three groups:

- Group 1 projects are considered existing or established commitments by the District.
- Group 2 projects have been developed and thoroughly evaluated by the District and typically have concrete implementation dates. These projects will be implemented to meet Subbasin sustainability goals, in conjunction with Group 1 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.

Table ES.1 summarizes the Group 1 and 2 projects and management actions.

Table ES.1 Projects and Management Actions

Description	Agency	Category	Status	Anticipated Timeframe
Group 1 – Baseline Project and Management Actions				
Groundwater Well Replacements	EVMWD	Project	Ongoing	Ongoing
Manage Pumping in Elsinore MA with In-Lieu Recharge due to Conjunctive Use Agreements	EVMWD, MWDSC, WMWD	Management Action	Ongoing	Implemented
Group 2 – Projects and Management Actions Evaluated Against the Sustainable Management Criteria				
Begin Groundwater Pumping in Lee Lake MA for Municipal Use	EVMWD	Project	In design	2019 to 2023: Design and Construction 2024 onwards: Implementation and Operation
Rotate Pumping Locations and Flows	EVMWD	Management Action	Not started	Can be implemented as needed dependent on groundwater levels
Recycled Water IPR	EVMWD	Project	Planning Phase	Dependent on wastewater flow increases
Septic Tank Conversions	EVMWD	Project	Not started	Dependent on funding sources
Shallow Monitoring Well Installation	EVMWD	Project	Not started	Dependent on feasibility study results

Abbreviations:
MWDSC - Metropolitan Water District of Southern California; WMWD - Western Municipal Water District.

The GSP has identified the sustainable yield of the Elsinore MA at 6,301 acre-feet per year (AFY) and the Lee Lake MA at 1,100 AFY, recognizing that sustainable yield will change over time. In order to account for private well use and to allow groundwater levels to return to historical levels, it is recommended that EVMWD pump 5,700 AFY from the Elsinore MA on an annual average basis, pumping more or less in a particular year dependent on conjunctive use agreements. Based on the hydrogeology of the Lee Lake MA, it is recommended that EVMWD pump 1,000 AFY from Lee Lake MA on an annual basis.

ES.7 Plan Implementation

The GSP will be adopted by the EVMWD in December 2021. Implementation of the GSP will commence after the GSP is adopted. The plan will be submitted to DWR by January 31, 2022. Within 20 days of submittal, DWR will post the plan for public viewing and will initiate a 75-day public comment period. The GSP will be approved by DWR within 2 years of the closing of the public comment period. EVMWD will initiate work on the identified management actions and projects during the DWR review period.

Annual reports on GSP implementation are required by DWR, with the first one due in April 2022. Periodic reports, with the first one due in 2026, are required at least every 5 years or upon amendment of the GSP. Sustainable yield and pumping recommendations will be reevaluated during the periodic reports.

Chapter 1

INTRODUCTION

1.1 Purpose of the Groundwater Sustainability Plan

The SGMA was signed into law in September 2014 by then Governor Jerry Brown. The SGMA created a statutory framework for groundwater management in California, requiring government and water agencies of high- and medium -priority basins to bring groundwater basins to a sustainable level of pumping and recharge to mitigate overdraft.

Under the SGMA, the identified subbasins must reach sustainability within 20 years of implementing a GSP. The GSP must consider the following six sustainability indicators:

1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply.
2. Significant and unreasonable reduction of groundwater storage.
3. Significant and unreasonable seawater intrusion.
4. Significant and unreasonable degraded water quality.
5. Significant and unreasonable land subsidence.
6. Depletions of interconnected surface water that have unreasonable adverse impacts on beneficial uses of the surface water.

The Elsinore Valley Subbasin is a medium priority basin located approximately 30 miles from the ocean. Seawater intrusion from the ocean or any other saline bodies of water is not feasible and was not considered in the development of this GSP.

1.2 GSP Development

The Elsinore Valley Subbasin is located within the service area of EVMWD. No other agencies overlap the boundaries of this subbasin therefore no inter-agency coordination was required for the development of this GSP.

For the development of the GSP, EVMWD formed a technical advisory committee with two outside technical experts.

1.2.1 Public Outreach

The Elsinore Valley Groundwater Sustainability Agency (EVGSA) has developed a Stakeholder Outreach Plan (Outreach Plan) per SGMA requirements, and the Outreach Plan is included in Appendix C. The Outreach Plan outlines the communication methods and strategies the EVGSA will employ to most effectively engage and involve stakeholders throughout GSP development and SGMA implementation.

The Outreach Plan addresses:

- Identification and inclusion of stakeholders.
- Methods for ongoing communication to stakeholders and interested parties.
- Methods for encouraging stakeholder input throughout the GSP development process.

- Approaches for receiving information about stakeholders' values, interests, and priorities.
- Methods for incorporating comments and feedback received during GSP development.
- Approach for abiding SGMA regulations for broad public participation and transparency.

Throughout the GSP development process, EVMWD held a series of four public meetings. Two during the preliminary GSP development and two during the public commenting period. Appendix D includes meeting slides and summaries. The District also maintains a webpage dedicated to posting updates, question and answers, and draft chapters (https://www.evmwd.com/who-we-are/water-resources). Comments received throughout the meetings and public commenting are available in Appendix E. In addition, EVMWD reached out to private pumping entities and other interests within the Subbasin for feedback and comment.

As a part of the GSP development, the District drilled two new monitoring wells, one in the Lee Lake MA and one in the Warm Springs MA. Coordination with local tribal entities was held in the event that cultural artifacts were found during the drilling process.

1.2.2 Existing Groundwater Users

In addition to EVMWD groundwater pumping, the following represent private groundwater uses throughout the Subbasin:

- Private wells serving individual homeowners (approximately 50 in total).
- Lake Elsinore Unified School District (LEUSD) irrigation wells.
- Elsinore Valley Cemetery (one well).
- Glen Eden Sun Club.

1.3 Agency Information

The mailing address for EVMWD is as follows:

P.O. Box 3000
31315 Chaney Street
Lake Elsinore, CA 92531

The primary contact for the GSP is as follows:

Jesus Gastelum, Senior Water Resources Planner/Engineer
Phone: (951) 674-3146

Other key EVMWD individuals involved in the development of this GSP included:

- Parag Kalaria, P.E., Manager of Water Resources.
- Shane Sibbett, P.E., Civil Engineer.
- Andrea Kraft, Assistant Engineer.
- Serena Johns, Senior Management Analyst.
- Jorge Chavez, Management Analyst.
- Ganesh Krishnamurthy, P.E., Assistant General Manager.
- Margie Armstrong, Director of Strategic Programs.
- Jason Dafforn, P.E., Director of Engineering and Water Resources.
- Jase Warner, Director of Operations.

A consultant team led by Carollo Engineers, Inc. (Carollo) and Todd Groundwater led the development of this GSP. Key individuals on the consultant team involved in this project included:

- Inge Wiersema, P.E., Carollo, Project Manager.
- Matt Huang, P.E., Carollo, Project Engineer.
- Chad Taylor, R.G., C.Hg., Todd Groundwater, Project Hydrogeologist.
- Mike Maley, P.E., R.G., C.Hg., C.E.G., Todd Groundwater, Groundwater Modeler.
- Gus Yates, R.G., C.Hg., Todd Groundwater, Water Budget.
- Karen Miller, R.G., C.Hg., M2 Resource Consulting, Grant Administration and Monitoring Network.
- Jack Hughes, Kearns & West Public Outreach.
- Tom Barnes, ESA, Environmental Compliance.
- Phyllis Stanin, R.G., C.Hg., C.E.G., Todd Groundwater, Technical Advisory Committee.
- David Ringel, P.E., Ringel Engineering, Technical Advisory Committee.
- Elisa Garvey, P.E., Carollo, Implementation Plan.
- Madison Rasmus, P.E., Carollo, Projects and Management Actions.

1.3.1 Organization and Management Structure of the GSA

The EVGSA is a single-agency GSA consisting only of EVMWD. All decisions are made through the EVMWD board of directors, consisting of five members elected to four-year, staggered terms.

1.3.2 Legal Authority of the GSA

EVGSA is a single agency GSA consisting of only EVMWD. EVGSA formed on January 12, 2017, in accordance with Section 10723(b) of the California Water Code and Section 6066 of the California Government Code. Surrounding agencies, Riverside County and Riverside County Flood Control District, gave support for EVMWD to be the sole managing agency of groundwater in the Elsinore Valley Subbasin.

Appendix F contains GSA formation documentation, including the Notice of Election to Become a GSA and the signed resolution officially forming the EVGSA, as well as the Resolution of GSP Approval.

The Resolution was officially approved by EVGSA on December XX, 2022.

1.4 Plan Organization

The GSP presented herein is organized into the following chapters:

- **Executive Summary** provides a summary of what will be included in the GSP.
- **Chapter 1 – Introduction** describes the GSP purpose, agency information, and GSP organization.
- **Chapter 2 – Plan Area** provides a description of the basin area and setting as well as existing monitoring and water resources programs.
- **Chapter 3 – Hydrogeologic Conceptual Model** describes the boundaries, geologic formations, principal aquifer units, and recharge and discharge areas included in the model.
- **Chapter 4 – Current and Historical Groundwater Conditions** describes the current, historical, and projected groundwater elevations, storage, land subsidence, and water quality in the Subbasin.

- **Chapter 5 – Water Budget** is a qualitative tabulation of al inflows, outflows, and storage change in the Subbasin and connected surface water system.
- **Chapter 6 – Sustainable Management Criteria** describes quantitative sustainability criteria to define, measure, and track sustainable groundwater resource management.
- **Chapter 7 – Monitoring Network** describes the existing groundwater monitoring within the Subbasin, and the representative monitoring required by the SGMA.
- **Chapter 8 – Projects and Management Actions** includes projects and management actions needed to achieve sustainability goals and mitigate changing conditions in the Subbasin.
- **Chapter 9 – Environmental Compliance and Permitting** discusses relevant environmental compliance and required permits needed to implement the proposed project and management actions in the Subbasin.
- **Chapter 10 – Implementation Plan** overviews the costs and schedule for implementation of the GSP.

Chapter 2

PLAN AREA

This chapter provides a description of the plan area and setting, consistent with the GSP Regulations §354.8.

2.1 Description of the Plan Area

The description of the plan provides a general description of the Elsinore Valley Subbasin GSP Area (GSP Area) 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. The Groundwater Management Plan (GWMP) (2005 GWMP) for the Elsinore Area, a portion of the Elsinore Valley Subbasin, was developed by EVMWD in 2005 (MWH 2005) and was implemented in 2008 (MWH 2011). The 2005 GWMP was used as background information for this chapter. Various studies and plans, developed more recently than the 2005 GWMP, were used to develop the description of the plan area.

2.2 Geographic Area

The Elsinore Valley Subbasin is located in the Santa Ana River Watershed and underlies the Elsinore Valley in western Riverside County. The location of the Elsinore Valley Subbasin is presented on Figure 2.1.

The boundary of the GSP Area, which is coincident with the Elsinore Valley Subbasin boundary is shown on Figure 2.2. The GSP Area is covers approximately 23,600 acres. The boundaries of the Bedford-Coldwater Subbasin, located to the northwest, and the Temecula Valley Subbasin, located to the southeast, are also presented on Figure 2.2. GSPs are under development of the Bedford-Coldwater Subbasin and the Temecula Valley Subbasin.

The hydrogeologic conditions of the Elsinore Valley Subbasin are described in detail in Chapter 3. The Elsinore Valley Subbasin is bounded by the Willard fault, a splay of the active Elsinore fault zone, and Santa Ana and Elsinore Mountains on the southwest; the Temecula Valley Groundwater Basin at a low surface drainage divide on the southeast; the Temescal Subbasin of the Upper Santa Ana River Valley Groundwater Basin at a constriction in Temescal Wash on the northwest; and non-water bearing rocks of the Peninsular Ranges along the Glen Ivy fault on the northeast (MWH 2011). In general, inflows to the subbasin are predominantly from the canyons to the northwest and the San Jacinto River on the northeast.

The general groundwater flow direction is from the northwest to the southeast, largely a result of groundwater extraction in the southeast region (Elsinore Area) of the Elsinore Valley Subbasin.

2.3 Land Use 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 with the GSP Area. Detailed discussion of land use planning and policies relevant to groundwater management is included in Section 2.7.

The jurisdictional boundaries for agencies that have land use management responsibilities in the GSP Area are shown on Figure 2.3. In general, these agencies can be categorized as follows:

- Counties.
- Cities.
- Federal Lands.
- Tribal Lands
- State Lands.
- Others.

2.3.1 Counties

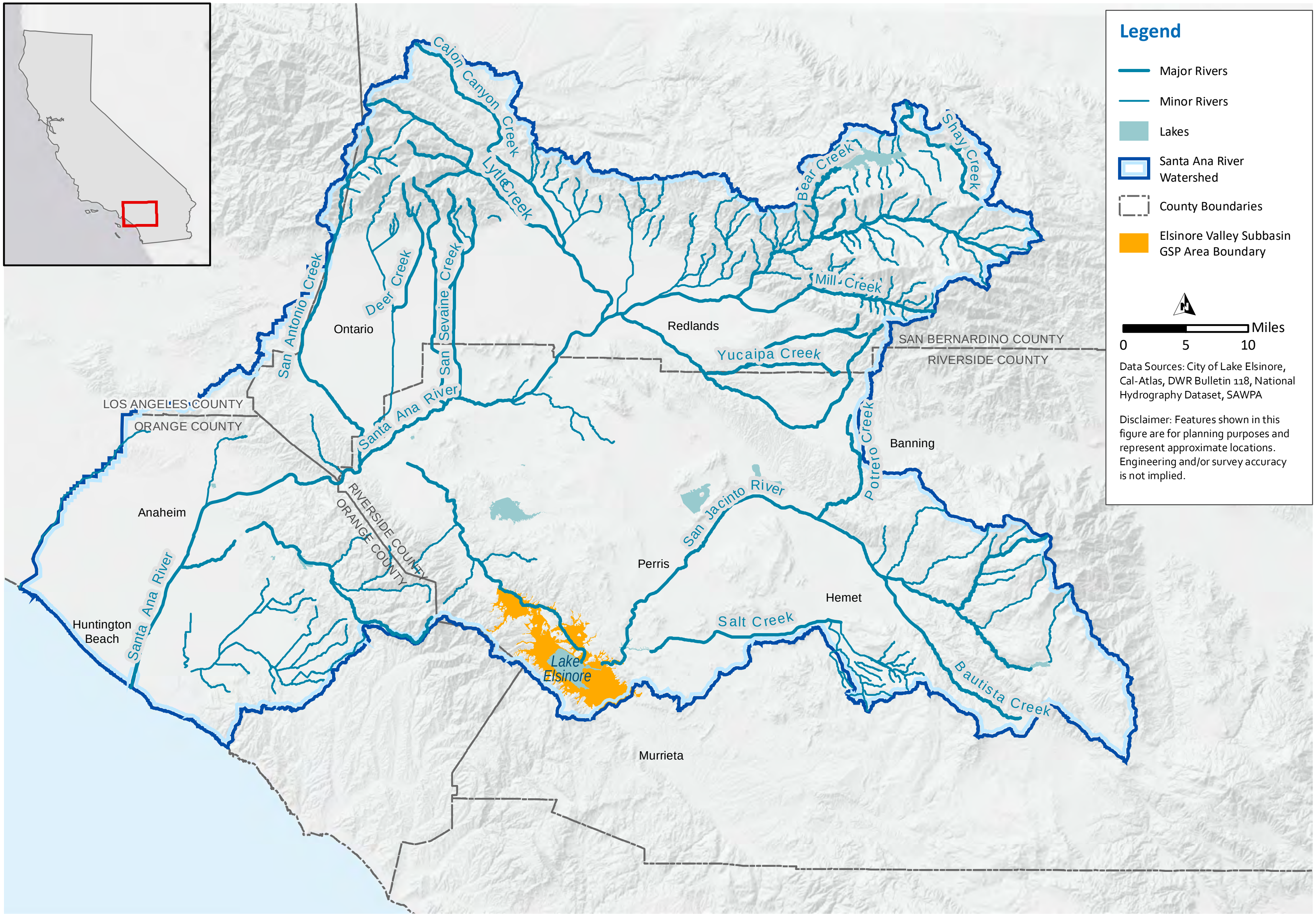
The GSP Area lies within the western portion of Riverside County. Riverside County has jurisdiction for land use planning for unincorporated areas in the County. The southwest portion of the GSP Area is within unincorporated area in Riverside County. Riverside County also has responsibility for small water systems (between 15 and 199 service connections) and for on-site wastewater treatment systems (OWTSs) through its Department of Environmental Health. Riverside County Department of Environmental Health is also responsible for regulation of the construction, destruction, and maintenance of groundwater wells.

2.3.2 Cities

The City of Lake Elsinore, City of Canyon Lake, and the City of Wildomar have land use planning authority within their respective boundaries. The City of Canyon Lake overlaps only a very small portion of the GSP Area along the San Jacinto River. General plan elements relevant to the GSP are discussed Section 2.7. In addition to land use planning, the cities of Lake Elsinore and Wildomar are responsible for stormwater management for their respective jurisdictions.

2.3.3 Federal Lands

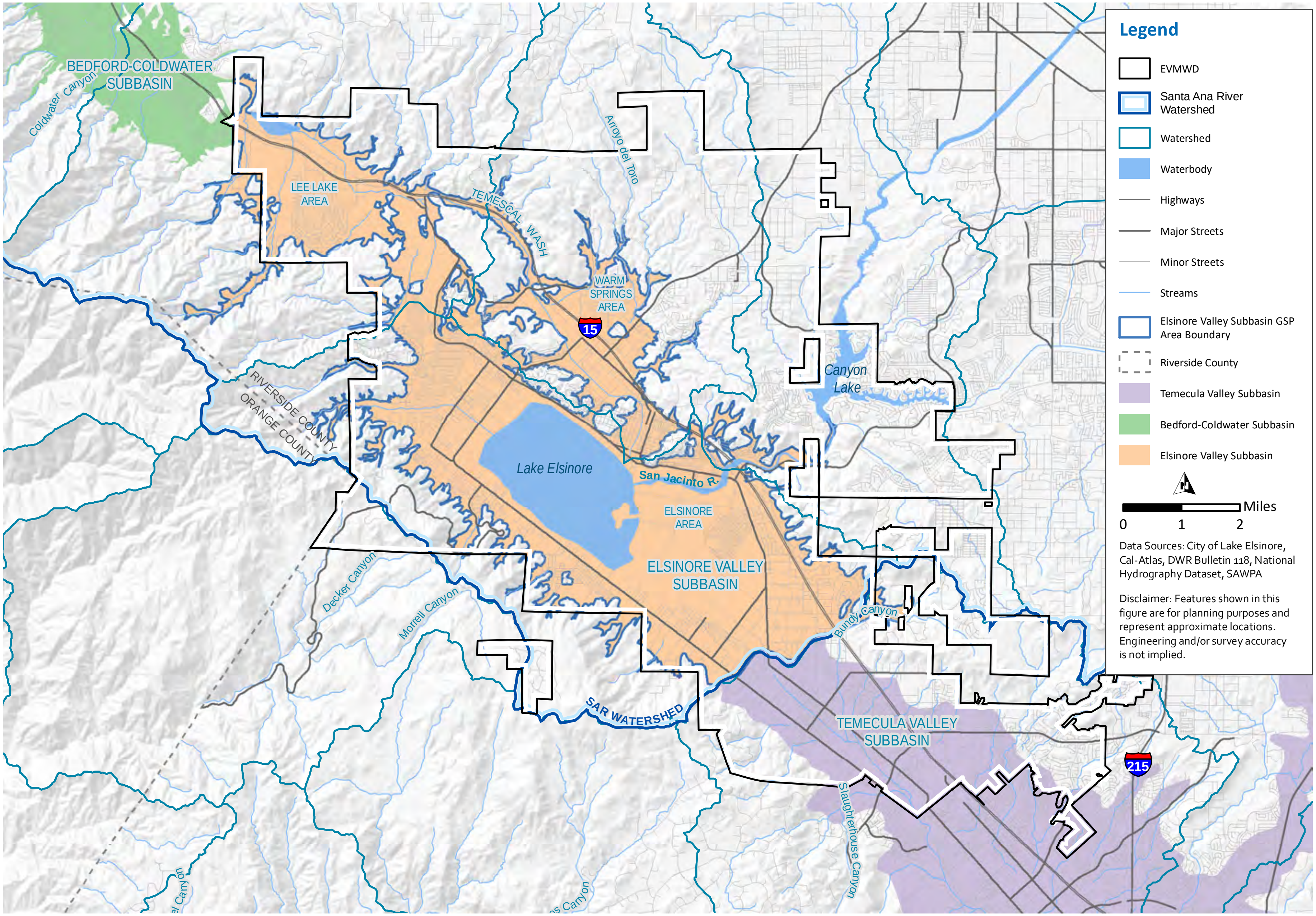
State and Federal Lands in the GSP Area are presented on Figure 2.4. There are small portions of the GSP Area within United States Forest Service (USFS) Land and Non-Forest Service Land (lands within the Forest Service boundary with undetermined ownership) within the USFS. The USFS Land is the Cleveland National Forest. Resource management efforts in the Cleveland National Forest target fire, ecology, archaeological resources, and recreational resources.



Data Sources: City of Lake Elsinore, 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.

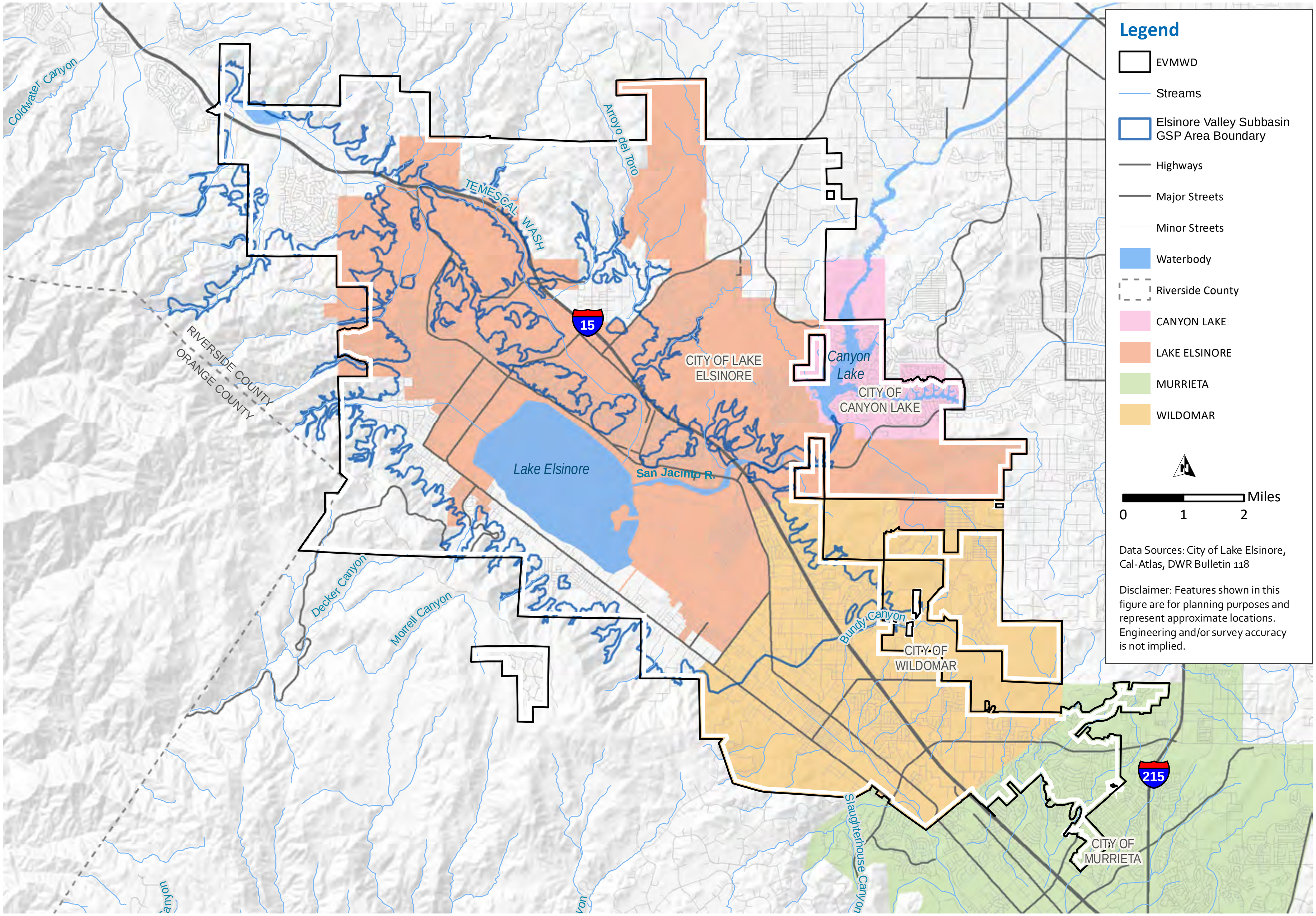
Figure 2.1 Elsinore Valley Subbasin Location



Data Sources: City of Lake Elsinore, 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.

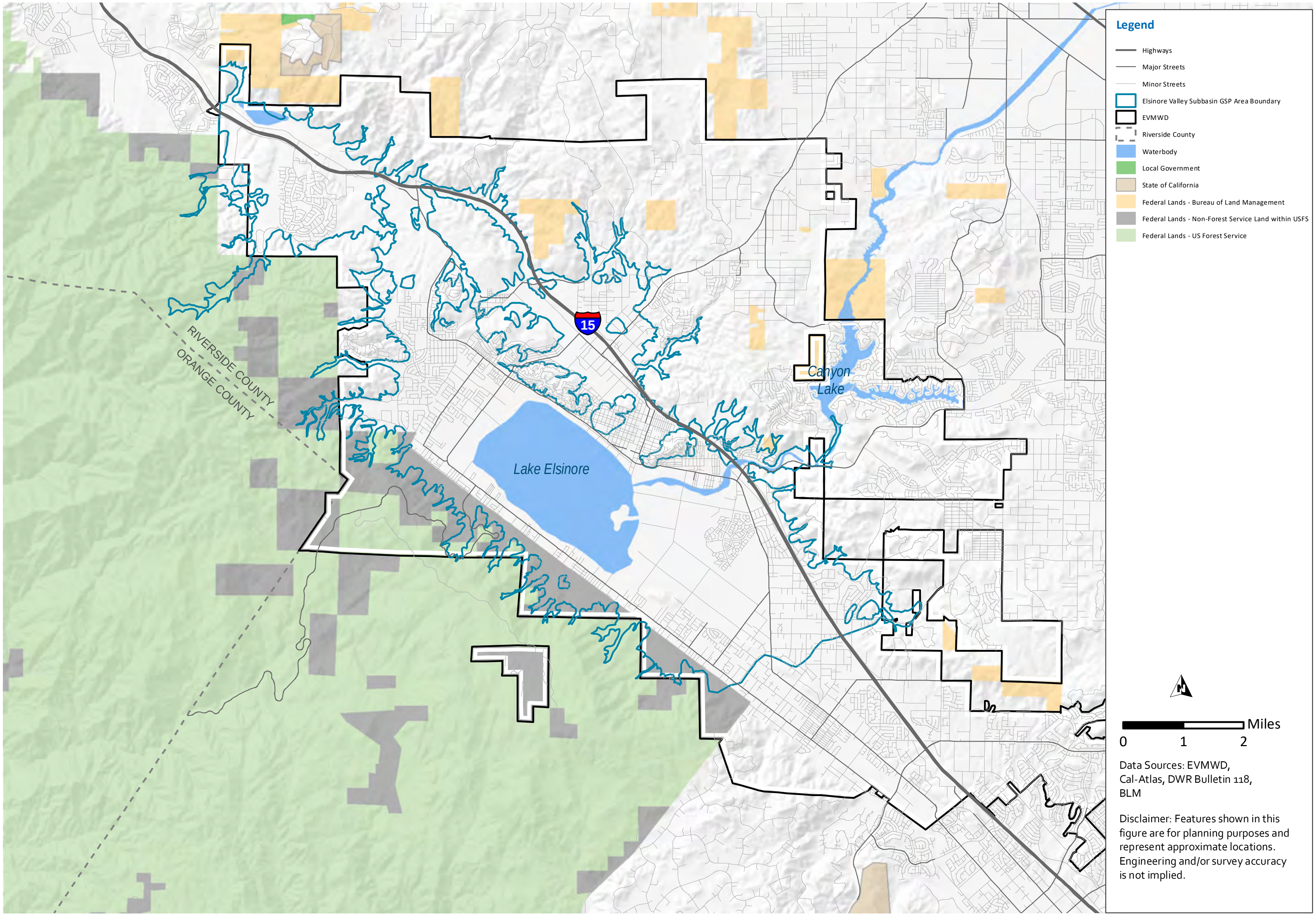
Figure 2.2 Elsinore Valley Groundwater Subbasin GSP Area



Data Sources: City of Lake Elsinore, Cal-Atlas, DWR Bulletin 118

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Figure 2.3 Jurisdictional Areas



Data Sources: EVMWD, 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.

Figure 2.4 Federal and State Lands

2.3.4 Tribal Lands

There are no Tribal Lands in the GSP Area. Regional tribal agencies have been included on the list of interested parties for the GSP, which 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 Subbasin. The EVGSA has 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 Subbasin and surrounding areas because there are important cultural resource sites within these areas. The EVGSA and regional tribal entities coordinate to assess infrastructure project sites prior to groundbreaking to identify and protect potential cultural resources.

2.3.5 State Lands

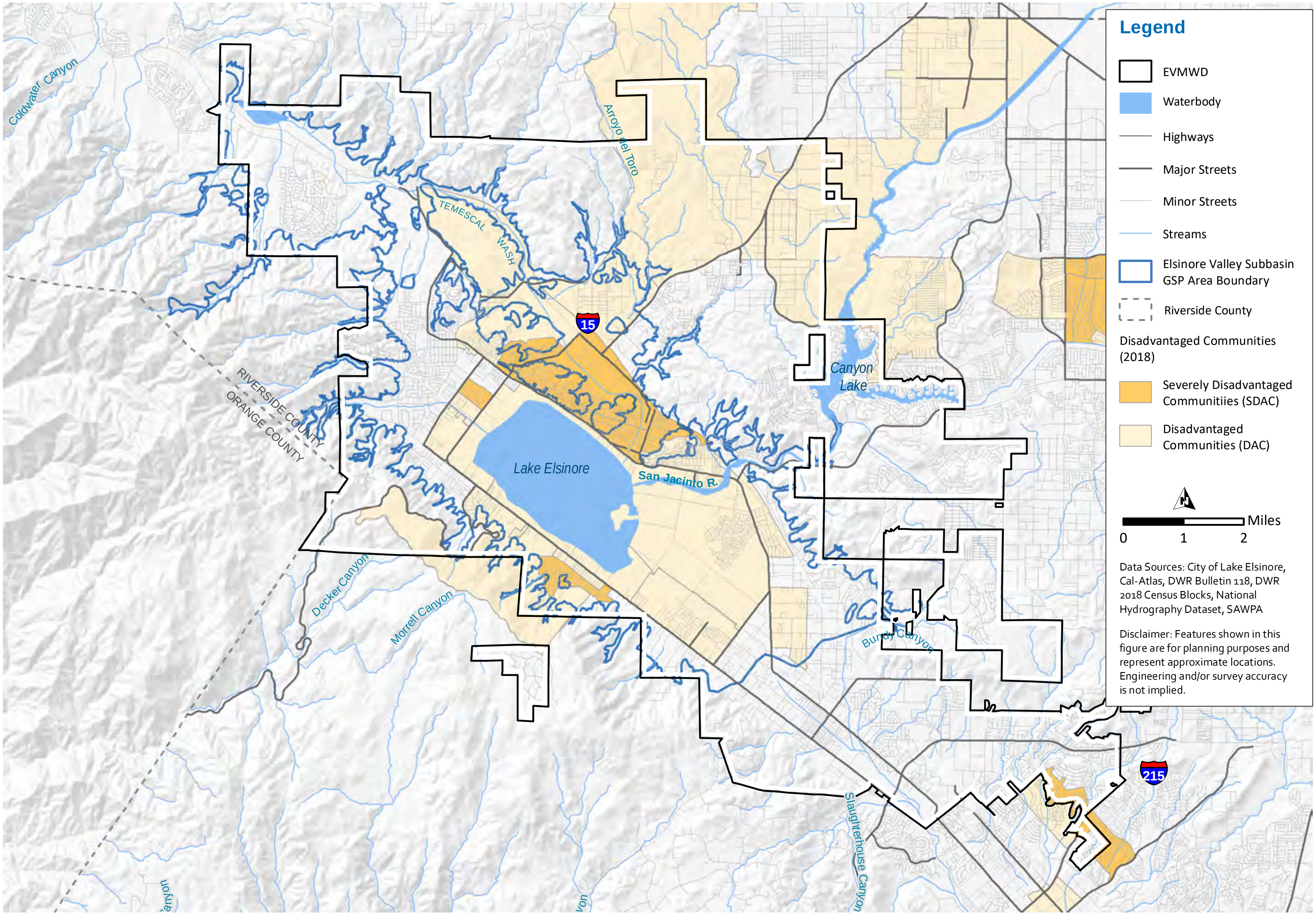
There are no State Lands in the GSP Area.

2.3.6 Disadvantaged Communities (DACs)

The DWR DAC Mapping Tool (https://gis.water.ca.gov/app/dacs/) was used to determine Census Block Groups that qualified as a DAC or severely disadvantaged community (SDAC). DACs are defined as Census block groups with median household incomes (MHIs) less than 80 percent of the statewide MHI. SDACs are Census block groups with MHIs less than 60 percent of the statewide MHI. Note that DAC and SDAC data available is from 2018 Census block data. Figure 2.5 shows the DAC and SDAC communities within the GSP area. Within the Subbasin, there are approximately 20,200 DAC members (36 percent of total Subbasin population) and 11,300 SDAC members (20 percent of total Subbasin population).

2.3.7 Others

The Canyon Lake Property Owners Association (POA) has responsibility for stormwater management within the City of Canyon Lake.



Data Sources: City of Lake Elsinore, Cal-Atlas, DWR Bulletin 118, DWR 2018 Census Blocks, 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.

Figure 2.5 Elsinore Valley Groundwater Subbasin DACs

2.4 Water Supply

Water supply for municipal and industrial (M&I) uses include groundwater, local surface water, and imported water purchased from the MWDSC. In addition, recycled water is used for non-potable uses. The water providers and additional detail on the various water sources are described in the following sections.

2.4.1 Water Providers

The majority population in the GSP Area is served by the EVMWD. The EVMWD service area and major facilities are shown on Figure 2.7. Additionally, some residents and business rely on private wells for groundwater.

EVMWD provides water and wastewater services to residential, institutional, commercial, and industrial customers in the Cities of Lake Elsinore, Canyon Lake, and Wildomar; parts of Murrieta and Corona; and unincorporated areas of Riverside County and Temescal Valley. The 96-square-mile service area is divided into two divisions; the Elsinore Division and the Temescal Division. The Elsinore Division is much larger than the Temescal Division with respect to water accounts and service area. EVMWD water sources include groundwater pumped from EVMWD wells, local surface water treated at the Canyon Lake Water Treatment Plant (CLWTP), and imported water from MWDSC. The percentages of each supply relative to the total supply are shown on Figure 2.6. Groundwater, local surface water, and imported water account for 23 percent, 9 percent, and 68 percent of EVMWD's potable water supply, respectively (Maddaus Water Management (MWM) 2018). EVMWD delivers approximately 24,400 AFY (MWM 2018).

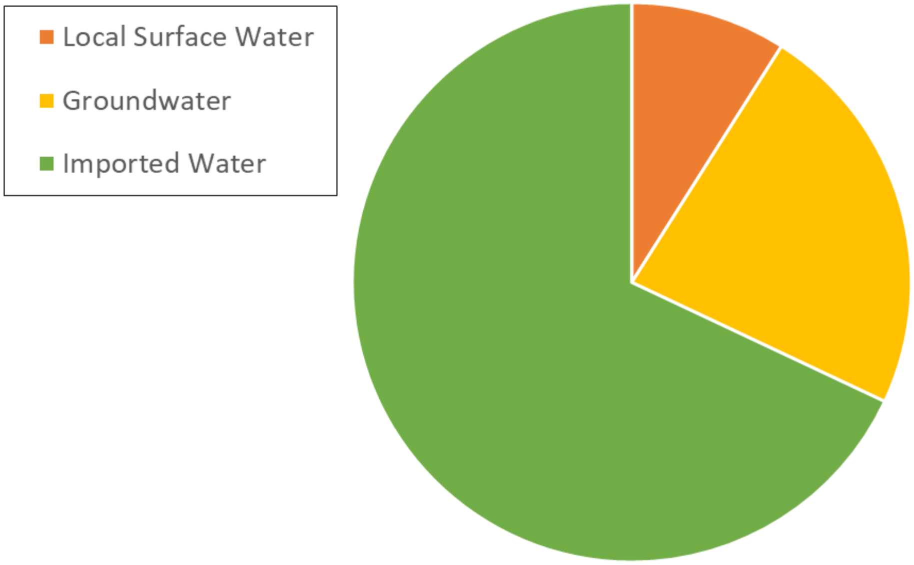


Figure 2.6 Percentage Contribution of EVMWD Water Supplies (Source MWM 2018)

2.4.2 Water Supply Sources

2.4.2.1 Groundwater

EVMWD is the primary producer of groundwater in the Elsinore Valley Subbasin, accounting for 99 percent of groundwater produced from the subbasin (MWH 2015). Since the implementation of the 2005 GWMP, EVWMD has limited pumping to approximately 5,500 AFY to be consistent with the safe yield that was defined for the Elsinore Area in the 2005 GWMP (MWH 2015). EVMWD has 10 wells in the Elsinore Valley Subbasin (MWM 2018) that extract water from a deep aquifer for the purpose of potable water supply. Locations of EVMWD's water supply wells are shown on Figure 2.7 **(**also shown on Figure 2.8**).**

EVMWD's groundwater facilities also include the Back Basin Water Treatment Plant (BBWTP). The treatment plant provides centralized treatment for arsenic (As) for two EVMWD wells, Cereal 3 and Cereal 4. The existing a capacity of the plant is 3,500 gallons per minute (gpm) (approximately 5,600 AFY), with the ability to expand to 7,000 gpm (approximately 11,300 AFY). If the plant were expanded, then groundwater extracted from other wells could also be treated for arsenic (MWH 2011).

As shown on Figure 2.8, EVMWD also has two non-potable wells that have been used to augment Lake Elsinore water levels. Since the development of the 2005 GWMP, the wells have only been used when there has not been sufficient recycled water available to maintain the minimum lake elevation goal of 1,240 ft in Lake Elsinore (MWH 2011).

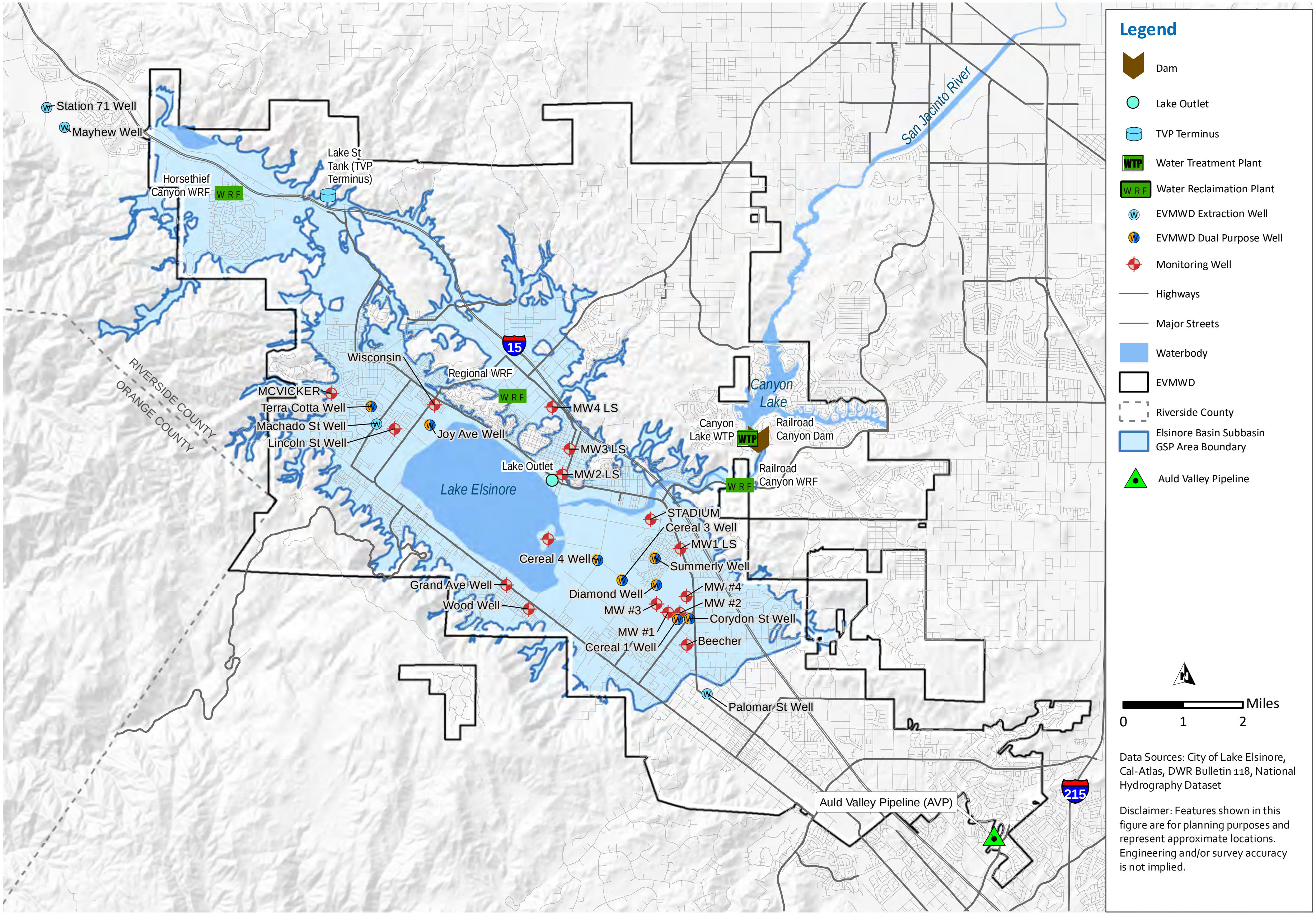
The practice of supplying recycled water to Lake Elsinore was established in the Lake Elsinore Comprehensive Water Management Agreement (March 2003) between the City of Lake Elsinore and the Lake Elsinore Redevelopment Agency. This agreement requires that all reclaimed water produced by the Regional Water Reclamation Facility (WRF) (with exception of the flow required for Temescal Creek) be reserved for replenishment of the lake when the lake elevation falls below 1,240 ft above mean sea level (ft-msl). The practice of discharging recycled water to Lake Elsinore is described in more detail in Section 2.4.2.4.

The remaining 1 percent of the groundwater produced from the subbasin is accounted for by local private pumpers and the City of Lake Elsinore. There are over 200 documented other wells in the Elsinore Valley Subbasin. Figure 2.8 presents the other documented wells in the subbasin. The total number of wells in the GSP area is approximately 280. Assuming a basin area of approximately 36 square miles (23,600 acres), the density of wells in the Elsinore Valley Subbasin is approximately 8 wells per square mile.

2.4.2.2 Local Surface Water

Lake Elsinore is a large local surface water body in the GSP Area with an estimated volume of approximately 60,000 acre-feet (AF). Per the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) (SARWQCB 2019), beneficial uses of the lake include recreation, warm water fishery, commercial, wildlife habitat, and rare threatened and endangered species. Lake Elsinore is not used for municipal water supply. Under average hydrologic conditions, there is insufficient precipitation and runoff to balance evaporation, resulting in declining water level in the lake. EVMWD provides recycled water to Lake Elsinore to maintain lake levels. Additional discussion on the use of recycled water for this purpose is included in the description of the recycled water systems in the GSP Area.

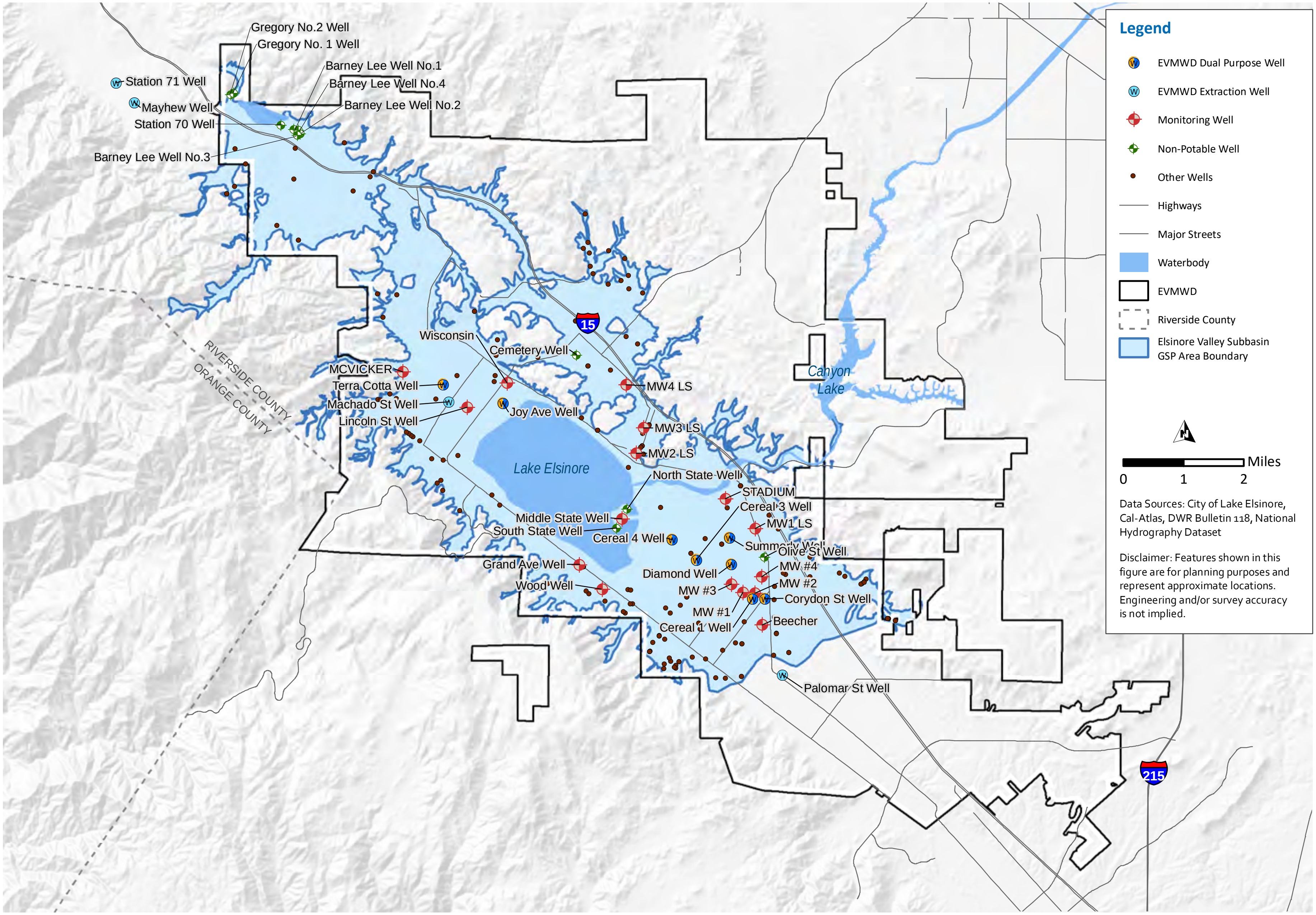
Canyon Lake (also called Railroad Canyon Reservoir) is located outside of the GSP Area, but it is used by EVMWD for a local potable water supply and distribution within the GSP Area. Canyon Lake impounds flows from the San Jacinto River, Salt Creek, and local surface runoff (EVMWD 2017). EVMWD owns all water and land rights within the footprint of Canyon Lake.



Data Sources: City of Lake Elsinore, 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.

Figure 2.7 EVMWD Facilities



Data Sources: City of Lake Elsinore, 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.

Figure 2.8 Groundwater Wells in the GSP Area

Canyon Lake was originally constructed with a capacity of 12,000 AF. However, siltation has decreased capacity of the lake to approximately 4,600 AF of useful storage volume (MWH 2016a), or less (recent estimates of 3,500 AF). Raw water can be purchased from WMWD at connections WR-18A (Colorado River Aqueduct [CRA] water) and WR-31 (State Water Project [SWP] water) can be discharged into the San Jacinto River to flow downstream to fill Canyon Lake. EVMWD has not purchased WR-18 water due to concerns with salinity (MWH 2016). EVMWD has purchased water from WR-31 (MWH 2016).

EVMWD treats surface water from Canyon Lake at the CLWTP. The CLWTP is a conventional WTP with a design capacity of 9 million gallons per day (mgd) (approximately 10,100 AFY). However, production is typically limited to between 4.5 mgd and 7 mgd (approximately 5,000 AFY to 7,800 AFY) based on water quality conditions and operational limitations.

Canyon Lake is also used for recreational purposes. The Canyon Lake POA leases the recreational surface rights through an agreement with EVMWD. Canyon Lake POA manages the use of the lake for recreation (https://canyonlakefacts.com/).

2.4.2.3 Imported Water

Imported water in the GSP Area is solely attributed to EVMWD operations. EVMWD purchases imported water from MWDSC through Eastern Municipal Water District (EMWD) and WMWD.

The water purchased from EMWD is treated at MWDSC's Skinner Filtration Plant. Source waters for the MWDSC Skinner Filtration Plant include water from the CRA and water from the SWP. The treated water is conveyed to EVMWD via the Auld Valley Pipeline (AVP). EVMWD has the rights to purchase 27,000 AFY, however, annual use is limited by hydraulic conditions to about 22,500 AFY (MWH 2016a).

Imported water from WMWD is treated at MWDSC's Mills Filtration Plant. The source water for the MWDSC Mills Filtration Plant is water from the SWP. The treated water is conveyed to EVMWD via the Mills Gravity Pipeline and the Temescal Valley Pipeline (TVP). EVMWD can obtain 12,700 AFY of imported water via the TVP (MWH 2016). EVMWD has the ability to increase its use of water from the Mills Filtration Plant with implementation of additional pumping capacity.

2.4.2.4 Recycled Water

As shown on Figure 2.7, there are three WRFs in the GSP Area. The Regional WRF, Railroad Canyon WRF, and the Horsethief Canyon WRF have capacities of 7.5 mgd, 1.12 mgd, and 0.5 mgd, respectively. EVMWD's recycled water distribution system serves the Horsethief, Railroad Canyon, Regional, and Wildomar areas.

EVMWD has been delivering recycled water to private irrigation to customers such as parks, schools, and golf courses since the 1990s (MWH 2016b). Recycled water from the Railroad Canyon WRF and the Horsethief Canyon WRF are the primary sources of recycled water for landscape irrigation in the service area.

EVMWD has also been delivering recycled water from the Regional WRF for environmental benefit. Approximately 0.5 mgd of recycled water from the Regional WRF is discharged into the Temescal Wash for the purpose of maintaining downstream riparian habitat. Under typical conditions, the remaining flow from the Regional WRF is delivered to Lake Elsinore to replenish the lake whenever the elevation drops below 1,240 ft per the Lake Elsinore Comprehensive Water Management Agreement. If the Lake Elsinore level exceeds 1,247 ft-msl) (upper limit established by the US Army Corps of Engineers), then all of the recycled water from the Regional WRF is discharged to Temescal Wash (MWH 2016b). In addition to EVMWD, EMWD provides recycled water to customers in and adjacent to the GSP Area. EMWD recycled water customers within the GSP Area include the Links at Summerly (golf course located east of Lake Elsinore) and schools/other customers in the City of Wildomar. EMWD also provides recycled water to the Canyon Lake Golf and Country Club, located adjacent to Canyon Lake.

2.4.2.5 Conjunctive Use/Managed Recharge/In-Lieu Recharge

The 2005 GWMP identified conjunctive use as an important component of management of the Elsinore Valley Subbasin. Dual-purpose wells were constructed by modifying existing production wells to dual-purpose extraction and injection wells. Groundwater injection practices began in 2007. The locations of the eight dual-purpose wells are shown on Figure 2.7 (MWH 2016a).

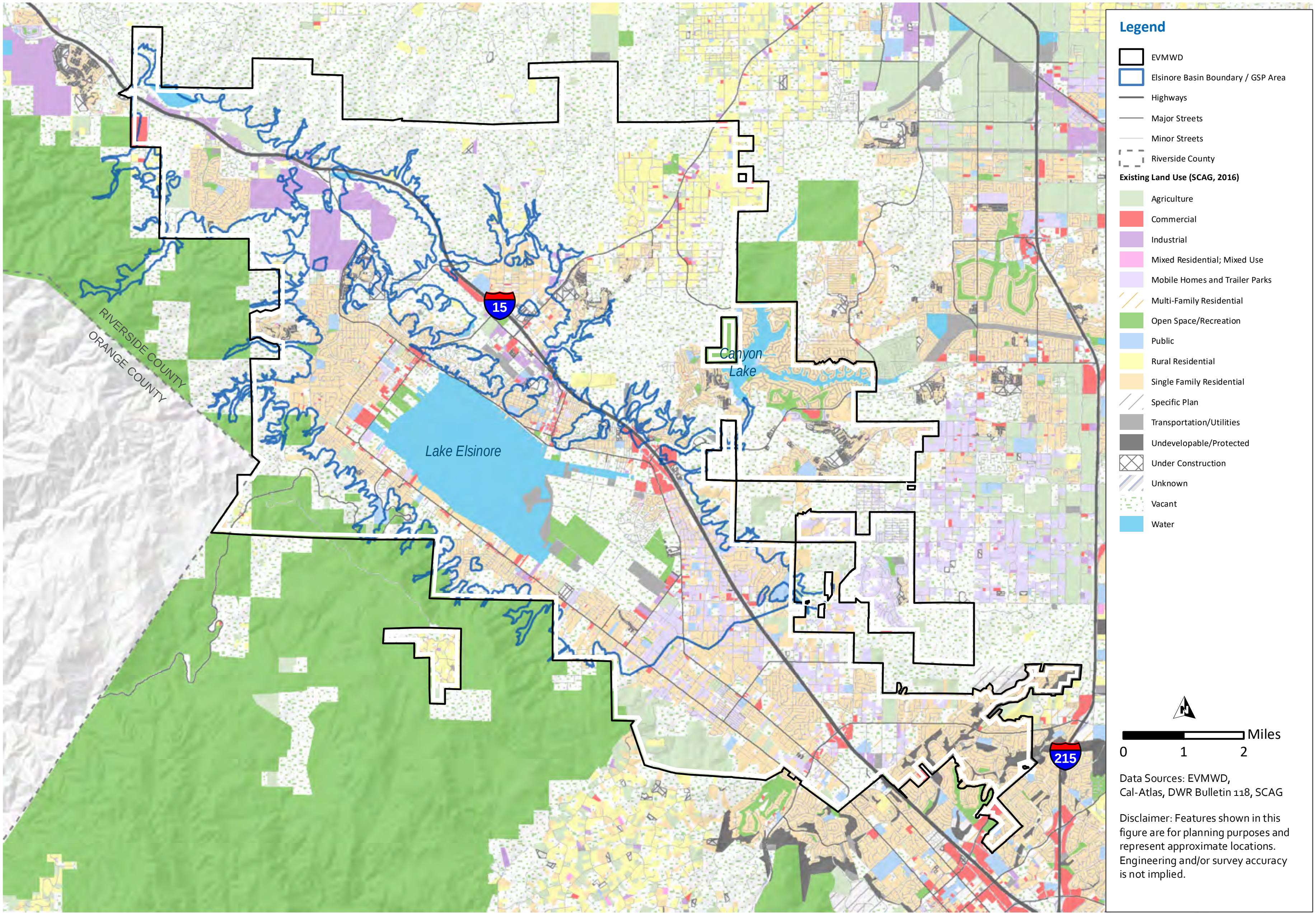
On an annual basis, MWDSC may deliver up to 3,000 AF of water for storage in the Elsinore Valley Groundwater Subbasin, and MWDSC may extract up to 4,000 AF of stored water as part of the Groundwater Storage Program (MWD 2011). During years when stored MWDSC deliveries are extracted, EVMWD's supply from imported water sources is reduced by an equal amount. The injected water, in combination with a decrease in annual pumping, has contributed to a stabilization of groundwater levels in the central-south portion of the Elsinore Valley Subbasin (MWD 2011).

Since 2016, EVMWD has been practicing in-lieu recharge. To meet demand, EVMWD has been purchasing imported water in-lieu of extracting groundwater. In-lieu recharge has continued to contribute to the stabilization of groundwater levels in the Elsinore Valley Subbasin.

2.4.3 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 land use types in the GSP Area is presented on Figure 2.9. 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 GSP Area. A significant portion of the GSP Area is characterized as residential land use. Residential land use represents 39 percent of the non-vacant GSP Area, where non-vacant land area is defined as the GSP Area less the vacant land and the area of Elsinore Lake.



Data Sources: EVMWD, Cal-Atlas, DWR Bulletin 118, SCAG

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Figure 2.9 Existing Land Use

In the GSP Area, water use sectors are summarized as follows:

- **Urban** - Urban water use within the GSP Area is associated with the City of Lake Elsinore, City of Wildomar, and City of Canyon Lake, as well as the unincorporated areas of Riverside County. Urban water use is attributed to residential, commercial, and institutional customers. EVMWD provides the majority of water to users in the GSP Area. Urban use in the EVMWD service area is primarily residential, accounting for approximately 75 percent of the total use (MWM 2018). EVMWD does not have any large commercial or large institutional customers in the service area (MWH 2011). Commercial and institutional uses, including dedicated irrigation for these sectors, accounts for approximately 21 percent of total use.
- **Industrial** - There are no large industrial customers in the EVMWD service area. Industrial land uses account for only approximately 8 percent of the non-vacant land area in the GSP Area.
- **Agricultural** - Agricultural land uses account for approximately 5 percent of the non-vacant land area in the GSP Area. EVMWD does not provide water to any agricultural customers within the GSP Area, as these areas utilize private wells for their irrigation needs.
- **Managed Wetlands** - EVMWD provides recycled wastewater for the Temescal Wash to support riparian habitat, and recycled wastewater to Lake Elsinore to augment the lake's water level.
- **Managed Recharge/Conjunctive Use/In-Lieu Recharge** - The conjunctive use program involves injection of imported water into the Elsinore Valley Subbasin, and subsequent extraction during drought and high demand periods (MWH 2011). In-lieu recharge has been practiced since 2016 and involves offsetting groundwater extractions with imported water to meet demands.

2.5 Water Resources Monitoring Programs

This section summarizes water resources monitoring in the GSP Area.

Water resource monitoring activities described in this section include:

- Climate.
- Surface water flow.
- Surface water quality (including Lake Elsinore and Canyon Lake).
- Imported water deliveries.
- Groundwater recharge/consumptive use.
- Water recycling.
- Wells and groundwater pumping.
- Groundwater levels.
- Groundwater quality.
- Land use.
- Land subsidence.

Several ongoing monitoring programs provide data and information relevant to the GSP Area. EVMWD, other local agencies, state agencies, and federal agencies are responsible for the various monitoring programs, which are summarized briefly below (Sections 2.5.1 through 2.5.12). Where applicable, monitoring locations are shown on Figure 2.10.

2.5.1 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 GSP Area. The closest CIMIS stations are:

- Perris - Menifee #240 - This station is located approximately 10 miles northwest of Lake Elsinore (Latitude: 33.76, Longitude: -117.2).
- Temecula #62 - This station is located approximately 13 miles southeast of Lake Elsinore (Latitude: 33.486650, Longitude: -117.22827).

Precipitation data for the past 100 years are available within the GSP Area from the California Data Exchange Center (CDEC) and through Riverside County Flood Control and Water Conservation District (RCFCWCD). The precipitation gauge is located on the north side of Lake Elsinore Station (Station ELS) that is operated by the California Department of Forestry and Fire Protection (CAL FIRE). EVMWD is currently operating a precipitation weather station that is part of the National Oceanic and Atmospheric Administration (NOAA)/Mesowest system. This weather station will eventually replace the CAL FIRE weather station.

2.5.2 Surface Water Flows

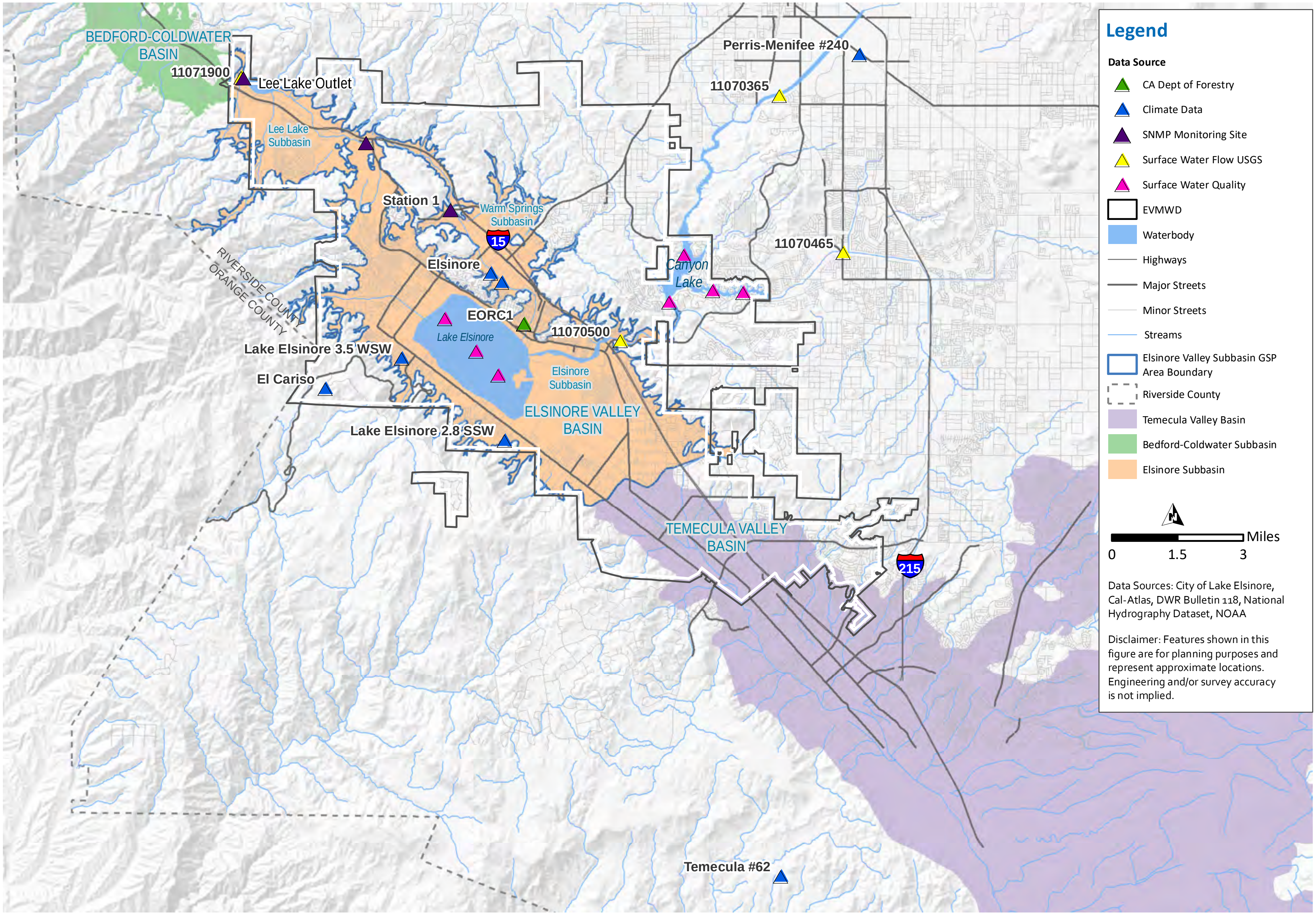
The United States Geological Survey (USGS) owns and operates several streamflow gauges in or near the GSP Area. These include:

- San Jacinto River Near Elsinore CA (11070500) - This station is located on the San Jacinto River downstream of the Canyon Lake Dam and upstream of the confluence with Lake Elsinore.
- San Jacinto River Near Sun City CA (11070365) - This station is located along the San Jacinto River upstream of Canyon Lake.
- Salt Creek at Murrieta Road near Sun City CA (11070465) - This station is located to the east of Canyon Lake.
- Corona Lake (Lee Lake) near Corona, CA (11071900) - This station is located at the spillway of Lee Lake.

2.5.3 Surface Water Quality

In 2005, the Santa Ana Regional Water Quality Control Board (SARWQCB) adopted the Nutrient total maximum daily load (TMDL) for Lake Elsinore and Canyon Lake (Lake Elsinore and San Jacinto Watersheds Authority [LESJWA] 2006). The TMDL monitoring program has evolved over time, with modifications in 2010, 2012, and 2015. While there have been changes in the monitoring program, it generally includes three stations in Lake Elsinore and four stations in Canyon Lake. Monitoring at these lake stations includes:

- Monthly sampling between October and May.
- Bi-weekly sampling between June and September.
- Water quality analysis for a suite of parameters related to nutrient impairment including, temperature, nitrogen species, specific conductance, phosphorus species, dissolved and total organic carbon (TOC), chlorophyll-a, sulfides, and dissolved oxygen, as well as others.



Data Sources: City of Lake Elsinore, Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset, NOAA

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Figure 2.10 Monitoring Site Locations

Last Revised: November 18, 2021 pw://IO-PW-INT.Carollo.local:Carollo/Documents/Client/CA/EVMWD/11585A00/GIS/Fig2_10_DataSourceLocations.mxd

The TMDL monitoring activities and results are compiled in annual reports. The most recent annual report was prepared in 2019 (Wood Environmental Infrastructure Inc. 2019)

Canyon Lake is a raw water supply for EVMWD. EVMWD reports on the water quality of their surface water facilities (raw and treated) to DDW. Data are available through EVMWD and the SWRCB (DDW water Quality Analysis Database - electronic data transfer [EDT] Library).

The Upper Temescal Valley SNMP includes several management actions, one of which is the implementation of a monitoring program. This monitoring program includes five surface water monitoring sites, two of which are in the GSP Area, and a discharge site at Lee Lake, which is also in the GSP Area (See Figure 2.10). Data collected at the surface water sites and the Lee Lake outlet (if flowing) will include TDS, nitrate, and the major anions and cations. Data collection will occur on a bi-weekly basis but may be modified in the future.

2.5.4 Groundwater Levels

EVMWD maintains a groundwater level monitoring program that is consistent with State requirements. The DWR runs the California Statewide Groundwater Elevation Monitoring (CASGEM) program. The 2005 GWMP included recommendations for groundwater level monitoring, and EVMWD has since implemented and updated their monitoring program. Currently, EVMWD has 15 monitoring wells in the GSP Area, which locations are shown on Figure 2.7. The period of record for groundwater level monitoring is about 20 years.

EVMWD is a DWR-accepted monitoring entity for the Elsinore Valley Groundwater Management Zone (GMZ) (EVMWD 2014). EVMWD has submitted a CASGEM monitoring plan to DWR (EVMWD 2014). EVMWD monitoring activities include:

- Water level measurements in all monitoring wells at a frequency of three times per year.
- Upload of EVMWD data to the CASGEM website.
- Seasonal aggregation of level data (and reporting to CASGEM) including summertime (June through August) and wintertime (December through April).

2.5.5 Groundwater Quality

Similar to EVMWD's groundwater level monitoring, the EVMWD groundwater quality monitoring activities have evolved since the implementation of the 2005 GWMP. The period of record for groundwater quality monitoring is about 20 years.

EVMWD conducts water quality analysis of its production wells (finished water) on an annual basis to comply with State and Federal drinking water regulations. Groundwater quality data are available through EVMWD. Parameters include but are not limited to arsenic, nitrate (as N), TDS, sulfate, hardness, sodium, TOC, pH, fluoride, and chloride. EVMWD provides groundwater quality data to DDW, and data are available through the SWRCB (DDW Water Quality Analysis Database - EDT Library).

EVMWD conducts more-frequent water quality monitoring on their wells per requirements of the Upper Temescal SNMP. EVMWD conducts monthly TDS monitoring on their production wells and their monitoring wells.

In addition, State-wide sources of groundwater quality data include the Water Data Library (WDL) and the GeoTracker/Groundwater Ambient Monitoring and Assessment (GAMA) program.

2.5.6 Groundwater Production

Groundwater pumpers include EVMWD, the City of Lake Elsinore, and other private users. As mentioned previously, EVMWD production accounts for approximately 99 percent of the total production from the Elsinore Valley Groundwater Subbasin.

Per the California Water Code, pumpers over 25 AFY must file an annual "Notice of Extraction and Diversion" with the SWRCB. Since 2006, the WMWD, San Bernardino Valley Municipal Water District (SBVMWD), and San Gorgonio Pass Water Agency (SGPWA) have been responsible for reporting on groundwater pumping (MWH 2011). Their central database is called *Watermains*, and EVMWD, Elsinore Water District (until acquired by EVMWD in 2011), and the City of Lake Elsinore have reported their well production to *Watermains* (total of 15 to 20 wells) since around year 2000 (MWH 2011). Production data are available through the Riverside County Watermaster (MWH 2011) and directly from EVMWD. The period of record for groundwater quality monitoring is about 20 years.

2.5.7 Conjunctive Use/Managed Recharge

Eight of the ten EVMWD wells are dual-purpose wells that can be used for extraction of groundwater and injection of imported water (MWH 2016a). EVMWD records monthly injection volumes and production at each of these wells. In addition, monthly water quality data for injection water (imported water) are available through EVMWD.

2.5.8 Recycled Water

EVMWD records recycled water flows and quality at the three reclamation facilities: Regional WRF, Railroad Canyon WRF, and the Horsethief Canyon WRF. EVMWD also records recycled water deliveries in the recycled water service areas for landscape irrigation, and delivery to Temescal Wash and Lake Elsinore. Per requirements of the Upper Temescal SNMP, EVMWD measures TDS on a monthly basis in the recycled water delivered within the Warm Springs and Lee Lake areas.

2.5.9 Imported Water

EVMWD maintains records of imported water purchases and deliveries through EMWD and WMWD. Monthly water quality data for imported water are available through EVMWD.

2.5.10 Land Use

Land use data for the GSP Area are available through the Southern California Association of Governments (SCAG). The most recent land use mapping data are from 2016.

2.5.11 Land Subsidence

While the potential for subsidence was recognized in the 2005 GWMP, it has not been a known issue to date. Hence, ground surface elevations have not been directly monitored in the GSP Area. Groundwater levels have been managed to stay above historical low levels to minimize the potential for ground settlement.

2.5.12 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.

2.6 Water Resources Management

There are a number of previous plans related to different aspects of water resources management in the GSP Area. The previous studies/plans are summarized in this section. Generally, this previous work falls into three main categories: groundwater subbasin management, water resources management, and water conservation. The categorization helps to provide some context for the summaries that follow:

- **Groundwater Basin Management** - Plans and studies focusing on groundwater management include the 2005 GWMP, the monitoring plan in the 2005 GWMP, and the subbasins status reports prepared in 2008, 2009, and 2011 (MWH 2008, 2009, 2011). Management of groundwater quality is described in general in the Basin Plan. More specific planning efforts are described in the Triennial Report on Water Supply and Recycled Water, developed per the requirements of the Upper Temescal SNMP (applicable to the Warm Springs and Lee Lake areas), and the investigation of Impacts of Septic Systems on Groundwater Quality (Applicable to the Elsinore Area).
- **Water Resources Management** - There are a number of water resources planning documents. WMWD’s Updated Integrated Regional Water Management Plan (IRWMP) (Kennedy/Jenks Consultants 2008) provides information on water resources on a regional scale. However, this plan is over 10 years old, and additional plans developed by EVMWD are more recent and more focused on the GSP Area. The 2015 EVMWD Urban Water Management Plan (UWMP) (MWH 2016) includes information on existing and future water demands and supplies, including groundwater, imported water, surface water, and recycled water. The 2015 UWMP also identified water supply strategies for meeting future demands. These strategies are consistent with those identified in the Integrated Resources Plan (IRP) (EVMWD 2017). The Indirect Potable Reuse Feasibility Study (Kennedy/Jenks Consultants 2017) provides a recommended alternative for IPR, a strategy included in the IRP. The Hydrogeologic Study of the Warm Springs Groundwater Subbasin (Geoscience and Kennedy/Jenks Consultants 2017) further explores one of the recommended water supply strategies identified in the IRP. In addition, EVMWD delivers groundwater and/or recycled water to Lake Elsinore. In this respect, plans and studies related to the management of Lake Elsinore are included.
- **Water Conservation** - The 2015 UWMP includes water use targets for 2020 and beyond, a description of best management practices (BMPs), and a water shortage contingency plan. The Water Conservation Business Plan (MWM 2018) focuses specifically on indoor and outdoor conservation measures to reduce existing and future demands.

2.6.1 Elsinore Basin Groundwater Management Plan

The 2005 GWMP was adopted by the EVMWD Board of Directors on March 24, 2005, under the authority of the Groundwater Management Planning Act (California Water Code Part 2.75, §10753) as amended. The 2005 GWMP objectives included providing an evaluation of a portion of the groundwater subbasin and developing a reliable groundwater supply to meet drought and dry season demands through the year 2020.

The major components of the 2005 GWMP included:

- Hydrogeologic conditions.
- Development and evaluation of baseline conditions.

- Identification of management issues and strategies.
- Identification and evaluation of four alternatives.
- Development of the recommended plan and corresponding implementation plan.

The 2005 GWMP included a thorough evaluation of the groundwater conditions and conceptual model. A key finding of the study was that the subbasin was potentially in a state of overdraft of about 4,400 AFY, and that in 2020 the overdraft may increase to about 6,500 AFY. As a result of the overdraft condition, significant decline in water levels was predicted. Concerns with the existing and projected overdraft include:

- An increased need for groundwater due to lake replenishment needs and a doubling of water demand between 2000 and 2020.
- Significant existing and projected groundwater level declines resulting in the risk of water quality degradation and land subsidence.
- An increasing trend in nitrate concentrations in areas with septic tanks and a projected increase of TDS concentrations.
- Potential for water quality contamination via the other wells in the subbasin with an unidentified well status.

The recommended alternative was designed to achieve balance in the subbasin by reducing demands and providing alternatives to groundwater pumping, such that groundwater production could be limited to the approximate sustainable yield level or less. The recommended plan included water conservation, dual-purpose wells for basin recharge, the use of recycled water as the primary source for lake replenishment, and a basin monitoring program.

The overarching recommendations of the 2005 GWMP included:

- Development of an Advisory Committee to continue the Stakeholder involvement process and to help the EVMWD Board of Directors effectively manage the subbasin.
- Implementation of conjunctive use projects to achieve a sustainable groundwater balance and ensure a reliable water supply.
- Implementation of a water conservation program to reduce potable water demands by five percent.
- Minimizing the use of groundwater for lake replenishment and save the high-quality groundwater to serve potable demands.
- Expanding the monitoring program to enhance the understanding of the groundwater subbasin and to help manage future conjunctive use operations.
- Developing septic tank conversion policies and well construction and abandonment policies to protect the basins water quality.

2.6.2 Groundwater Monitoring Plan and Management Reports

The 2005 GWMP included a groundwater monitoring plan for the Elsinore Valley Groundwater Subbasin (MWH 2005). At the time, the Joint Groundwater Monitoring Program was developed by EVMWD and Elsinore Water District. With acquisition of Elsinore Water District (in 2011), EVWMD has had primary responsibility for groundwater monitoring in the subbasin.

Key components of the 2005 GWMP monitoring plan included:

- Construction of five new monitoring wells.
- Monitoring of water levels on a monthly basis.

- Monitoring water quality data on an annual basis.
- Monitoring surface water flows.
- Monitoring land subsidence.
- Conducting a well canvas.
- Conducting spinner logging testing, water quality zone testing, and aquifer testing.

Results of the monitoring program were intended to inform the implementation of management activities, as data and information would provide guidance for adjusting management activities, as needed.

To date, three subbasin status reports have been prepared in 2008, 2009, and 2011 (MWH 2008, 2009, 2011). The most recent subbasin status report (MWH 2011) provided an update on the condition of water supply and water quality, trends in groundwater levels and quality (approximate period 1996 to 2010), and activities in Elsinore Valley Subbasin. General observations on groundwater levels, production, and groundwater quality included:

- From 2000 to 2010, all EVMWD wells except the Olive Well (which had been out of production due to water quality issues) and the Middle Island Well experienced a general decline in groundwater levels.
- From 2005 through 2010, groundwater levels in EVWMD's four monitoring wells generally remained constant.
- From 2000 to 2006, groundwater production gradually increased. In 2007 through 2010, production decreased due to increased management of production from the subbasin.

The subbasin status report summarizes activities that had been completed or were in progress in the 2009 through 2010 period. These included:

- Construction of blending well pipelines.
- Established agreement with the SARWQCB for imported water recharge.
- Continuation of the Groundwater Advisory Committee.
- Implementation of the WELLSAFE program.
- Implementation of a well construction, destruction, and abandonment policy.
- Management of groundwater production.
- CASGEM groundwater elevation monitoring.

The subbasin status report also included an update on implementation of the 2005 GWMP monitoring program and recommended modifications to the monitoring program. The subbasin status report recommended implementation of additional monitoring wells, groundwater quality monitoring, injection water quality monitoring, and other activities. These recommendations are briefly summarized below.

- Recommended Wells - Complete construction of three new wells to meet the recommendation of the 2005 GWMP for five new monitoring wells.
- Groundwater Quality Monitoring - Estimate vertical distribution of flow within existing production wells with TDS, sulfate, and arsenic issues. Conduct additional monitoring of wells screened exclusively in the alluvium. Continue conducting groundwater level and quality monitoring in several specific areas in the subbasin to assess impacts of groundwater storage, and to evaluate the feasibility of surface recharge.
- Injection Water Quality - To support reporting on ambient water quality reporting (every three years) per the requirements in the Cooperative Agreement to Protect Water Quality

and Encourage the Conjunctive Uses of Imported Water in the Santa Ana River Basin (SARWQCB 2008) with the Regional Board, and conduct monthly water quality at all well-injection sites for TDS and nitrogen (as N).

2.6.3 Water Quality Control Plan for the Santa Ana River Basin

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 designates beneficial uses for surface and ground waters, 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 describes implementation programs to protect all waters in the Region.

The Basin Plan includes numeric TDS and nitrate objectives for the Elsinore Area of 480 mg/L and 1 mg/L (as N), respectively. Numeric salt and nutrient objectives for the Lee Lake and Warm Springs areas were developed as part of the Upper Temescal Valley GMZ SNMP, as described in Section 2.6.4.

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 SARWQCB contributes to the data collection effort.

2.6.4 Upper Temescal Valley Groundwater Management Zone SNMP

The Upper Temescal Valley SNMP was developed as a joint management plan prepared by EVMWD and EMWD (WEI 2017). The Upper Temescal Valley SNMP has been submitted to the SARWQCB but has yet to be adopted into the Basin Plan.

The ultimate goal of the SNMP was to define the management activities that EVMWD and EMWD will implement to comply with the TDS and nitrate concentration objectives of the GMZs and surface water bodies that are impacted by recycled water discharge and reuse in the Upper Temescal Valley Watershed (WEI 2017). The study area for the Upper Temescal Valley SNMP was the Upper Temescal Valley GMZ, which is coincident with the Warm Springs and Lee Lake areas of the Elsinore Valley Groundwater Subbasin.

The Upper Temescal Valley SNMP included recommended antidegradation objectives for TDS and nitrate of 820 mg/L and 7.9 mg/L (as N), respectively. The assimilative capacity analysis for the Upper Temescal Valley SNMP concluded that there was 70 mg/L of assimilative capacity for TDS and 3.2 mg/L (as N) assimilative capacity for nitrate. While there is assimilative capacity for both TDS and nitrate, the Upper Temescal Valley SNMP included recommended salt and nutrient management actions based on the recommended objectives, current and projected nitrate concentrations, and the potential for violations of wastewater reclamation discharge limits (under drought conditions in particular).

The management actions, with the exception of one action that is applicable only to EMWD, in the Upper Temescal Valley SNMP include (WEI 2017):

- Implementation of a new SNMP Monitoring and Reporting Program, including the addition of new groundwater and surface water monitoring locations, in the Upper Temescal Valley GMZ.

- Triennial reporting of the water supply and discharge water quality management activities of each agency, including water supply and discharge water quality trends.
- Recalculation of current ambient water quality and ambient water quality projections for the Upper Temescal Valley by June 2020 and thereafter based on a method and schedule approved by the SARWQCB.
- Participation in Task Force efforts to periodically update the wasteload allocation (WLA) for the Santa Ana River Watershed.
- Participation in Task Force efforts to assist the Regional Board in the development of updated TDS management strategies for recycled water discharges during times of drought.
- Annual reporting of progress and activities related to this SNMP to the Regional Board.
- Periodic updates of the SNMP Actions.

2.6.5 2018 Triennial Report on Water Supply and Recycled Water in the EVMWD - Salinity Trends and Management

The SNMP for the Upper Temescal Valley GMZ includes required management actions, one of which is that EVMWD prepares a report on salt and nutrient management in the EVMWD service area every three years. EVMWD prepared and submitted the first triennial report in 2018 (WEI 2018). This report characterizes the existing and planned activities of the EVMWD to manage TDS concentration trends in source water, recycled water, and groundwater (WEI 2018) in the Elsinore GMZ and the Upper Temescal Valley GMZ and is briefly summarized below. The Elsinore GMZ a portion of the Elsinore Valley Subbasin that generally surrounds Lake Elsinore. The Lee Lake and Warm Springs areas are not included in the Elsinore GMZ but are part of the Upper Temescal Valley GMZ.

2.6.5.1 Elsinore GMZ

The need for EVMWD salinity management is focused primarily on the use or recycled water in the Elsinore Valley Subbasin. Recycled water from EVMWD reclamation facilities is used for landscape/urban irrigation, as well as to supplement water levels in Lake Elsinore and to maintain habitat in Temescal Wash. The receiving waters in the Santa Ana Region that are impacted by the EVMWD’s recycled water discharge and irrigation activities include Lake Elsinore (WEI 2018).

The report states that there is no assimilative capacity for neither nitrate nor TDS in the Elsinore GMZ and outlined the key issues associated with the EVMWD’s recycled water operations, including:

- TDS concentration of the discharges from the Railroad Canyon WRF exceeds the waste discharge permit limitation.
- TDS concentrations of the recycled water supply used in the Elsinore GMZ exceed the anti-degradation objective.

In October 2014, EVMWD committed to preparing a maximum benefit salinity management plan for the Elsinore GMZ including a salt offset program to mitigate its TDS liabilities (WEI 2018). The most recent version of the maximum benefit salinity management plan was submitted to the SARWQCB in August 2018. Key elements of the proposed approach included:

- Adopting a maximum-benefit-based SNMP that will include the IPR project as the EVMWD's future salt mitigation program.
- Adopting new maximum-benefit-based TDS and nitrate water quality objectives for the Elsinore GMZ to create assimilative capacity and to define the salinity management actions that EVMWD will implement (maximum benefit commitments) for the long-term management of the water quality and beneficial uses of the Elsinore GMZ.

At the time of GSP completion (December 2021), EVMWD was working closely with SARWQCB staff to approve maximum-benefit based TDS and nitrate objectives for the Elsinore GMZ and the associated commitments for salinity management. The proposed TDS and nitrate limits in the Elsinore GMZ are 530 mg/L and 5 mg/L, respectively.

In addition to outlining EVMWD management of TDS and nutrients and their proposed regulatory compliance approach, the report provides information on existing water quality and trends. General observations included:

- North of Lake Elsinore: TDS concentrations ranged from 230 to 800 mg/L. Shallower wells have greater TDS concentrations than deeper wells. Two of the three wells (one shallow and one deep) showed increasing TDS concentrations since 2014.
- South of Lake Elsinore: TDS concentrations ranged from 220 to 1,100 mg/L. Shallower wells had greater TDS concentrations than deeper wells. EVMWD wells screened across the deep aquifer (Corydon, Cereal 4, Diamond, Summerly) showed temporal variations but no long-term increasing trends over the period of analysis; and one well (Diamond) showed an increasing trend in TDS concentration since 2014.

Upper Temescal Valley GMZ

As discussed in the summary of the Upper Temescal Valley SNMP, antidegradation objectives and assimilative capacity for TDS and nitrate have been established for the Upper Temescal Valley GMZ, and salt and nutrient management actions were identified. The proposed TDS and nitrate limits in the Upper Temescal Valley GMZ are 820 mg/L and 7.9 mg/L, respectively. The triennial report (WEI 2018) summarizes the progress on implementing the management actions. Brief summaries of the status of the salt and nutrient management actions are provided as follows (WEI 2018):

- Development and implementation of a surface water and groundwater monitoring program - The field surface water monitoring program currently includes in-stream monitoring of surface water flows in Temescal Wash and will be expanded in the future to include measurements of surface water flow. The groundwater monitoring program involves periodic monitoring of water levels and water quality at all accessible wells in the GMZ. The monitoring program began in January 2018, and three quarterly monitoring reports have been submitted to the Regional Board.
- Triennial reporting of water supply and discharge water quality and associated management challenges - The first triennial report has been completed (WEI 2018).

- Participation in regional efforts to periodically update the WLA analysis for recycled water discharges to the Santa Ana River and its tributaries. The Task Force is currently working to update the WLA.
- Participation in the regional effort to develop salt mitigation strategies for short-term violations of TDS discharge limitations in times of drought - The SARWQCB is evaluating options to update its TDS management plan for regulating recycled water discharges during times of drought. This will involve several technical studies. EVMWD is participating financially in this process and will incorporate the adopted salt offset strategies from these efforts, as appropriate, into future updates of the Upper Temescal Valley SNMP.
- Periodic recomputation of current and projected ambient water quality - The first recomputation will be completed by June 30, 2020. This effort also includes updating the projections of future ambient water quality based on the recycled water reuse and development plans of the agencies in the Upper Temescal Valley to determine if new SNMP management actions are needed.
- Periodic update of the SNMP action items pursuant to the ambient water quality findings - This will be updated after the above described recomputation.
- Annual reporting of progress and activities related to implementation of the SNMP - Quarterly monitoring reports and an annual report have been submitted to the SARWQCB.

In addition to reporting on the implementation of management actions, the triennial report includes a characterization of groundwater quality and trends in the Upper Temescal Valley GMZ. The general observation was that the TDS concentrations in the Upper Temescal Valley GMZ increase during dry periods and decrease during wet periods (WEI 2018). With the implementation of the Upper Temescal Valley SNMP monitoring program, there will be more data and information in the future that will be used to assess water quality and trends.

2.6.6 Impacts of Septic Tanks on Groundwater Quality

EVMWD conducted a study on the impacts of nitrate from septic tanks on groundwater quality in the Elsinore Valley Subbasin (Kennedy/Jenks Consultants 2013). Based on geographic information system (GIS) data at the time, EVMWD estimated that approximately 3,900 parcels within the Elsinore Valley Subbasin were connected to individual septic systems, and these septic systems generated approximately 1,000 AFY of recharge to the subbasin (Kennedy/Jenks Consultants 2013).

The study found that the removal of septic systems over a 20- to 40-year period would lead to significantly lower groundwater nitrate concentrations, as compared to continued use of the septic systems (Kennedy/Jenks Consultants 2013). Furthermore, the study recommendations included a phased approach, where specific areas were prioritized based on anticipated benefit of conversion from septic systems to the sewer system.

A subsequent study was conducted to evaluate the sources and processes affecting groundwater nitrate contamination within the Elsinore GMZ (Sickman 2014). Sources of nitrate were identified using stable isotope measurements. Key conclusions of the study included:

- Some nitrate from septic systems is entering the groundwater, and it is possible that much or most of the nitrate in some wells is coming from septic tanks.

- Denitrification is occurring, and the process of denitrification makes it challenging to assess the degree of septic contamination using only nitrate concentrations.
- Denitrification is stimulated by septic system inputs and is helping remove nitrate from the aquifer.

To further assess the extent of septic contamination, Sickman (2014) recommended a subsequent study with expanded scope and duration.

2.6.7 Western Municipal Water District Updated Integrated Regional Water Management Plan

EVMWD purchases imported water from WMWD. Therefore, it is relevant to track WMWD planning efforts that affect the EVMWD service area or the imported water delivered to EVMWD.

WMWD completed its most recent IRWMP in 2008 (Kennedy/Jenks Consultants 2008). The purpose of the IRWMP was to address long-range water quantity, quality, and environmental planning needs within WMWD's service area. WMWD is conducting another IRWMP update, which is expected to be completed in 2020.

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 (WEI 2018).

Several projects, with relevance to EVMWD, were identified in the IRWMP including infrastructure associated with the Wildomar Recycled Water Distribution System, and infrastructure improvements to increase the capacity of the TVP.

2.6.8 EVMWD Urban Water Management Plans

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.

EVMWD has prepared UWMPs in 2005, 2010, and 2015. According to the 2015 UWMP, EVMWD is in compliance with state requirements to reduce per-capita water use by 20 percent by 2020 (Senate Bill X7-7). As reported in EVMWD 2015 UWMP, the 2015 per-capita daily water use of 128 gallons per capita per day (gpcd) was currently below the interim 2015 target of 213 gpcd and below the 2020 target of 189 gpcd (MWH 2016).

Per the 2015 UWMP, EVMWD should be able to meet demands in 2020 using their existing water sources, but that near-term drought and MWDSC supply reductions are forcing EVMWD to be proactive in analyzing future supply alternatives and continue to evaluate short-term and long-term supply options (MWH 2016). The 2015 UWMP referred to the IRP (EVMWD 2017) and the preferred scenario for meeting future water demands. These projects were included in the summary of the IRP.

2.6.9 Recycled Water System Master Plan

The purpose of the 2016 Recycled Water System Master Plan (MWH 2016) was to identify existing and future recycled water demand and supplies in the EVMWD recycled water system, and to develop recommended alternatives to address and system deficiencies (MWH 2016). The Master Plan included development of a Capital Improvement Program (CIP), which contains recommended projects for the Wildomar, Horsethief, and Regional areas. The infrastructure improvements in the CIP were identified for implementation between 2015 and 2020. The CIP also included IPR at the Regional WRF. This project was also identified in the EVMWD IRP (see Section 2.6.10) and further explored in a separate feasibility study (see Section 2.6. 11).

2.6.10 EVMWD Integrated Resources Plan

EVMWD developed an IRP in 2017 (EVMWD 2017). The plan establishes EVMWD's long-term strategy for providing reliable water supplies to a growing customer base. The foundational goals of the IRP included:

- Creating new water.
- Increasing supply reliability.
- Decreasing dependence on imported water.
- Promoting reuse.
- Improving water quality.
- Improving groundwater management.
- Promoting conservation.

The IRP identified scenarios to reduce the anticipated 2040 water supply deficit of 16,114 AFY. The recommended scenario included use of EVMWD's water supply assets in the San Bernardino Basin Area (SBBA) and Lee Lake, Bedford, Warm Springs, and Temecula-Pauba basins, to provide reliable, high-quality groundwater and improve the overall water quality within EVMWD's service area, as well as other projects. The scenarios include the following:

- Pump Lee Lake area groundwater (Barney Lee wells) via the TVP; no treatment.
- Pump Bedford groundwater (Flagger wells) via the TVP; no treatment.
- Palomar Well replacement.
- Extract groundwater from Warm Springs area; no treatment.
- Modify operation of Canyon Lake.
- IPR at Regional WRF; injection/extraction with advanced water treatment.
- Temecula-Pauba groundwater.
- Implement increased water conservation measures; enhanced treatment.

The following sections present a phased implementation of the recommended scenario over the planning period (2017 through 2035). A separate feasibility analysis on IPR was prepared and is summarized in Section 2.6. 11.

2.6.11 Indirect Potable Reuse Feasibility Study

The objective of the Indirect Potable Reuse Feasibility Study (Kennedy/Jenks Consultants 2017) was to develop a recommended IPR project. For this project, alternatives that employed potable reuse via direct injection and surface water augmentation were considered. Nine preliminary alternatives were developed and the refined down to a list of five. The recommended alternative included an advanced treatment facility, injection wells, and a conveyance system, to be implemented in two phases. Key components of the recommended alternative are described below (Kennedy/Jenks Consultants 2017):

- Advanced Water Treatment Facility (AWTF) - The treatment train included microfiltration, three-stage reverse osmosis, advanced oxidation, and product water stabilization. The planned capacity of the treatment facility is 6 mgd (Phase 1 at 3 mgd and Phase 2 at 3 mgd).
- Injection Wells - Five injection wells (with three wells for Phase 1 and two additional wells for Phase 2) are included in the recommended alternative. The injection wells are all located on the southeast side of Lake Elsinore, and specific locations are shown in the report.

2.6.12 Hydrogeologic Study of the Warm Springs Groundwater Subbasin

EVMWD conducted the Hydrogeologic Study of the Warm Springs Groundwater Subbasin (Geoscience and Kennedy/Jenks Consultants 2017) to explore opportunities for developing local water supplies. This study was consistent with the long-term water supply strategy outlined in EVMWD's IRP (2017).

As shown on Figure 2.2, the Warm Springs area is located within the Elsinore Valley Subbasin. In the past it has been referred to as the Warm Springs Groundwater Subbasin although it is not officially designated as such by DWR. The primary objectives of the study were to:

- Quantify the groundwater storage and safe yield of the Warm Springs Groundwater Subbasin.
- Estimate yield for future Warm Springs Groundwater Subbasin municipal supply well(s).
- Determine water quality for the Warm Springs Groundwater Subbasin.
- Describe necessary water treatments needed for the produced water to be potable.
- Identify potential well sites.

The study found that there was a possibility that recharge in excess of pumping leaves the Warm Springs Groundwater Subbasin as outflow. In this case, installation of a groundwater well in the Warm Springs Groundwater Subbasin would have the potential to induce additional groundwater recharge through additional drawdown from pumping, and therefore increase the sustainable yield in the Warm Springs Groundwater Subbasin (Geoscience and Kennedy/Jenks Consultants 2017). The proposed location for a new well was the west-central part of the subbasin, but that additional work was recommended to verify hydrogeologic conditions and the potential influence of recycled water recharge (Geoscience and Kennedy/Jenks Consultants 2017).

2.6.13 Lake Elsinore Water Management

The relevant studies and projects on Lake Elsinore include management of water level in the lake and management of water quality.

The Elsinore Lake Management project was designed to address lake level and water quality in Lake Elsinore. The US Army Corps of Engineers, the US Bureau of Land Management, and the RCFCWCD developed and implemented the project, which was completed in 1995. The project identified the need for supplemental water to maintain the lake at an elevation range between 1,240 ft-msl and 1,247 ft-msl (modified from the original 1,249 ft-msl).

The Lake Elsinore Comprehensive Water Management Agreement (March 2003) between the City of Lake Elsinore and the Lake Elsinore Redevelopment Agency established the requirement that EVMWD reserve reclaimed water from the Regional WRF for lake replenishment (with the exception of reclaimed water needed for Temescal Wash) when the lake water level is below 1,240 ft-msl. The agreement also requires that the "Island Wells" (North State Well, Middle State Well, and South State Well) be maintained to provide supplemental water.

The water quality of Lake Elsinore has been studied extensively as a result of the development of a nutrient TMDL for the lake. The SARWQCB established TMDLs for nutrients in Canyon Lake and Lake Elsinore in 2004. The LESJWA, is a joint powers authority that was founded by the City of Lake Elsinore, City of Canyon Lake, the County of Riverside, EVMWD, and the Santa Ana Watershed Project Authority. The LESJWA established a TMDL Task Force of TMDL-affected stakeholders (TMDL Task Force). The LESJWA and the TMDL Task Force have managed the water quality monitoring required by the TMDL agreement and have led efforts to implement the TMDL through implementation of numerous nutrient source control measures throughout the watershed and in both lakes (SARWQCB Tentative Resolution R8-2019-0041).

A Tentative Basin Plan Amendment (SARWQCB Tentative Resolution R8-2019-0041), issued in April 2019, is a revision to the Nutrient TMDLs for Lake Elsinore and Canyon Lake. The revisions include revised numeric targets for both lakes to require further reductions of nutrients discharged to the lakes and an updated Implementation Plan (SARWQCB Public Notice). The revised TMDL includes WLAs and load allocations for supplemental water to Lake Elsinore.

2.6.14 Water Conservation Business Plan

The purpose of the Water Conservation Business Plan (MWM 2018) analysis was to:

- Evaluate current conservation measures and identify new ones that will reduce future water demand.
- Estimate the costs and water savings of these measures.
- Combine the measures into increasingly more aggressive programs, then evaluate the costs and water savings of these programs.

The evaluation included measures directed at existing customers and new development to help new and existing residential and business customers become increasingly more water efficient. The recommended program included 21 measures and was a combination of current and new measures. The recommended program included innovative water conservation measures, including, but not limited to, commercial, industrial, and institutional (CII) indoor water efficiency evaluations and a water neutrality ordinance (MWM 2018). The conservation measures are described in detail in the business plan (MWM 2018).

2.6.15 Drought Contingency Plan

The Drought Contingency Plan (Civiltec Engineering Inc. 2017) was developed to provide EVMWD with a plan to proactively offset the direct impacts of drought conditions. The EVMWD Drought Task Force (DTF) was identified as having key responsibilities for drought contingency actions. The plan includes the six elements listed below:

- Drought Monitoring - The plan established five drought stages and corresponding criteria (triggers for each stage). The plant identified the DTF as being responsible for monitoring water supply and/or demand conditions and determining, on a monthly basis, when the criteria/triggers are met.
- Vulnerability Assessment - The vulnerability assessment found that EVMWD is vulnerable to more frequent and longer droughts that may occur as a result of climate change. The impacts of more frequent and longer droughts are expected to include reduced imported water supply reliability and decreased local water quality and habitat.
- Mitigation Actions - The plan identified the need for mitigation measures to address the uncertainty associated with water supply reliability due to climate change, extended drought conditions, and the cost of imported water. The key mitigation measure to address these issues is to develop a long-term strategy for providing reliable water supply. The Drought Contingency Plan refers to the IRP (EVMWD 2017), which is described in Section 2.6.9.
- Response Actions - The plan identified response actions, which are planned actions that are implemented based on specific drought condition triggers. The plan utilizes the same triggers and water use restrictions as established in the EVMWD Water Shortage Contingency Plan (based on the EVMWD ordinance 225).
- Operations and Administrative Framework - The plan includes an operational and administrative framework that names the responsible parties and establishes responsibility for each element of the plan.
- Plan Update Process - The plan identifies the DTF as responsible for plan updates and outlines the process for soliciting input and review on any Drought Contingency Plan updates.

2.6.16 Water Resources Management Implementation Status

Most of the previous plans (summarized above) have included recommendations for water resources management activities in the GSP Area. Since the time of publication, many of these recommendations have been implemented. Some of the most significant recommended management actions that have been implemented are included in Table 2.1.

Table 2.1 Status of Recommended Management Activities

Management Activity	Implementation Year
Development of a Water Planning Committee(1)	2006
Development of agreement with the SARWQCB for imported water recharge and implementation of conjunctive use projects	2004
Reduction in groundwater production	2006
Implementation of a water conservation program	2009
Reduction in use of groundwater for replenishing Lake Elsinore(2)	2011
Development of septic tank conversion policies	In progress
Development of well construction and abandonment policies	2009

Notes:

(1) An Advisory Committee previously existed, however, it ceased to exist when EVMWD merged with Elsinore Water District. The existing Water Planning Committee provides some direction on groundwater management and planning issues.

(2) Reducing the use of groundwater for replenishing Lake Elsinore has not been implemented as a policy. However, since 2011, considerable decrease in this use has occurred.

2.7 General Plans

This section presents relevant elements of General Plans and other land use planning in the GSP Area as relevant to groundwater sustainability. This section 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 Elsinore Valley Groundwater Subbasin.

This section summarizes the goals, objectives, policies, and implementation measures as described in the General Plans for Riverside County, City of Lake Elsinore, City of Canyon Lake, and City of Wildomar, which, together, encompass the GSP Area. The jurisdictional boundaries in the GSP Area are presented on Figure 2.3.

Applicable general plans include:

- The Riverside County General Plan- The entire GSP Area is within Riverside County.
- City of Elsinore General Plan - Most of the GSP Area is within the City of Elsinore jurisdictional boundary. The City of Lake Elsinore General Plan includes plans and policies applicable to the entire city, and 16 districts and 18 specific plans. The most relevant districts are the East Lake District, the Riverview District, and the Lake View Hills District.
- City of Canyon Lake - The jurisdictional boundary of the City of Canyon Lake overlaps a very small portion of the GSP Area along the San Jacinto River, and water that is used and recharged in this this area eventually drains into the Elsinore Valley Groundwater Subbasin.
- City of Wildomar - The southeast region of the GSP Area is within the jurisdictional boundary of the City of Wildomar. However, the City of Wildomar does not have a city-specific general plan and, therefore, follows the Riverside County General Plan.

The goals and policies that are water resources related are summarized as follows.

2.7.1 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. There are a number of policies related to water supply and conveyance, water conservation, watershed management, and groundwater recharge. Several of these policies are summarized in Table 2.2.

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 a water-efficient landscape ordinance and corresponding 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 into 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 BMPs 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 adequate 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 ft of the outside boundary of the riparian vegetation, the top of the bank, or the 100-year floodplain, whichever is greater.

Note:

(1) The policy statements have been shortened for use in this table. The full text is included in the Riverside County General Plan.

2.7.2 City of Lake Elsinore General Plan

The City of Lake Elsinore General Plan was adopted in 2011. The plan includes three topical chapters, one of which is Resource Protection and Preservation. In addition, the plan includes 16 District Plans that cover specific, defined geographic areas within the city and its sphere of influence.

Hydrology and Water Quality are addressed in the Resource Protection and Preservation chapter. There are no specific hydrology and water quality policies in any of the District Plans. The primary goal related to hydrology and water resources is to improve water quality and ensure the water supply is not degraded as a result of urbanization of the city. Related policies include:

- Encourage developers to provide clean water systems that reduce pollutants being discharged into the drainage system to the maximum extent feasible and meet required federal National Pollutant Discharge Elimination System (NPDES) standards.
- Support public education and awareness programs to reduce pollutant discharges into the drainage system.
- Require BMPs through project conditions of approval for development to meet the federal NPDES permit requirements.
- Utilize the 1998 North American Vertical Datum to be consistent with the national standard for mean sea level, which would increase the measurement of the mean sea level for Lake Elsinore by approximately 2.4 ft.

The District Plans include a general discussion of planned growth and development within each district. The specific plans address development of specific communities within the City of Lake Elsinore and within various districts. Updates to some of the specific plans have occurred relatively recently, while others have not been revised or amended in over 10 years. The discussion below includes information select districts and specific plans in the City of Lake Elsinore.

- East Lake District - The East Lake District is located at the southeast end of Lake Elsinore and is governed by the approved East Lake Specific Plan (City of Lake Elsinore 2017). Most of the East Lake District lies within a 100-year floodplain (City of Lake Elsinore 2011). The East Lake District includes a portion of the reach of the San Jacinto River between Canyon Lake and Lake Elsinore. Residential, commercial/industrial, and recreational development has occurred in the East Lake District, under the guidance of the East Lake Specific Plan (and amendments). The most recent amendment (City of Lake Elsinore 2017) identifies additional residential and commercial development, along with preservation of open space.
- Lake Elsinore Hills District - The Lake Elsinore Hills District is located on the north side of Interstate 15 (I-15). It includes a portion of the reach of the San Jacinto River between Canyon Lake and Lake Elsinore. The Lake Elsinore Hills District is governed by many specific plans (City of Lake Elsinore 2013). The specific plans that overlap with the San Jacinto River include Canyon Creek, Tuscany Hills, and Canyon Hills. In general, these specific plans include future land use consisting of residential, commercial, recreational, and open-space areas. Per the Lake Elsinore Hills District Land Use Plan (City of Lake Elsinore 2013), some of the planned residential and commercial development was completed, and additional development (guided by the specific plans) was anticipated.
- Alberhill District - The Alberhill District is located northwest of Lake Elsinore. Historically, a significant portion of the Alberhill District was dedicated to clay mining activities.

Alberhill District goals included transitioning from mining activities to residential community uses (City of Lake Elsinore 2011). The Alberhill Villages Specific Plan (City of Lake Elsinore 2017) outlines the planned development of a new community (network of residential communities with a mix of residential, commercial, light-industrial, and public uses).

2.7.3 City of Canyon Lake General Plan

The City of Canyon Lake only has a small portion of overlap between the Elsinore Subbasin and the city limits, mostly in the area of the San Jacinto River. This area has been designated as open space.

2.7.4 General Plan Influences on EVGSA's Ability to Achieve Sustainability

Land use plans have set aside certain key areas as open space for groundwater recharge and flood control, such as the San Jacinto River and Leach Canyon. In general, however, there is planned growth the Elsinore Valley Subbasin, with conversion of uses that allow infiltration to uses that will likely not infiltrate as efficiently. While the use of low-impact development practices and stormwater BMPs that promote infiltration would help mitigate the loss of infiltration due to land use changes, future development may lead to an overall loss in groundwater recharge. In addition, changes in land use plans outside the GSP area could influence the ability of the EVGSA to achieve sustainable groundwater management. In particular, changes in land use in the regions that provide inflows to the subbasin, canyons to the northwest, and the San Jacinto River on the northeast could influence the ability of the EVGSA to achieve sustainable groundwater management.

2.7.5 GSP Influences on General Plans

GSP implementation will not affect water supply assumptions of land use plans. If necessary, there may be land use recommendations to create or maintain open space so that there is sufficient location for recharge to occur into the groundwater basin.

2.8 Additional GSP Elements

The GSP requirements include a list of additional GSP elements that may or may not be relevant to a GSP. Several of these elements are not applicable to the GSP Area. The elements, applicability to the GSP Area, and associated section of this report (if applicable) are presented in Sections 2.8.1 through 2.8.10.

2.8.1 Wellhead Protection Areas and Recharge Areas

The management of wellhead protection areas and recharge areas is documented in the Drinking Water Source Assessment and Protection Plan (Kennedy/Jenks Consultants 2002). This plan identified potential contamination sources within the 2-year, 5-year, and 10-year travel time radii for eight of EVMWD's wells (MWH 2005).

2.8.2 Groundwater Well Permitting, Construction, and Destruction Requirements

2.8.2.1 Riverside County

The Riverside County Department of Environmental Health 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 installation is complete to ensure they comply with state well standards and meet minimum drinking water standards. If found in compliance, the homeowner is issued a clearance letter authorizing their use.

2.8.2.2 EVMWD

EVMWD has a Well Construction, Destruction, and Abandonment Policy (approved in 2009). The purpose of this policy was to standardize and draft practices for subbasin-wide construction, destruction and abandonment of water wells (MWH 2011). The policy focused on protecting the groundwater subbasin through appropriate abandonment and destruction wells (MWH 2011). The policy is included in Appendix G.

EVMWD, with oversight from the Elsinore Basin Groundwater Advisory Committee, has developed the WELLSAFE program. The WELLSAFE program offers free well caps and professional installation to any and all property owners within the subbasin who have wells that are no longer in use, either temporarily or permanently.

2.8.3 Groundwater Contamination Migration and Clean-Up

Previous studies have investigated nitrate contamination from septic systems (see Sections 2.6.1 and 2.6.6). In addition, there are other sources of groundwater contamination in the Elsinore Valley Subbasin.

There are several contaminated sites in the Elsinore Valley Subbasin that are in varied stages of remediation. The remediation activities for contaminated sites directly over the Elsinore Valley Subbasin are managed and tracked by the SARWQCB. GeoTracker is the SWRCB data management system (DMS) for sites that impact groundwater or have the potential to impact groundwater. GeoTracker contains sites that require groundwater cleanup and the status of required clean-up activities. In the Elsinore Valley Subbasin, there are a number of closed sites (where clean-up activities have been completed). Currently there are six open sites, as shown on Figure 2.11. The pollutants of concern for these sites include metals, hydrocarbons, motor oil, and gasoline. The status of each site is summarized in Table 2.3.

Table 2.3 Status of Contamination Sites in the Elsinore Valley Subbasin

Site	Contaminants of Concern	Status	Comments
Elsinore Landfill	Non-specified	OPEN - Closed/with monitoring as of 1/1/2014	This landfill is inactive and does not accept any solid waste. Acceptance of refuse was halted on 10/31/1986. Closure construction at the site was completed in November 1992; final closure certification was completed in 1994.
Village Cleaners	Chlorinated hydrocarbons, tetrachloroethylene	OPEN - Inactive as of 7/1/1992	None.

Site	Contaminants of Concern	Status	Comments
Pinto and Crasnean Properties	Lead, total petroleum hydrocarbons (TPH), waste oil/motor/ hydraulic/lubricating	OPEN - Inactive as of 7/25/2018	On 2/26/2002, Riverside County transferred oversight responsibilities for this case to the Regional Board due to non-compliance with cleanup directives. Regional Board staff are researching historical use of the site to determine responsible parties.
Marlar's Auto Service	Gasoline	OPEN - Inactive as of 3/15/2016	None.
Arco #5346	Gasoline	OPEN - Remediation as of 4/7/2008	Groundwater monitoring and remediation required.
Mobil #18-991	Gasoline	OPEN - Remediation as of 9/4/2007	Groundwater monitoring and remediation required. "Pump and treat" was conducted.

2.8.4 Conjunctive Use and Underground Storage Program

EVMWD has an ongoing conjunctive use program in the Elsinore area since 2005. Eight of EVMWD's groundwater wells were converted to dual-purpose injection/extraction. Since 2013, the Elsinore area has been operated using in-lieu conjunctive use, with water pumped during dry years, and pumping minimized during other years. EVMWD has an ongoing agreement with MWDSC to reduce their imported water supply purchases during dry years and to receive additional water in wet years as part of their conjunctive use program.

2.8.5 Miscellaneous Measures

EVMWD has taken various measures to address addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects.

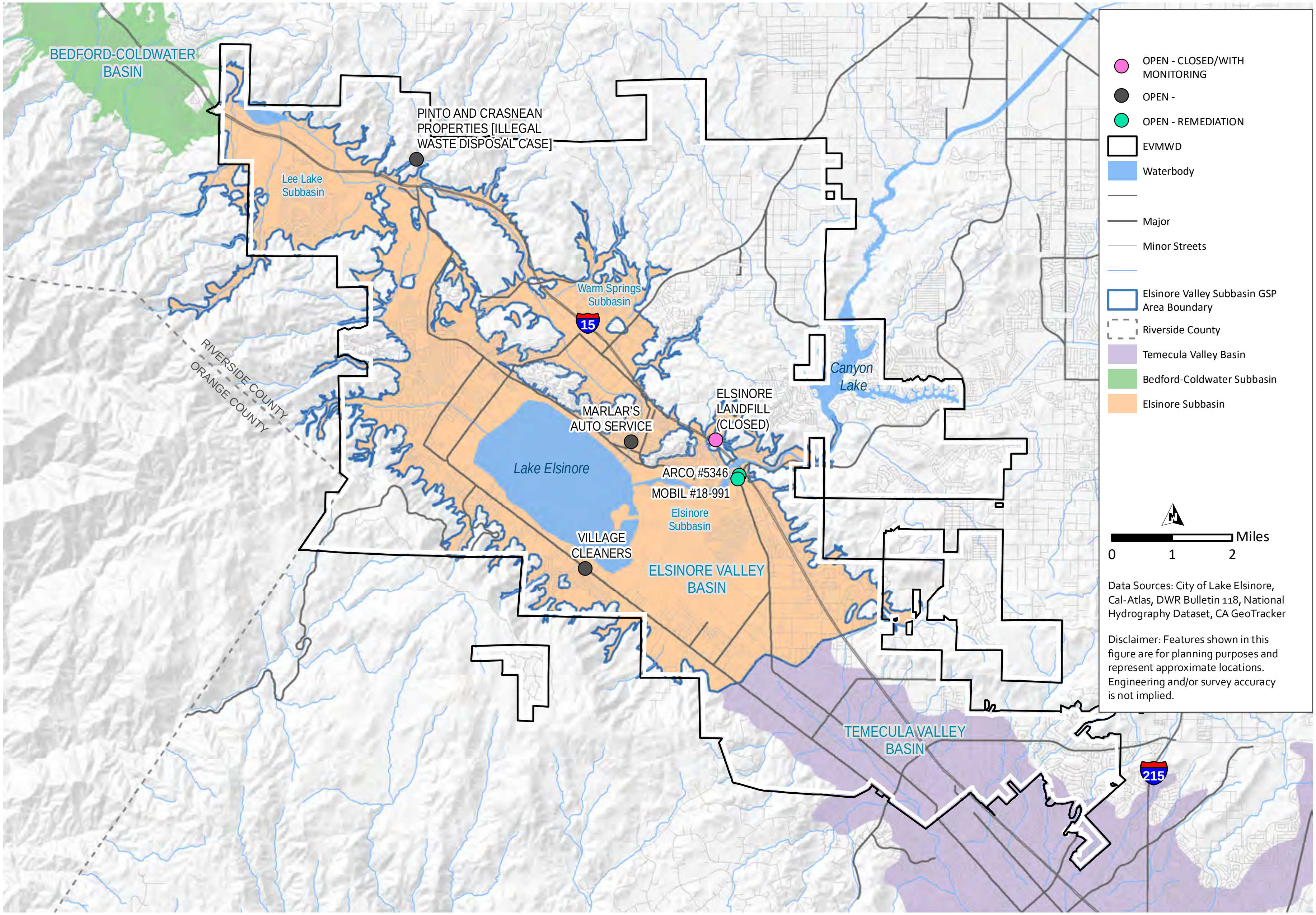
Measures addressing groundwater contamination cleanup are discussed in Section 2.8.3.

As noted in Section 2.8.4, EVMWD has an ongoing groundwater recharge and in-lieu use program. There is also an effort to collect stormwater in recharge areas such as McVicker Canyon, as discussed in the 2005 GWMP.

EVMWD has an active water conservation program, and the conservation program is discussed in EVMWD's Water Conservation Plan (EVMWD 2018) and documented in EVMWD's quinquennial Urban Water Management Plan (MWH 2016).

EVMWD has an existing recycled water system, and its proposed recycled water system is discussed in their Recycled Water Master Plan (MWH 2016).

EVMWD does not have any current conveyance and extraction projects underway (some planning projects may begin by the time the final version of this report is published).



Data Sources: City of Lake Elsinore, 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.

Figure 2.11 Groundwater Contamination Sites

2.8.6 Efficient Water Management Practices

EVMWD has an active water conservation program, and the conservation program is discussed in EVMWD's Water Conservation Plan (EVMWD 2018) and documented in EVMWD's quinquennial Urban Water Management Plan (MWH 2016).

2.8.7 Relationships with State and Federal Agencies

The EVGSA has developed a stakeholder list, which includes local groups, state agencies, and federal agencies. These stakeholders have a variety of different interests/expertise, including holders of groundwater rights, public water systems, land use planning agencies, regulatory agencies, etc. These stakeholders will be engaged throughout the development of the Elsinore Valley Subbasin GSP.

2.8.8 Land Use Plan Coordination

Land use planning agencies have been invited as stakeholders to the GSP planning process. EVMWD recognizes the importance of the natural recharge areas, where stormwater is recharged into the groundwater basin. Certain key locations, such as McVicker Canyon, have been designated as open space in order to allow for the groundwater recharge.

2.8.9 Impacts on Groundwater Dependent Ecosystems

Previous reports do not indicate the presence of GDEs. However, if there is not sufficient water (groundwater or recycled water) to maintain the water level of Lake Elsinore, then some habitat loss could occur (MWH 2005).

2.8.10 Control of Saline Water Intrusion

The Elsinore Valley Subbasin is located more approximately 30 miles from the ocean, and, therefore, seawater intrusion is not considered to be a threat. While Lake Elsinore is more saline than the underlying groundwater, confining clay layers limit migration of lake water into the underlying groundwater (MWH 2005).

Chapter 3

HYDROGEOLOGIC CONCEPTUAL MODEL

This chapter describes the hydrogeologic conceptual model of the Elsinore Valley Subbasin (Subbasin), including the boundaries, geologic formations and structures, principal aquifer units, and recharge and discharge areas. The Hydrogeologic Conceptual Model presented in this chapter is a summary of relevant and important aspects of the Subbasin 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. 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 Elsinore Valley Subbasin (8-4.1) underlies a portion of the Elsinore Groundwater Basin (8.4) in southwestern Riverside County and covers approximately 200 square miles. Elsinore Valley Subbasin is adjacent to two other groundwater basins/subbasins: the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin (8-4.2) to the north and the Temecula Valley Basin (9-5) to the south. Ground surface elevation in the Subbasin range from just over 1,000 ft-msl in the northwest at the boundary with the Bedford-Coldwater Subbasin to over 2,000 ft-msl at the western boundary in the Santa Ana Mountains. Figure 3.1 illustrates the topography of the Subbasin and surrounding uplands. Note that this map and all others in this section have been reoriented (relative to maps in Chapter 2) in order to maximize the basin area and to better show detailed information; as shown, the north arrow does not point to the top of the page.

The Subbasin consists of three general hydrologic areas (Figure 3.1): the Elsinore Area that is the main, southern portion of the Subbasin, the Lee Lake Area located at the northern downstream portion of the Subbasin, and the Warm Springs Area in the northeastern Subbasin. The Elsinore Area is the largest area of the Subbasin and provides most of the groundwater production. It is located in the southern and central Subbasin and is bounded on the west and north by the highlands of the Santa Ana Mountains, to the south by the Temecula Valley Basin, and to the east by bedrock outcrops in the pediment of the Temescal Mountains. The Lee Lake Area is the northernmost part of the Subbasin bounded by the Santa Ana Mountains to the west and the Temescal Mountains to the east. The Lee Lake Area has limited hydraulic connection with the Elsinore Area to the south through narrow alluvial valleys between bedrock highs and a similarly limited connection to the Bedford-Coldwater Subbasin to the north through the narrow and shallow alluvial channel of the Temescal Wash (Todd and AKM Consulting Engineers (AKM) 2008). The Warm Springs Area is located in the northeast of the Subbasin and is bordered on the north and east by the Temescal Mountains. The Warm Springs Area is connected to both the Elsinore and Lee Lake Areas through the Temescal Wash.

3.2 Surface Water Features

Figure 3.2 shows surface water features including rivers, streams, lakes, and ponds within and surrounding the Subbasin. The sub-watersheds (USGS 2020a) that drain into and through the Subbasin are shown on Figure 3.3. The Subbasin covers portions of the Dawson Canyon-Temescal Wash, Arroyo Del Toro-Temescal Wash, and Lake Elsinore subwatersheds and the low-lying part of the Railroad Canyon Reservoir-San Jacinto River subwatershed.

Most of the Subbasin is within the Lake Elsinore watershed. Lake Elsinore is a natural lake with an area of approximately 3,300 acres. In the past the lake has varied in size from 6,000 acres in very wet years to a dry playa in drought years. In 1995, a levee was constructed to maintain the lake at a fixed size and to moderate historical variations in lake surface area. (MWH 2005).

Railroad Canyon Reservoir, located upstream of the Subbasin in the San Jacinto River Watershed, is a reservoir that is fed by the San Jacinto River watershed and, occasionally, untreated imported water from connections to the MWDSC CRA and the SWP. Canyon Lake spills into Railroad Canyon which in turn flows to Lake Elsinore (MWH 2002).

3.3 Soils

Soil characteristics 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 United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (NRCS2020) 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 the underlying geology or hydrogeology. The hydrologic group information relates to the material in the top 6 ft of the subsurface. Soils with high infiltration rates can be underlain by low permeability materials (silts and clays), or vice versa. As shown on Figure 3.4 the hydrologic characteristics of soils in the Subbasin range from Group A to Group D. The Elsinore and Lee Lake Areas generally have more high infiltration rate soils, while those in the Warm Springs area generally have lower infiltration rates.

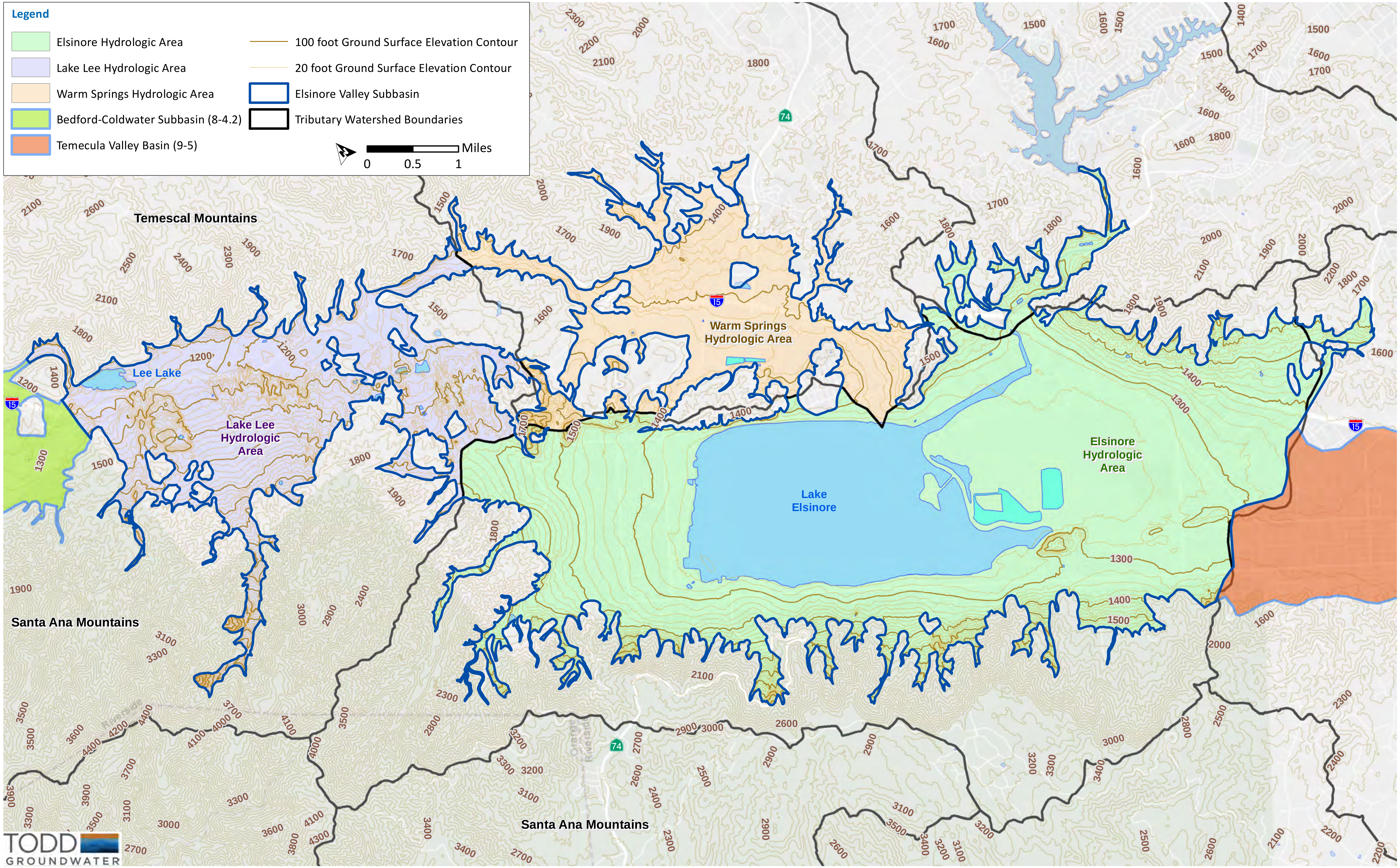


Figure 3.1 Basin Topography

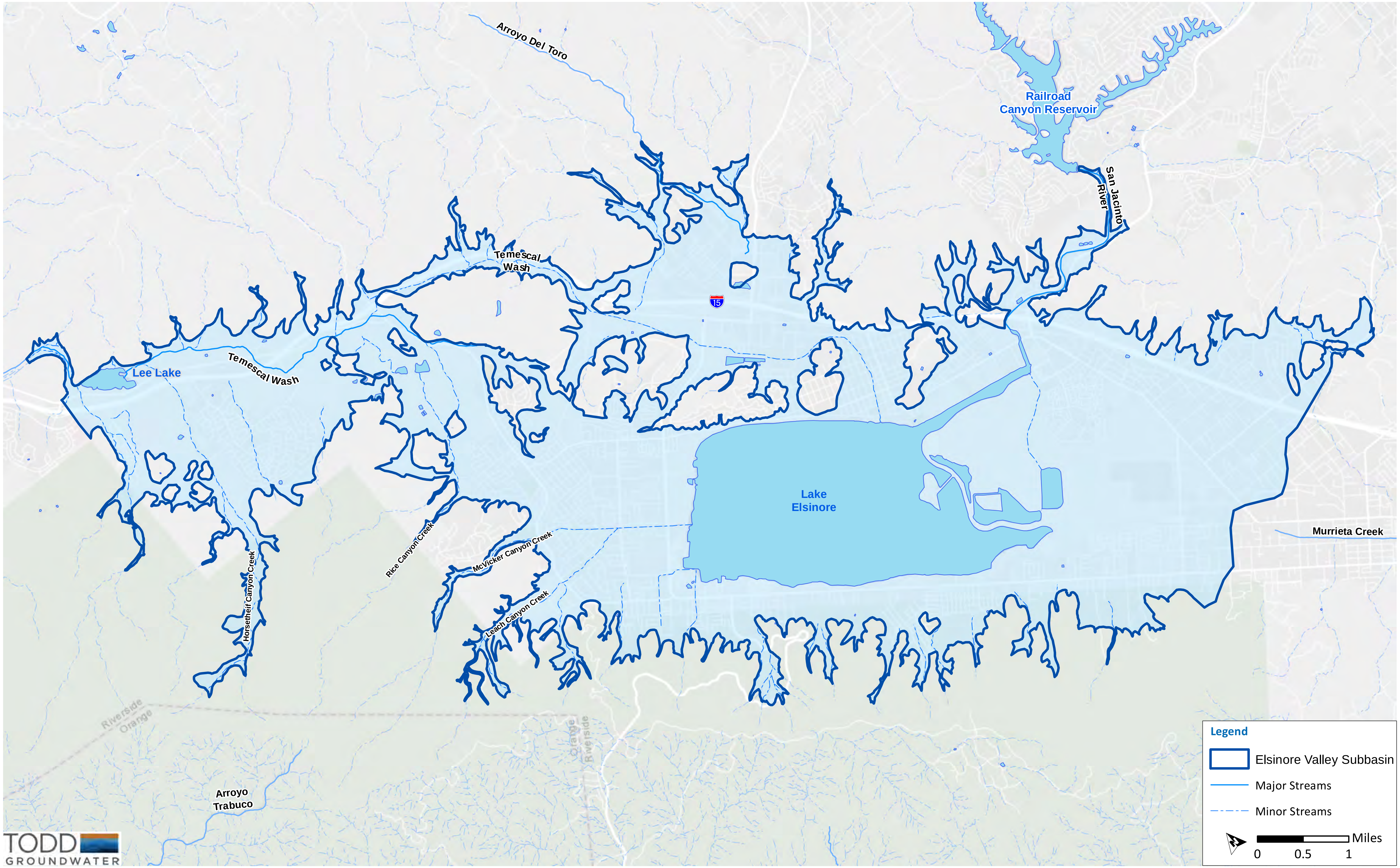


Figure 3.2 Surface Water Bodies Tributary to Elsinore Valley Subbasin

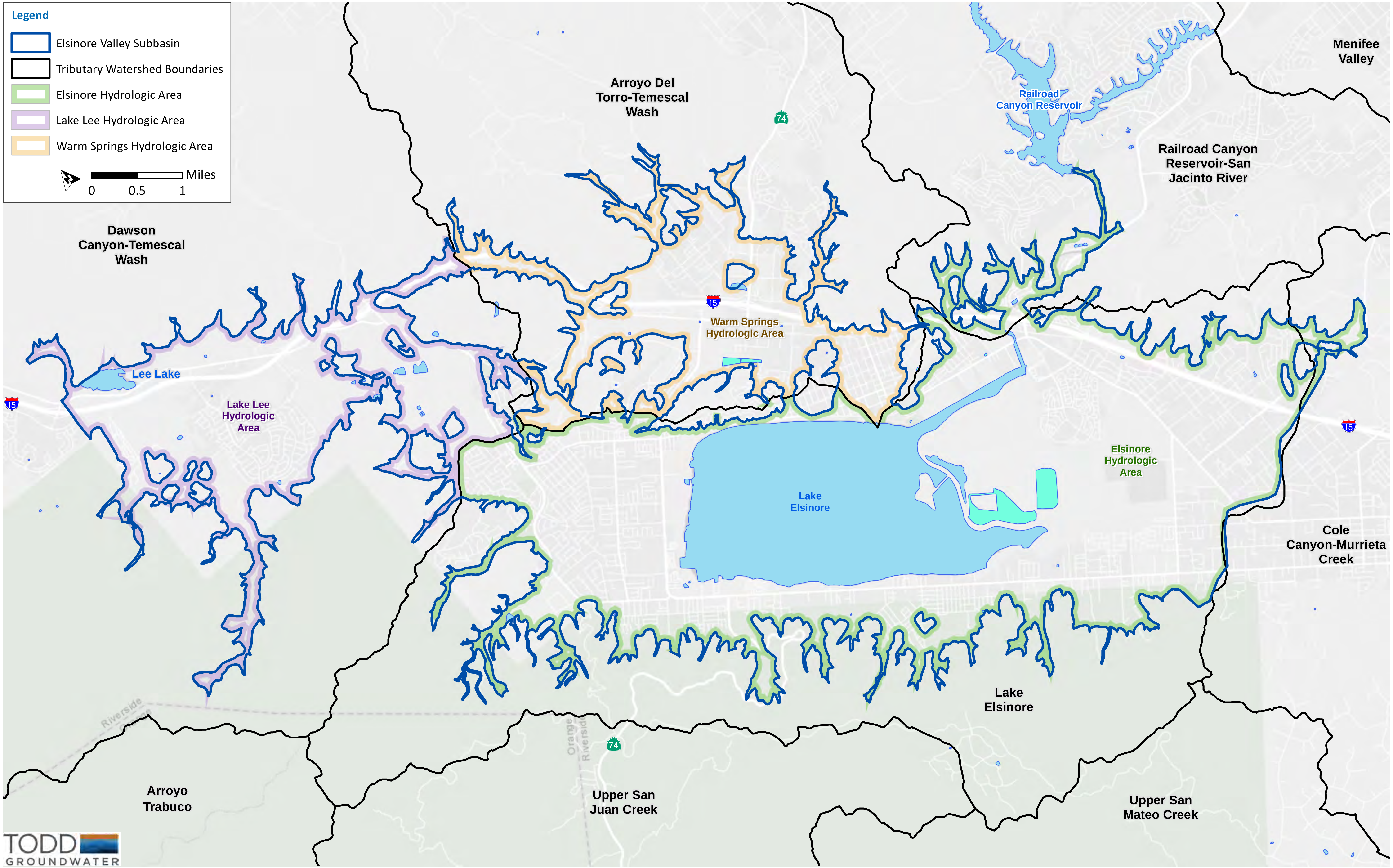
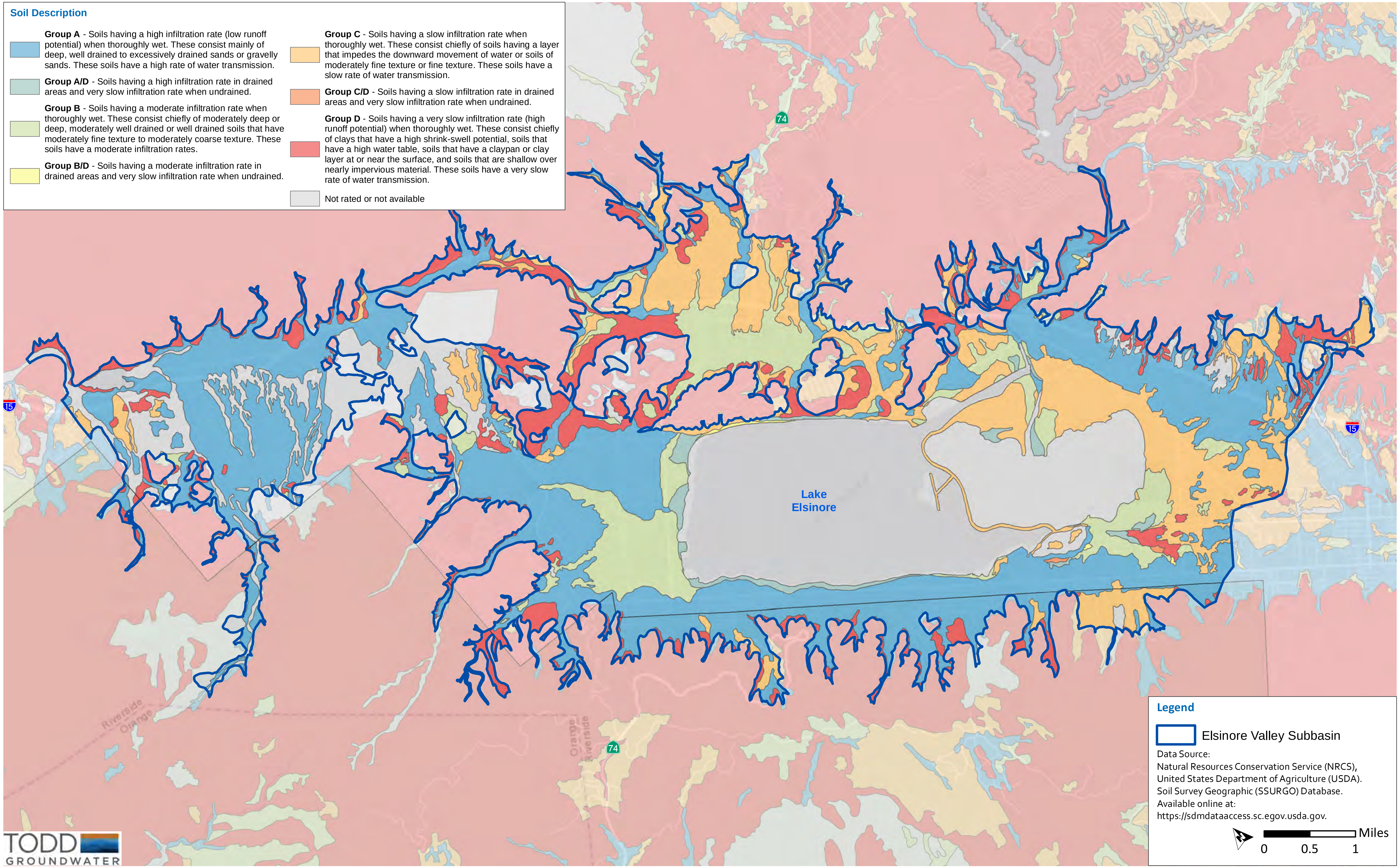


Figure 3.3 Tributary Watershed



Soil Description

🟦	**Group A** - Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
🟦	**Group A/D** - Soils having a high infiltration rate in drained areas and very slow infiltration rate when undrained.
🟩	**Group B** - Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate infiltration rates.
🟨	**Group B/D** - Soils having a moderate infiltration rate in drained areas and very slow infiltration rate when undrained.
🟧	**Group C** - Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
🟧	**Group C/D** - Soils having a slow infiltration rate in drained areas and very slow infiltration rate when undrained.
🟥	**Group D** - Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.
⬜	Not rated or not available

Legend

☐ Elsinore Valley Subbasin

Data Source:
Natural Resources Conservation Service (NRCS),
United States Department of Agriculture (USDA).
Soil Survey Geographic (SSURGO) Database.
Available online at:
https://sdmdataaccess.sc.egov.usda.gov.

Figure 3.4 Subbasin Soil Hydrologic Properties

3.4 Geologic Setting

The Subbasin is located within one of the structural blocks of the Peninsular Ranges of Southern California. The groundwater basins in this region occupy valleys in linear, low-lying areas between the Santa Ana and Elsinore Mountains on the west and the Temescal Mountains, Perris Plain, and Gavilan Plateau on the east (Norris and Webb 1990). These valleys were formed by differential movement between parallel strike slip faults to form a pull-apart basin (Dorsey et al. 2012). Within the Subbasin, the large pull-apart basin is located within the Elsinore Area between the Glen Ivy and Wildomar Faults (Figure 3.5). These faults are associated with the Elsinore Fault Zone, which extends approximately 120 miles from Baja California north to the Corona area where it divides into the Whittier and Chino Faults (MWH 2005 and Todd and AKM 2008). The active Elsinore Fault Zone diagonally crosses the Subbasin and is a major element of the right-lateral strike-slip San Andreas Fault system. The Elsinore Fault Zone separates the Santa Ana Mountains block west of the fault zone from the Perris block to the east (Morton and Weber 2003).

Over the course of geologic history, the Subbasin would have been characterized by various streams and lakes like the San Jacinto River, Temescal Wash, and Lake Elsinore of today. These surface water features have changed in location and course over time with resulting variations in erosion and deposition. Given all the above, the geologic setting of the Subbasin is complex.

3.4.1 Pull-Apart Basin

The Elsinore Fault Zone forms a complex series of pull-apart basins (Morton and Weber 2003). A total of 10 kilometers of dextral strike-slip separation at an average rate of 4 to 7 millimeters per year occurred along several overlapping fault segments in which at least two pull-apart basins developed. The largest and most pronounced of these pull-apart basins forms a flat-floored closed depression within the Subbasin that is approximately 7 miles long and 5.5 miles wide and partly filled by Lake Elsinore (Dorsey et al. 2012).

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*. Basins commonly display a length to width ratio of 3:1 (Wu et.al. 2012).

The Subbasin developed along in the pull-apart basin in the northern Elsinore fault zone over the last 2 million years (Dorsey et al. 2012). The pull-apart basin is bounded by active faults flanked by both Pleistocene and Holocene alluvial fans emanating from both the Perris block and the Santa Ana Mountains. Although the basin sidewall faults have not been definitively identified, they are expressed by the rapid change in lithology and basin depth at the northwestern and southeastern margins of the basin.

As the Subbasin formed, it was apparently occupied by streams, rivers, and lakes similar to the San Jacinto River and Lake Elsinore of today. As a result, the geology and structure of the Subbasin is complex (Morton and Weber, 2003). Geologic units regarded as within the Subbasin include the Pauba Formation consisting of sandstones, siltstones, and clays (DWR 2003 and 2016) and the late Pleistocene to Holocene alluvium, which includes from alluvial fan, fluvial, flood plain and lacustrine (lake) deposits. In places, these deposits include fine-grained layers that restrict vertical movement of groundwater. For example, clay layers deposited by the ancestral and current

Lake Elsinore create a shallow zone of saturation that is largely disconnected from the underlying regional aquifer (Kirby 2019).

3.4.2 Geologic Units

Geologic units in the groundwater basin include the Pauba Formation consisting of sandstones, siltstones, and clays (DWR 2003 and 2016) and the late Pleistocene to Holocene alluvium, which includes alluvial fan, fluvial, flood plain and lacustrine (lake) deposits. Surficial geology for the Subbasin is shown on Figure 3.5; additional details relating to the geologic units in and around the Subbasin are presented below.

Bedrock units surrounding, below and within the boundaries of the Subbasin generally consist of granodiorite, tonalite, and diorite rocks of Jurassic to Cretaceous age (Neblett and Associates 1998 and USGS 2004 and 2006) as well as metasedimentary rocks (slates and sandstones) of Jurassic age.

3.4.2.1 Recent Alluvium

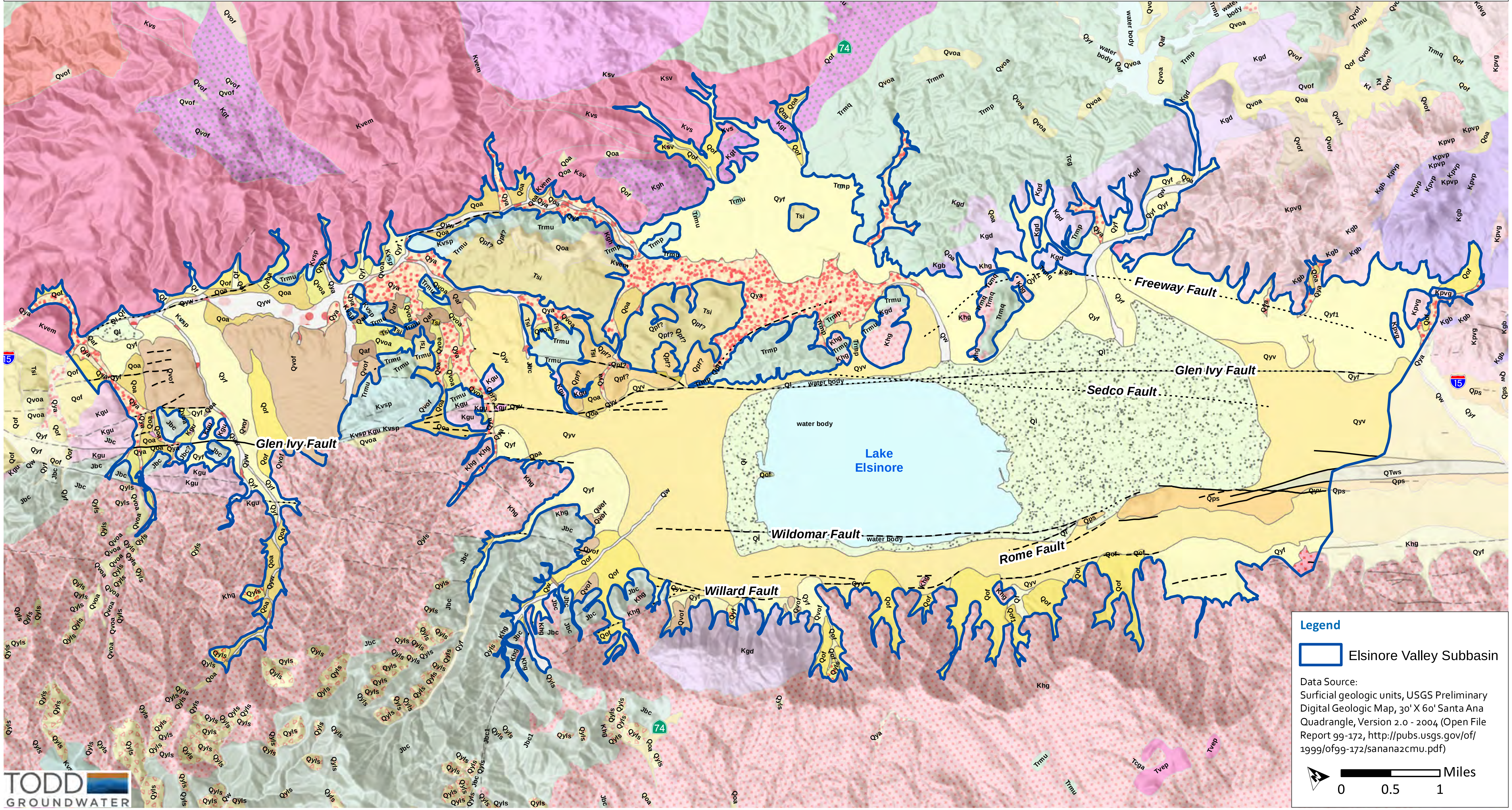
Recent alluvium comprises the youngest geologic units in the Subbasin. These are Quaternary artificial fill, very young wash deposits, very young alluvial-fan deposits, very young lacustrine deposits, young wash deposits, young alluvial-fan deposits, young axial-channel deposits, young alluvial-valley deposits, and young landslide deposits (USGS 2004 and 2006). These units generally consist of interfingering gravels, sands, silts and clays resulting from fluvial, alluvial fan, lacustrine, and landslide depositional environments. Most of these interfingering lenses are laterally discontinuous and do not correlate well across long distances (MWH 2005 and 2009). The combined recent alluvium is more than 300-ft thick in some portions of the Subbasin, particularly in the center of the Elsinore Area (Geoscience 1994). This hydrologic area also has clay deposits as much as 100-ft thick at or near the surface, which impedes percolation of water (MWH 2005). These clay deposits are most common beneath Lake Elsinore in the center of the hydrologic area, and they are responsible for retaining the lake. The presence of these low permeability materials limits the hydraulic connection between Lake Elsinore and the underlying aquifer materials.

3.4.2.2 Older Alluvium

Older alluvium is similar to the recent alluvium, consisting of interfingering gravels, sands, silts and clays of Quaternary age deposited from older alluvial fan and fluvial depositional environments. The older alluvium includes alluvial-fan, old axial-channel, old alluvial-valley, very old alluvial-fan, very old axial-channel (USGS 2004 and 2006). The older alluvium, like the recent alluvium, is up to 300-ft thick in the deepest area of the Subbasin (Geoscience 1994). Because of their similar depositional environments, clear and definitive lithologic markers between recent and older alluvium generally cannot be determined from well logs. However, older alluvium is generally more consolidated and contains more clay than does the recent alluvium (Geoscience 1994).

Surficial Geology Description

- Fault Location, dashed where uncertain dotted where concealed
- Qaf - Artificial fill
- Qw - Very young wash deposits
- Qf - Very young alluvial-fan deposits
- Ql - Very young lacustrine deposits
- Qyw - Young wash deposits
- Qyf - 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
- Qvof - Very old alluvial-fan deposits
- Qvoa - Very old axial-channel deposits
- Qps, Qpf - Pauba Formation
- QTws - Sandstone and conglomerate of Wildomar area
- Tcgr - Rhyolite-clast conglomerate of Lake Mathews area
- Tcg - Conglomerate of Lake Mathews area
- Tvsr - Santa Rosa basalt of Mann (1955)
- Tvep - Basalt of Elsinore Peak
- Tcga - Conglomerate of Arlington Mountain
- Tsi - Silverado Formation
- Kgr - Granophyre
- Kgg, Kgt, Kgtf, Kgti, Kgh, Kght - Gavilan Ring Complex
- Katg - Granodiorite of Arroyo del Toro Pluton
- Kcto, Kcg, Kcgd, Kct, Kcgq, Kcgb - Cajalco Pluton
- Kdvg - Domenigoni Valley Pluton
- Kgbf - Fine-grained hornblende gabbro, Railroad Canyon area
- Kpvgr, Kpvp, Kpvg, Kpvgb - Paloma Valley Ring Complex
- Kgu - Granite, undifferentiated
- Kgd - Granodiorite, undifferentiated
- Kt - Tonalite, undifferentiated
- Kd - Diorite, undifferentiated
- Kgb - Gabbro, undifferentiated
- Khg - Heterogeneous granitic rocks
- Kvsp, Kvspi - Santiago Peak Volcanics
- Kvem, Kvr, Ksv, Kvs - Estelle Mountain volcanics of Herzig (1991)
- Jbc, Jbcm - Bedford Canyon Formation
- Trmu, Trmq, Trmgp, Trmp, Trms, Trmm - Rocks of Menifee Valley
- Water Body



Legend

Elsinore Valley Subbasin

Data Source:
Surficial geologic units, USGS Preliminary Digital Geologic Map, 30' X 60' Santa Ana Quadrangle, Version 2.0 - 2004 (Open File Report 99-172, http://pubs.usgs.gov/of/1999/of99-172/sanana2cmu.pdf)

Figure 3.5 Surficial Geology

3.4.2.3 Tertiary Sedimentary Formations

The Pauba Formation is a non-marine Pleistocene unit of the Peninsular Range Assemblage (USGS 2004 and 2006) characterized by poorly sorted, subangular granitic sands and gravels with laterally discontinuous lenses of silts and clays (Geoscience 1994 and MWH 2005 and 2009). It is sometimes locally referred to as the Fernando Group (MWH 2005 and 2009). It is generally impossible to distinguish the Pauba Formation from the overlying alluvium as they are both characterized by the same lithology. The Pauba Formation is thin or absent along the margins of the Subbasin but is as much as 1,200-ft thick in the center of the Subbasin (MWH 2005).

In the Warm Springs and Lee Lake Areas there are exposures of the Paleocene Silverado Formation. Clay beds of the Silverado Formation have been an important source of clay. Overlying the Silverado Formation are discontinuous exposures of conglomeratic younger Tertiary sedimentary rocks that are tentatively correlated with the Pauba Formation (Harder 2014).

The Bedford Canyon Formation is characterized by blue to black slate alternating with layers of fine-grained sandstone. The Bedford Canyon Formation occurs over a large area of the Lee Lake Area that underlies the Recent and Older Alluvium throughout the Lee Lake Area. Groundwater in the Bedford Canyon Formation occurs primarily in fractures and weathered zones that are found at shallow depths that does not produce significant groundwater supplies (Geoscience 1994).

3.4.2.4 Tertiary Peninsular Range Assemblage

The local Tertiary material of the Peninsular Range Assemblage consists of a mixture of sedimentary and igneous rocks. These include the sandstone and conglomerate of the Wildomar area, rhyolite-clast conglomerate of Lake Mathews area, conglomerate of Lake Mathews area, Santa Rosa basalt of Mann (1955), basalt of Elsinore Peak, conglomerate of Arlington Mountain, Silverado Formation (USGS 2004 and 2006). The sedimentary units in this group are composed of partially to fully lithified sandstones and conglomerates (coarse-grained rocks with a large fraction of gravel-sized particles) and the igneous units are basalts which result from surficial volcanic activity. None of these units are known to have significant potential for groundwater production due to low porosity and storativity.

3.4.2.5 Cretaceous Peninsular Range Assemblage

Much of the area surrounding the Subbasin is characterized by Cretaceous intrusive igneous rocks, commonly referred to as granites. These units are present at varying depths and have limited to no primary porosity, although groundwater is sometimes present in fractures. These are not productive aquifer units, and in many places represent the bottom of the Subbasin.

3.4.2.6 Jurassic Bedford Canyon Formation

The Bedford Canyon Formation (USGS 2004 and 2006) is an older, lithified, sedimentary to metasedimentary unit of the Peninsular Range Assemblage characterized by blue to black slate alternating with layers of fine-grained sandstones of Jurassic age. This formation crops out in areas outside the Subbasin and generally underlies the Pauba Formation at depth within the Subbasin (Geoscience 1994). Groundwater in the Bedford Canyon Formation is generally limited to shallow weathered zones and fractures at depth.

3.4.2.7 Triassic Rocks of the Menifee Valley

The Rocks of the Menifee Valley are the oldest geologic units cropping out in the area around the Subbasin (USGS 2004 and 2006). These are primarily metamorphosed sedimentary rocks of

Triassic age that likely have no primary porosity and limited potential for groundwater production from fractures.

3.5 Faults

The Elsinore Valley Subbasin contains two major faults – the Glen Ivy Fault zone including the inferred Sedco and Freeway faults and the Wildomar Fault zone, which includes the Wildomar Fault, Rome Fault and Willard Fault – as shown on Figure 3.5. These faults are steeply dipping (nearly vertical) with predominant right-lateral strike-slip motion. Together they represent the Elsinore Fault Zone (Norris and Webb 1990, Treiman 1998, MWH 2005, and USGS 2004 and 2006).

The Glen Ivy Fault may present a partial barrier to groundwater flow in the southern Elsinore Area sometimes referred to as the Back Basin. This is based on water level differences and on analysis of sources of groundwater recharge across the fault, as evaluated in the Back Basin Pilot Injection Program (BBPIP, MWH 2005).

The Rome Fault, a splay of the Wildomar Fault, results in the local topographic high called Rome Hill. Differences in water levels across the Rome Fault indicate that it also may be a barrier to groundwater flow (MWH 2005) and may hinder subsurface flow from the highlands south of the fault to the central portion of the Elsinore Area. However, this area of the Subbasin also has more low permeability materials (resulting from lake deposition of fine-grained sediments) that may impede flow.

The Willard Fault, which extends along the southeast and eastern side of the Subbasin, offsets basement rocks in the area but does not appear to be a barrier to flow (MWH 2005). The Wildomar Fault parallels the Willard Fault near the edge of Lake Elsinore and does appear to be a barrier to groundwater flow.

3.6 Aquifers

3.6.1 Description of Principal Aquifer Units

The principal aquifer units in the Subbasin vary among the three hydrologic areas as described below. A single principal aquifer is defined in the Elsinore, Lee Lake, and Warm Springs areas, respectively.

3.6.1.1 Elsinore Hydrologic Area

The alluvium and the Pauba Formation together form the principal aquifer units in the Elsinore Area. While these aquifers may be delineated in some locations, they are not necessarily hydraulically distinct in all areas of the Subbasin; both are productive groundwater resources.

The alluvium (both young and old) in the Elsinore Area forms the shallowest aquifer units. These alluvial deposits may be more than 300-ft thick locally and are composed of interfingered gravels, sands, silts, and clays (MWH 2005). Groundwater is generally unconfined in these aquifer units, and perched conditions may occur in the shallow alluvial materials. The alluvial aquifer may be separated in some locations from the underlying Pauba Formation by a clay aquitard (MWH 2005).

The Pauba Formation is composed of medium to coarse-grained sandstones, siltstones, and clay (DWR 2003 and 2016 and MWH 2005 and 2009) and is up to 2,300-ft thick beneath Lake Elsinore (DWR 2003 and 2016). Groundwater is semi-confined to confined in the Pauba Formation. The Pauba Formation appears to be more confined toward the center of the Elsinore Area and less so where it is present on the edges of the hydrologic area. Confinement in the Pauba Formation is gradational towards the center of the Elsinore Area, likely resulting from fine-grained content increasing towards Lake Elsinore. The Bedford Canyon Formation (which crops out in parts of the Lee Lake Area) underlies the Pauba Formation in the Lake Elsinore Area but does not produce significant groundwater (MWH 2005).

Granitic bedrock underlies the aquifer units in this hydrologic region at depths from as shallow as 50 ft and up to 2,800 ft (MWH 2005). These underlying granites do not produce significant groundwater, except in fractures (MWH 2005).

3.6.1.2 Lee Lake Hydrologic Area

The alluvium along Temescal Wash is the principal aquifer in the Lee Lake Area (Harder 2014). The alluvial deposits are a mix of interlayered gravels, sands, silts, and clays resulting from alluvial fan and fluvial processes (USGS 2004 and 2006). Alluvial aquifer materials are present in other parts of this hydrologic area, but their extent and production capacity are uncertain.

The Jurassic Bedford Canyon Formation, composed of alternating slate and fine-grained sandstone, underlies alluvial deposits in this hydrologic area and is generally less than 200-ft deep (Harder 2014). It is reported to have some groundwater production potential (Harder 2014).

3.6.1.3 Warm Springs Hydrologic Area

The principal aquifer in the Warm Springs Area is alluvium including surficial alluvial fan and fluvial deposits (Geoscience 2017). The Silverado Formation underlies the alluvial deposits and comprises an upper calcareous sandstone member and a lower non-marine sandstone member with a basal conglomerate. It consists mainly of poorly sorted coarse-grained sandstone interlayered with low permeability clay beds (Schoellhamer et al. 1981). The Silverado Formation has limited groundwater production potential (Geoscience 2017).

3.6.2 Physical Properties of Aquifers

Summary descriptions of Subbasin aquifers are provided in the geologic setting section above. Estimates of aquifer parameter are available from testing of municipal wells located mostly in the Elsinore Area. These tests indicate transmissivity (the rate at which water passes through a unit width of the aquifer under a unit hydraulic gradient) values ranging between 850 to over 220,000 gallons per day per foot (gpd/ft). The aquifer parameter values from testing have been assessed along with other aquifer properties in association with numerical model construction and calibration. Available aquifer parameter information and distribution within the Subbasin are described in the numerical model documentation report included in Appendix G.

3.6.3 Description of Lateral Boundaries

The Subbasin is defined largely by the contact between consolidated bedrock, which surrounds and underlies the Subbasin, and the alluvium (DWR 2003 and 2016, WEI 2000, MWH 2005, Harder 2014, and Geoscience 2017). These bedrock/alluvial contacts occur in association with the development of the pull-apart basin along the Elsinore Fault Zone between the Santa Ana and Temescal Mountains.

The Subbasin adjoins the Bedford-Coldwater Subbasin on the north (Figure 3.1). This Subbasin boundary is defined by thin alluvial material, shallow bedrock, and a narrow valley north (downstream) of the Lee Lake Area (Todd and AKM 2008, Harder 2014, and WEI 2015). Only minor inter-basin flow occurs across this narrow boundary within the bedrock canyon along Temescal Wash (Todd and AKM 2008).

The southern edge of the Subbasin is defined by a surface water drainage divide, low permeability sediments, and shallow bedrock that limit groundwater flow into or from the Temecula Valley Basin (DWR 2003 and 2016 and WEI 2000). This southern boundary is aligned with a surface water divide between the Lake Elsinore watershed and the Cole Canyon-Murrieta Creek sub-watersheds, which is also the divide between the San Jacinto Valley and Santa Margarita watersheds (WEI 2000).

3.7 Structures Affecting Groundwater

The Elsinore Valley Subbasin is defined largely by the lateral extent of alluvium bounded by bedrock. The southern and northern boundaries with the Bedford-Coldwater Subbasin and Temecula Valley Basin, respectively, are defined at least in part by shallow bedrock (Todd and AKM 2008, Harder 2014, and WEI 2015). These windows of shallow bedrock limit and control groundwater flow in those areas.

The major faults within the Subbasin do affect groundwater levels and flow as discussed briefly in Section 3.5 above (MWH 2009). Groundwater flow is primarily from the margins of the Subbasin towards the central, deeper areas; especially in the Elsinore Area. Groundwater levels within this deep portion of the Subbasin are currently significantly lower than those in areas between the boundary of the Subbasin and the faults. In these marginal areas, groundwater levels are generally shallow, but groundwater flow is towards the center of the Subbasin indicating that the faults cause restrictions to flow rather than barriers. Groundwater flow is most affected by the major regional faults that bound the deep pull-apart basin area (see Figure 3.5). The other faults shown on Figure 3.5 located in areas away from the large pull-apart basin are considered to have a minor effect on groundwater flow.

3.8 Definable Basin Bottom

The bottom of Elsinore Valley Subbasin is defined by various low permeability bedrock formations including but not necessarily limited to those forming the Subbasin boundaries on Figure 3.5. The depths to bedrock in the Elsinore Valley Subbasin generally are shallow around the perimeter and deep in the center. Depth to bedrock in the Lee Lake Area ranges from less than 50 ft to approximately 200 to 400 ft (Harder 2014), while depth to bedrock in the Elsinore Area ranges from approximately 200 to 2,800 ft (MWH 2005 and 2009). Depth to bedrock in some portions of the Warm Springs Area is less than 50 ft but is variable and uncertain in other areas; some investigations have previously estimated local depths between 600 and 1,000 ft (Geoscience 2017), but recent drilling revealed depths to bedrock less than 50 ft. Given the complex structural setting and the numerous bedrock outcrops within the general area of the Subbasin, the depth to bedrock, and associated Subbasin bottom, is expected to be highly variable. No mapping of the depth of the Subbasin bottom exists. While estimates of the depth of the Subbasin bottom are available in many locations, these estimates are not sufficient to map the Subbasin bottom. This includes the areas between aquifer units and hydrologic areas. Significant exploratory drilling or extensive detailed geophysical work would be required to generate a comprehensive map of the bottom of the Subbasin.

3.9 Cross Sections

Six hydrogeologic cross sections were constructed to characterize the thickness and distribution of aquifer sediments and to delineate the hydrostratigraphy within the Subbasin (Figure 3.6). The goals of constructing cross sections were to identify hydrogeologic structures affecting groundwater and to illustrate aquifers described above. The assessment was designed to use and combine existing information in the ArcHydro Groundwater (Strassberg et al. 2011) data format that supports application of geographic evaluation tools within a GIS platform. The information assessed in this evaluation included:

- Surficial geology.
- Faulting.
- Lithologic borehole logs.
- Well construction information.
- 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 Subbasin to be easily translated from GIS for use in other formats.

3.9.1 Available Data and Information

Existing datasets and information were collected from the following available sources:

- National Elevation Dataset (NED) ground surface digital elevation model data for Riverside County (USGS 2020b).
- Surficial geology in GIS coverage format (USGS 2004 and 2006).
- Fault locations and orientations (USGS 2004 and 2006).
- Fault subsurface expressions (Treiman 1998).
- Lithologic and well construction logs from EVMWD.
- Drillers Log files from DWR, digitized by EVMWD.
- Hydrogeologic conceptualizations from previous investigations (MWH 2005 and 2009, Harder 2014, WEI 2015, and Geoscience 2017).
- Previously completed cross sections of portions of the Subbasin (MWH 2005 and 2009, WEI 2015, and Geoscience 2017).

These data and information sources resulted in a dataset of nearly 700 locatable wells and boreholes within and near the Subbasin. Of these, lithologic and construction records were digitized for 361 wells and boreholes (Figure 3.6). These location, lithologic, and well construction records were combined into a unified dataset covering the Subbasin and surrounding areas. The unified dataset is composed of a series of related tables and GIS datasets in a geodatabase that follows the data storage conventions of ArcHydro Groundwater. Construction of the unified database required combination of well data from multiple data sources, often containing different information types. At each stage of database construction, care was taken to include all relevant data from each data source; in some cases, this process produced multiple records for the same well with conflicting information. Duplicate well locations or records were combined into single records preserving the information from each individual data source.

Multiple faults cross portions of the Subbasin, as discussed above. To portray these faults on cross sections, it was necessary to estimate orientations and approximate dip angles. The USGS has compiled a database of fault and fold information for the entire United States (Treiman 1998) that incorporates local mapping and includes information regarding the subsurface expressions of the faults in the Elsinore Fault zone within the area of the Subbasin. The data compiled by USGS indicated that the faults in the Subbasin generally have dip angles of 85 degrees; faults on the western side of the Subbasin dip to the east or northeast while those on the eastern side of the Subbasin dip towards the west or southwest (Treiman 1998).

3.9.2 Cross Section Construction

The six cross section transect locations shown on Figure 3.6 were selected based on available data to provide lithologic coverage throughout the Subbasin. These cross sections intersect and extend slightly beyond Subbasin boundaries; sections are designated as A - A′ through F - F′, as indicated on Figure 3.6.

The datasets incorporated into the database were used to populate the cross sections for use in hydrostratigraphic correlation. These data were applied to the sections using the ArcHydro Groundwater extension to ESRI's ArcGIS Desktop software. ArcHydro Groundwater includes tools for plotting surficial geology, faults, lithologic, construction, and elevation surfaces from a two-dimensional map to two-dimensional cross sections. The wells with lithologic and construction information in the vicinity of the cross sections are shown on Figure 3.6. Each cross section was populated with the following datasets:

- Ground surface elevations from NED files.
- Surficial geology.
- Faults.
- Well and borehole lithology and well construction from all wells within 1,000 ft of each cross section.

These data were plotted to the cross sections using the ArcHydro Groundwater toolset and then used to interpret and correlate hydrostratigraphy. Lithologic data were used to interpret sand and gravel aquifer units throughout the Subbasin. In locations where multiple lithologic logs were present on a cross section, preference was given to the closest logs. Mapped surface geology (USGS 2004 and 2006) and subsurface conditions around the faults were used to interpret the geometry of geologic units.

The resulting cross sections are shown individually with well construction, hydrostratigraphy, faulting, and bedrock on Figure 3.7 through Figure 3.11. Areas with no well or lithologic data are blank and the transition is indicated by a dashed line. Initial evaluation of the lithology from well and borehole logs indicated that sands are generally the most prevalent material in the Subbasin. As a result, the cross sections show sands in areas where information is limited. Cross sections A - A′, B - B′, and C - C′ are the longitudinal profiles down the length of the Subbasin. These cross sections show the significant variability in the presence and thickness of the Subbasin aquifer materials as bedrock depths vary between deep areas of the Subbasin and bedrock outcrops. These longitudinal cross sections are semi-parallel to the faults in the Subbasin. The transverse cross sections also illustrate the variability in lithology and thickness throughout the Subbasin, insofar as data are available.

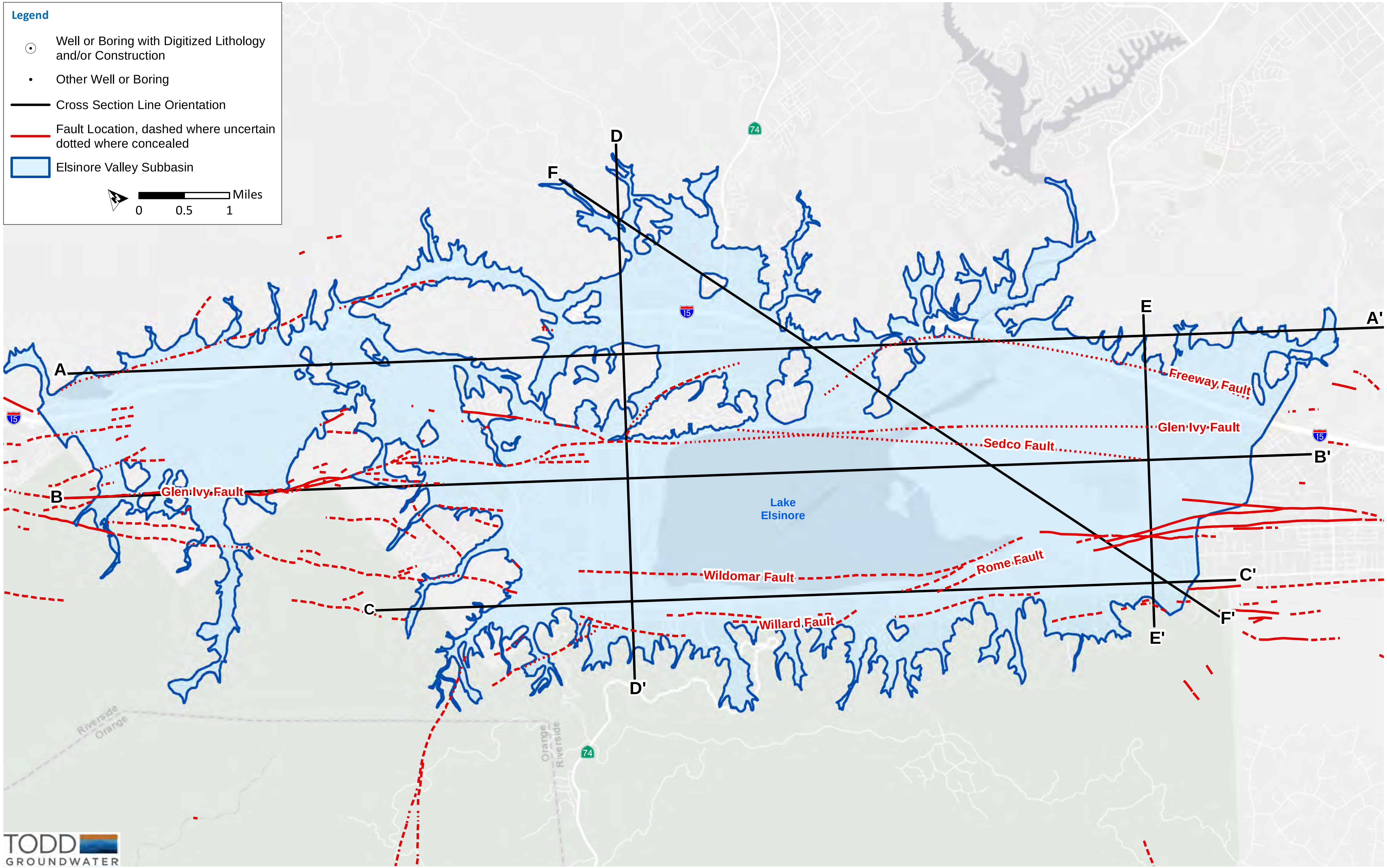
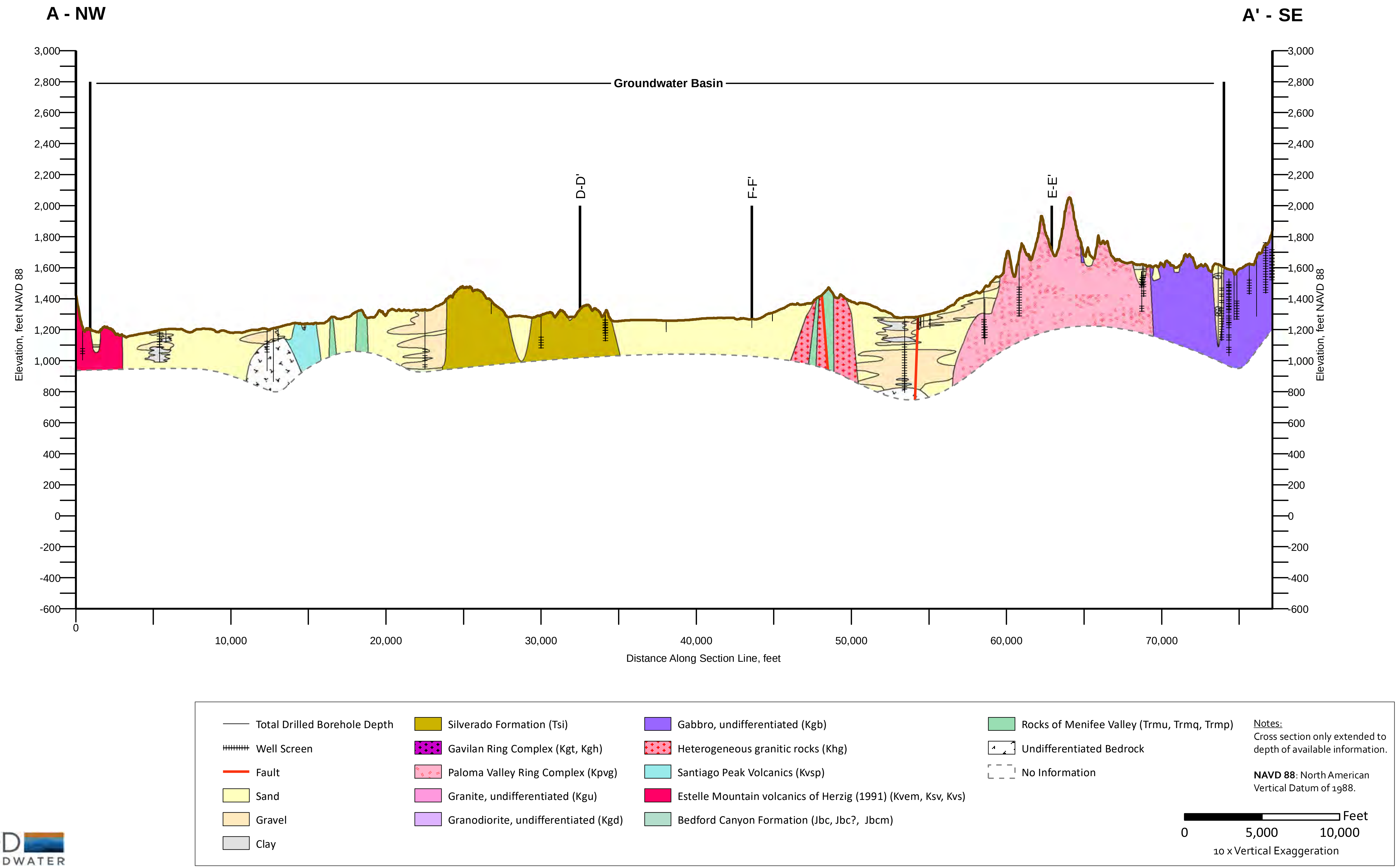


Figure 3.6 Cross Section Orientations



Notes:
Cross section only extended to depth of available information.

NAVD 88: North American Vertical Datum of 1988.

Figure 3.7 Cross Section A to A'

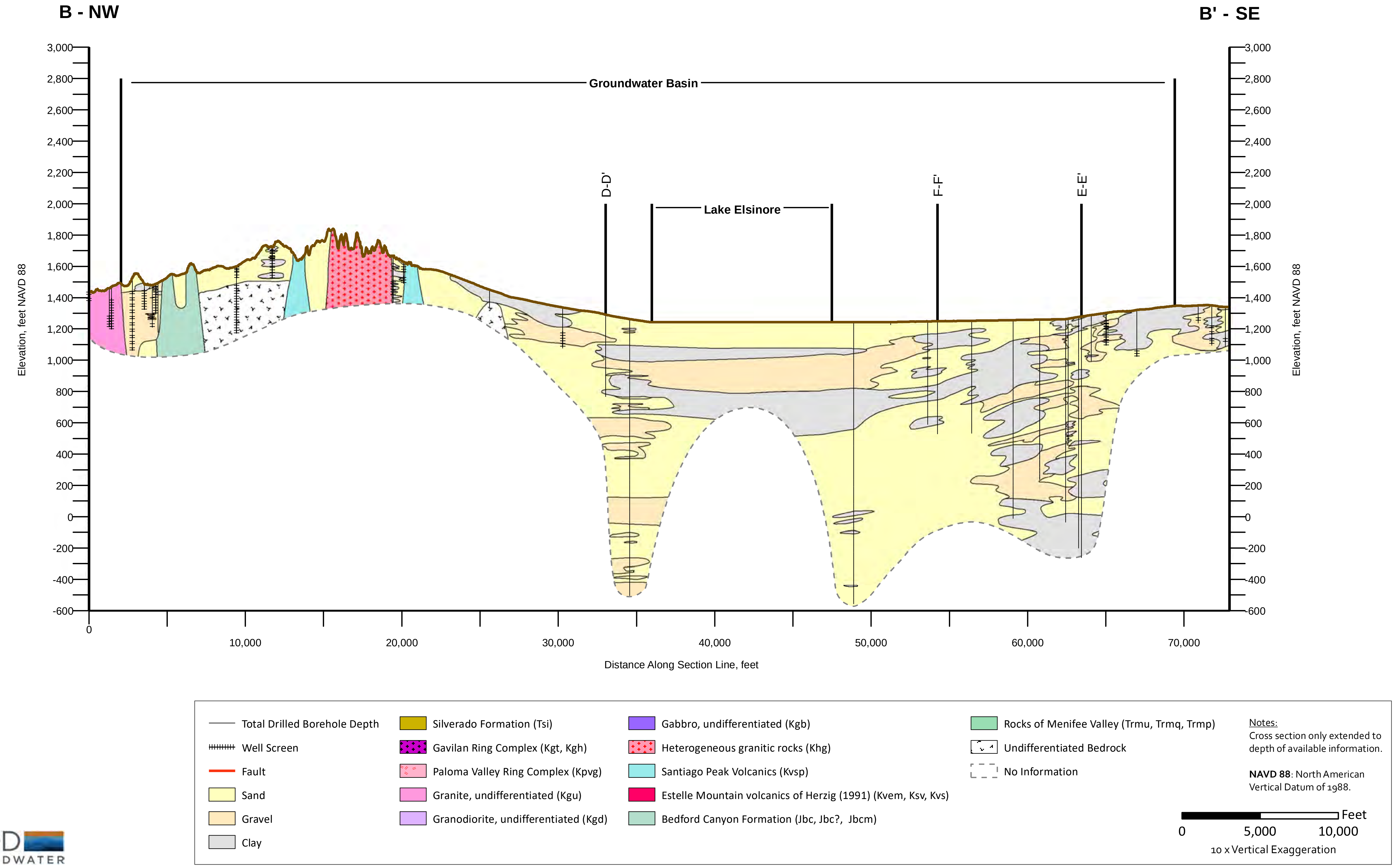


Figure 3.8 Cross Section B to B'

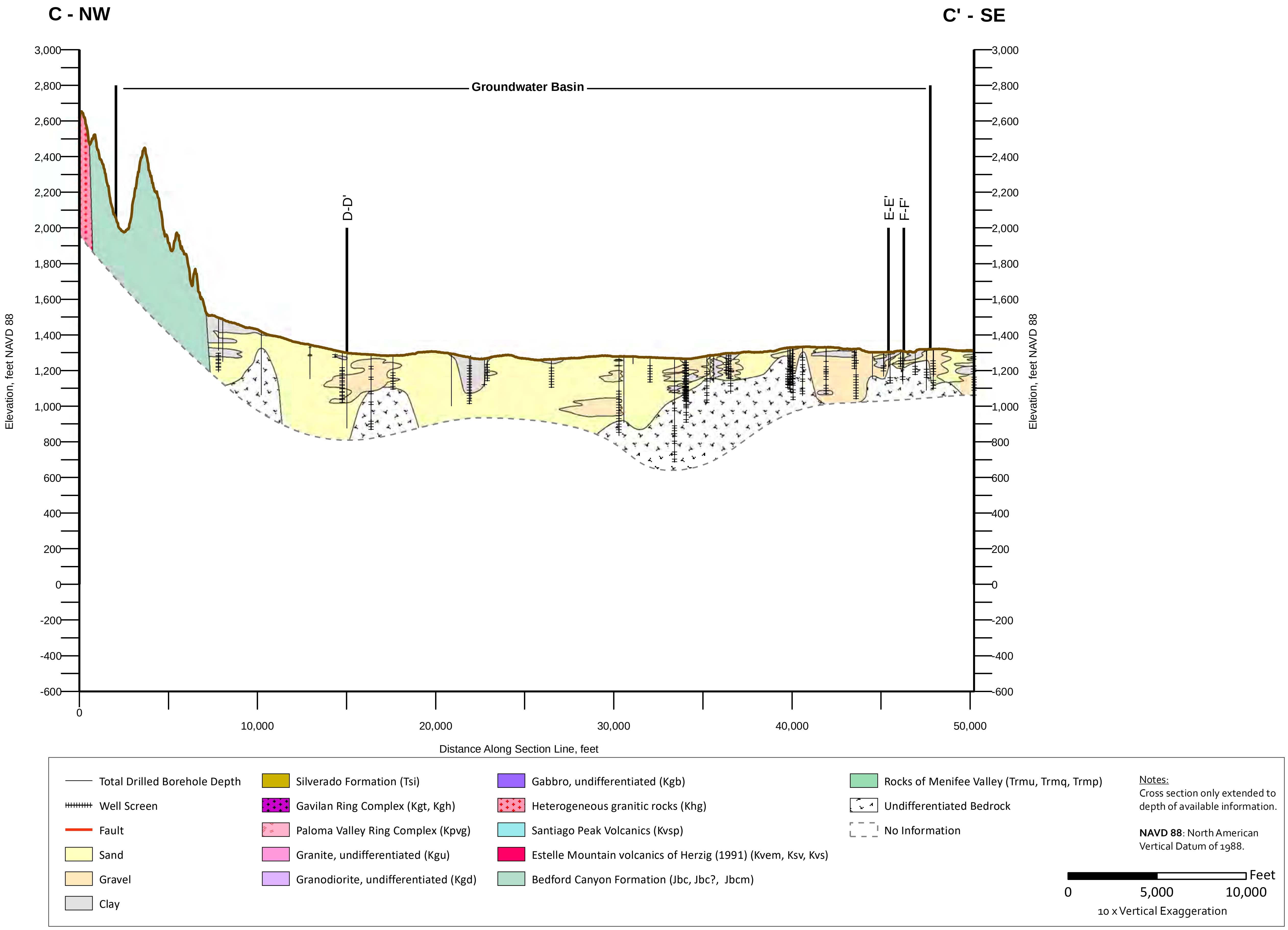
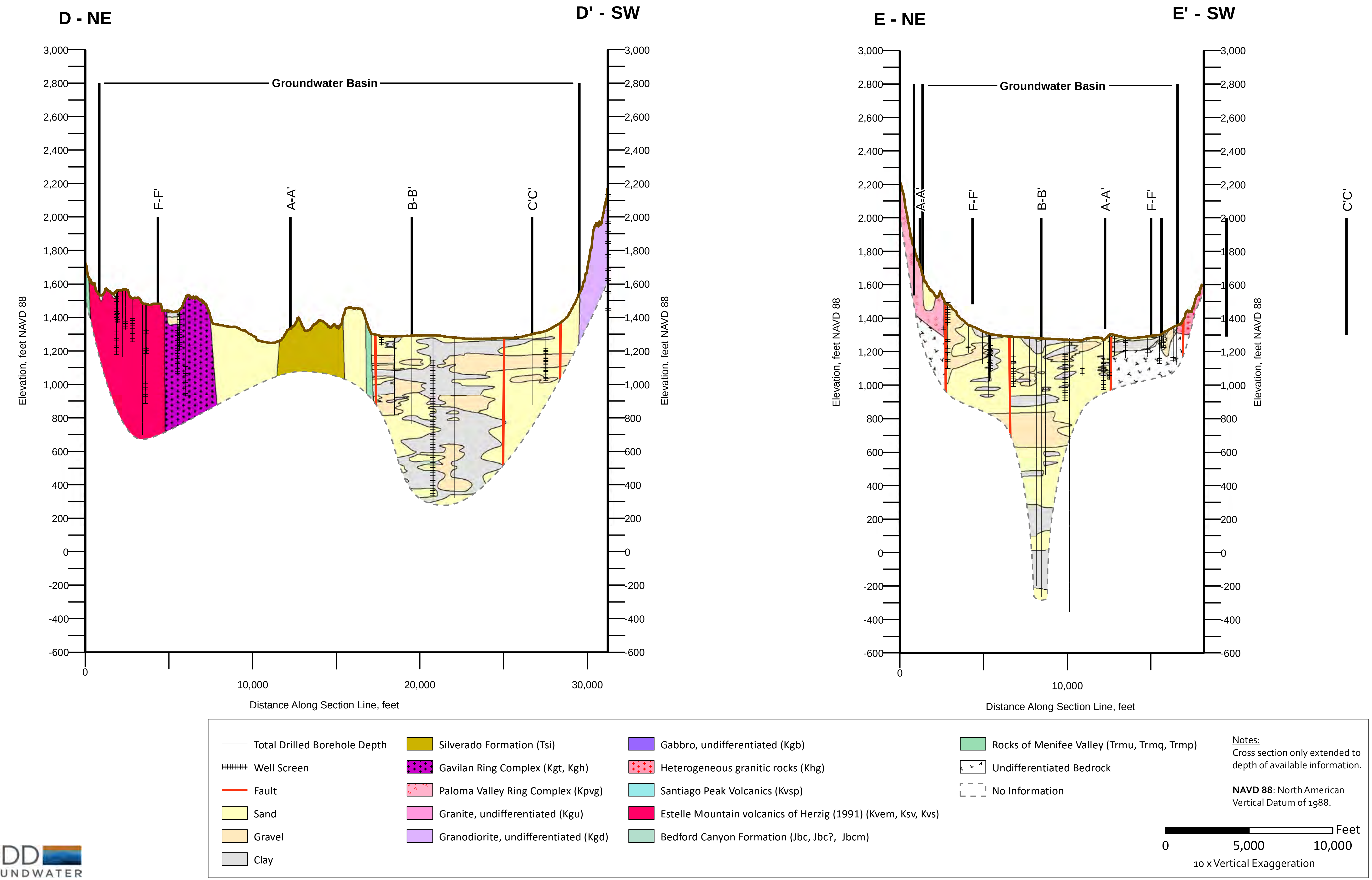


Figure 3.9 Cross Section C to C'



Notes:
Cross section only extended to depth of available information.

NAVD 88: North American Vertical Datum of 1988.

Figure 3.10 Cross Sections D to D' and E to E'

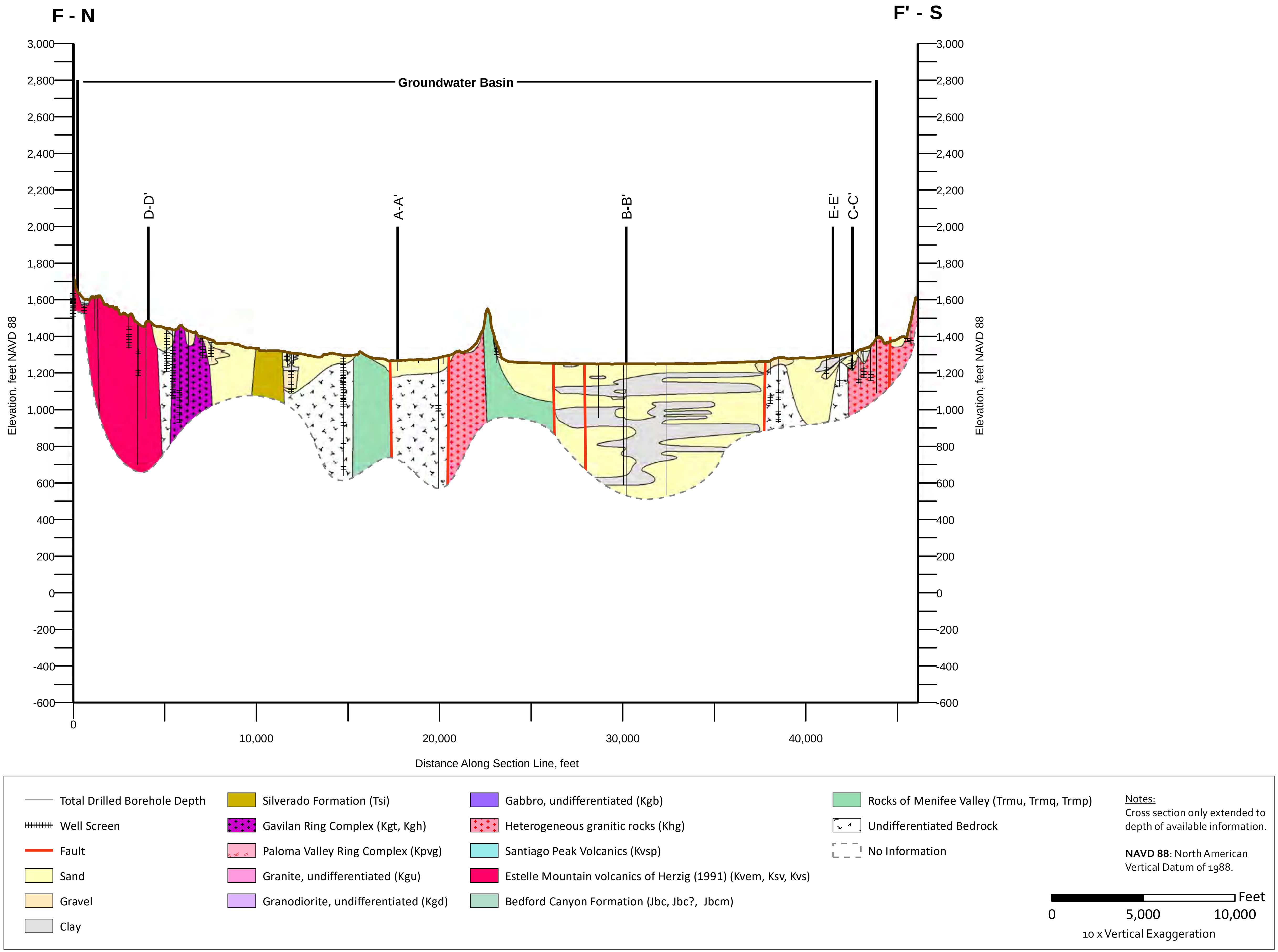


Figure 3.11 Cross Section F to F'

3.9.3 Hydrostratigraphic Evaluation

The cross sections are consistent with and support the conceptual model described above. These sections show that most of the Subbasin is composed of a mix of interbedded sands and gravels (coarse grained materials) and silts and clays (fine grained materials) in discontinuous lenticular deposits. In general, a higher percentage of sand and gravel occurs near the historical drainage channels and the alluvial fan areas near Subbasin boundaries (proximal fan areas), as would be expected. The central Elsinore Area has a higher percentage of fine-grained deposits, which are often thick and massive. These silt and clay units are the result of lakebed (lacustrine) deposition associated with Lake Elsinore and its predecessor playa lakes. The cross sections also show that distinction of primary alluvial aquifer materials from older underlying aquifers is infeasible with available information. Alluvial aquifer materials that are offset or otherwise affected by faulting have not been indicated by the hydrostratigraphic evaluation and cross section construction. Additionally, the cross sections show that most water wells do not extend deep enough to document the full thickness of the water bearing materials in the thickest areas of the Subbasin. Surficial geologic mapping and lithologic logs show bedrock to be present at variable depths throughout the Subbasin.

3.10 Recharge and Discharge Areas

Most Subbasin recharge comes from infiltration of runoff from precipitation on the surrounding hills and mountains. Large amounts of runoff from the mountains flow in unlined channels into and through the Subbasin. The amount of water available for recharge varies annually with changes in rainfall and runoff. Runoff into the Subbasin is subject to evapotranspiration (ET), infiltration, and continued surface flow to the Temescal Wash and out of the subbasin. The watersheds contributing to the Subbasin include multiple drainages, all of which flow across the Subbasin in generally east-west orientations. The main source of stream recharge in the Subbasin is infiltration from the San Jacinto River and Temescal Wash (DWR 2003 and 2016, MWH 2005, and Harder 2014). Recharge also occurs from direct precipitation; urban, irrigation, and industrial return flows; wastewater return flows including septic systems; managed aquifer recharge; infiltration from smaller stream channels; and subsurface inflow in the Lee Lake and Warm Springs Areas (WEI 2000, MWH 2005, DWR 2003 and 2016, Harder 2014, and Geoscience 2017). The Elsinore Area is assumed to have negligible subsurface inflow and outflow from outside the Subbasin (MWH 2005). Recharge areas are shown by type in Figure 3.12.

Discharge from the Subbasin is almost entirely from groundwater pumping (WEI 2000, MWH 2005, DWR 2003 and 2016, Harder 2014, and Geoscience 2017). There is some limited discharge across the northern Subbasin boundary with the Bedford-Coldwater Subbasin, but the thin and narrowly constricted alluvial material in this area limits the volume and timing of subsurface outflow (Todd and AKM 2008). Flow to springs and seeps is not a significant discharge component in the Subbasin.

Groundwater recharge and discharge details, including descriptions of sources and sinks and volumetric estimates over time are presented in Chapter 5 – Water Budget.

3.11 Primary Groundwater Uses

The primary groundwater uses in the Subbasin are municipal pumping, with some small volume of distributed rural residential pumping occurring both inside and outside of municipal service areas. Groundwater use estimates are included in Chapter 5 – Water Budget.

3.11.1 Elsinore Hydrologic Area

Groundwater in the principal aquifer in the Elsinore Area is primarily used for municipal water supply. This includes pumping for potable and non-potable uses. There are also private wells used for domestic water supply. The Elsinore Area has also been used for storage and recovery.

3.11.2 Lee Lake Hydrologic Area

The principal aquifer in the Lee Lake Area is mostly used for municipal and domestic water supply. There has historically also been non-potable pumping in this hydrologic area to support agricultural and industrial water uses.

3.11.3 Warm Springs Hydrologic Area

There is little groundwater use in the Warm Springs Area. What groundwater is pumped in this hydrologic area is pumped for municipal and domestic supply.

3.12 Data Gaps in the Hydrogeologic Conceptual Model

In SGMA, data gaps refers to unavailable data or information that are necessary for the assessment or monitoring of sustainability. SGMA requires GSPs to develop plans for filling data gaps so that sustainability can be assessed and monitored. The hydrogeologic conceptual model has not identified any SGMA data gaps. There are components of the hydrogeologic conceptual model that may be refined in the future as more data become available, and those are identified in individual sections above.

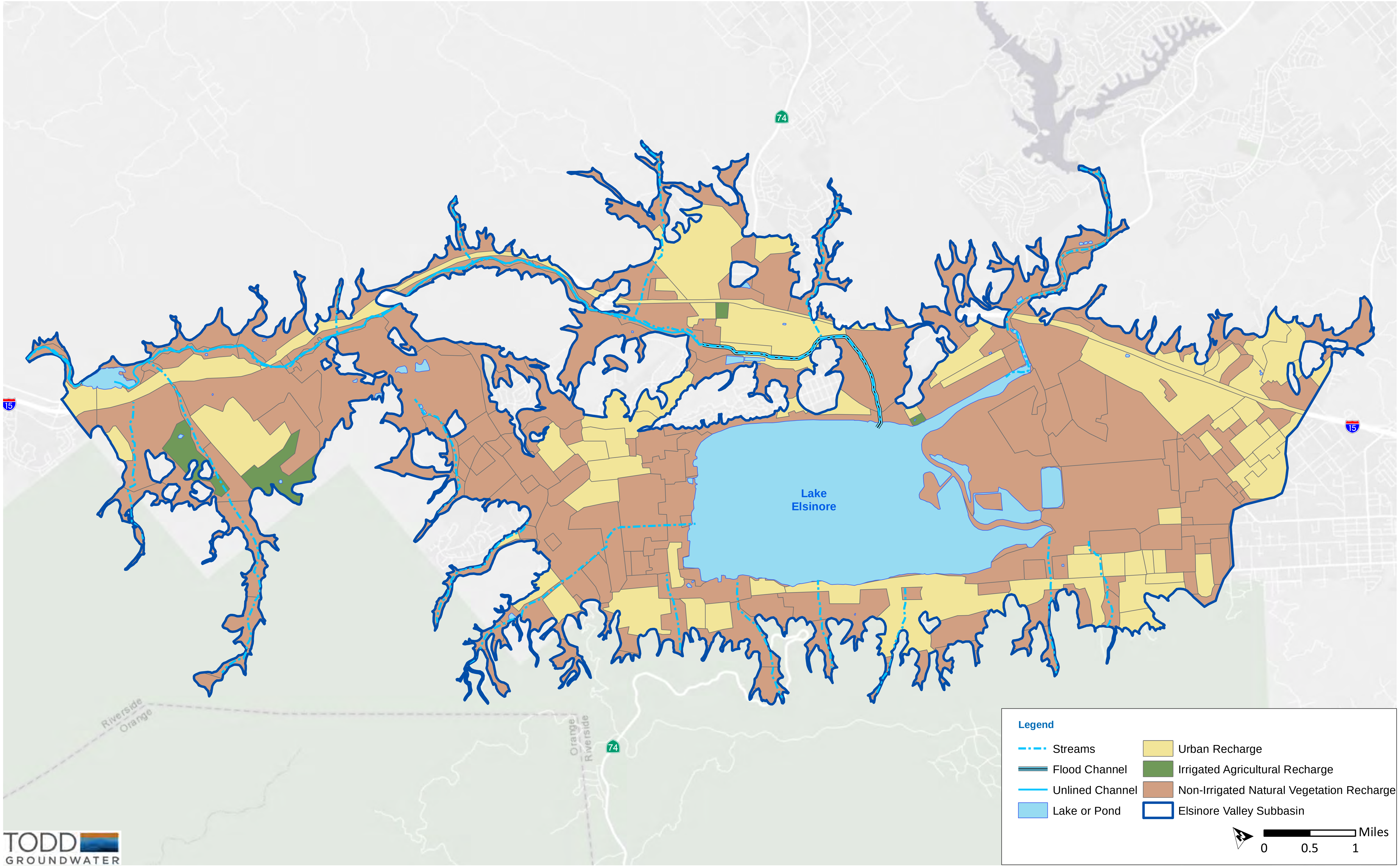


Figure 3.12 Groundwater Recharge and Discharge

Chapter 4

CURRENT AND HISTORICAL GROUNDWATER CONDITIONS

This chapter describes the current and historical groundwater conditions in the Subbasin. The SGMA requires definition of various study periods for current, historical, and projected future conditions. Current conditions, by definition in SGMA, include those occurring after January 1, 2015. Historical conditions must start with the most recently available information and extend back in time at least 10 years to evaluate historical high and low groundwater levels. This chapter assesses and describes groundwater conditions using available data for the period between 1990 and 2019 to ensure a comprehensive groundwater evaluation and provide context for the water budget analysis.

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 (No risk of seawater intrusion exists in this inland Subbasin).
- Interconnected surface water and GDEs.

4.1 Groundwater Elevations

4.1.1 Available Data

Groundwater elevation records were collected from multiple sources, including previous investigations, EVMWD, USGS National Water Information System (NWIS), DWR CASGEM, and others. Data were collected, reviewed, and compiled into a single unified groundwater elevation dataset. 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. The historically monitored wells are shown on Figure 4.1.

4.1.2 Groundwater Occurrence

As summarized in Chapter 3, groundwater is present in multiple aquifer units throughout the Subbasin. Groundwater in these Subbasin aquifers generally occurs under unconfined conditions; however, there are areas of the Subbasin in which subsurface hydrogeology indicates partial or fully confined conditions. Groundwater elevation, trends, flow, and vertical gradients are described below.

4.1.3 Groundwater Elevations and Trends

EVMWD has submitted seasonal high and low groundwater levels to the CASGEM program for selected wells since 2010. In addition, water level data are also available from EVMWD for other wells and from DWR and the USGS. While water levels for 181 wells were collected, 106 of these wells were part of a USGS study and monitored only once in spring 1968. There are 60 wells in and around the Subbasin with more than three water levels measurements that were monitored in the last 10 years.

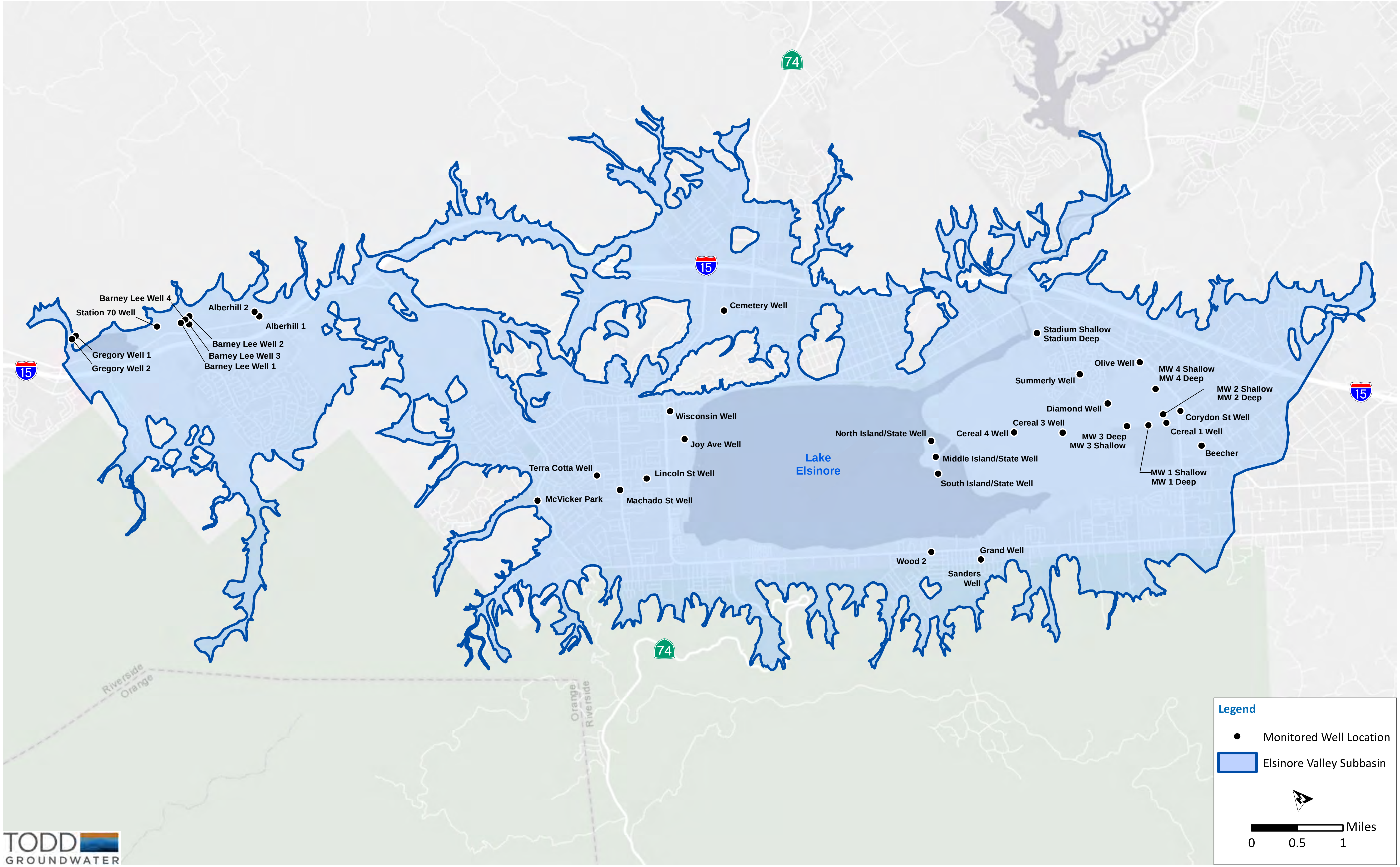
Hydrographs for these 60 wells were prepared and reviewed to identify representative wells. This review focused on identifying and selecting wells with representative hydrographs that show local, regional, and temporal patterns in groundwater elevations throughout the Subbasin. The selection of representative wells was based on a combined quantitative and qualitative approach that considered hydrographs with long records, regional and local trends in groundwater elevations, presence of vertical gradients, and distribution across the Subbasin. Specifically:

- Location – Wells were prioritized considering broad distribution across the Subbasin, availability of other wells nearby, and location near active recharge or discharge areas.
- Ongoing/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.
- Vertical gradients – Paired wells with shallow and deep screened zones and wells with total depth and construction differences within close proximity to one another were identified for assessment of vertical gradients throughout the Subbasin.

The selected wells and hydrographs are shown on Figures 4.2 through 4.4.

4.1.3.1 Elsinore Hydrologic Area

The Elsinore Area hydrographs on Figure 4.2 show wide geographic and vertical variability in groundwater elevations. The wells with a long period of record generally show steady declines in groundwater elevations from the 1990s to about 2010. This trend can be seen in the hydrographs for the Lincoln, North Island, and Cereal 1 and 3 wells, and, to some extent, in the Terra Cotta, Machado, and Olive St. wells (although recent declines appear more significant in this well). These wells, and the Wisconsin and MW 1 Shallow and Deep wells that have shorter periods of record, show groundwater elevations stabilizing or rising after 2010 coinciding with reductions in pumping in the area (see Water Budget Chapter 5) until they were affected by drought conditions and declined again between 2012 and 2015. Most of these wells have rising groundwater elevations since 2015. The Olive and Wisconsin wells are exceptions to the recent recovery; water levels in these wells have continued to decline through 2019.



TODD GROUNDWATER

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Figure 4.1 Historically Monitored Wells

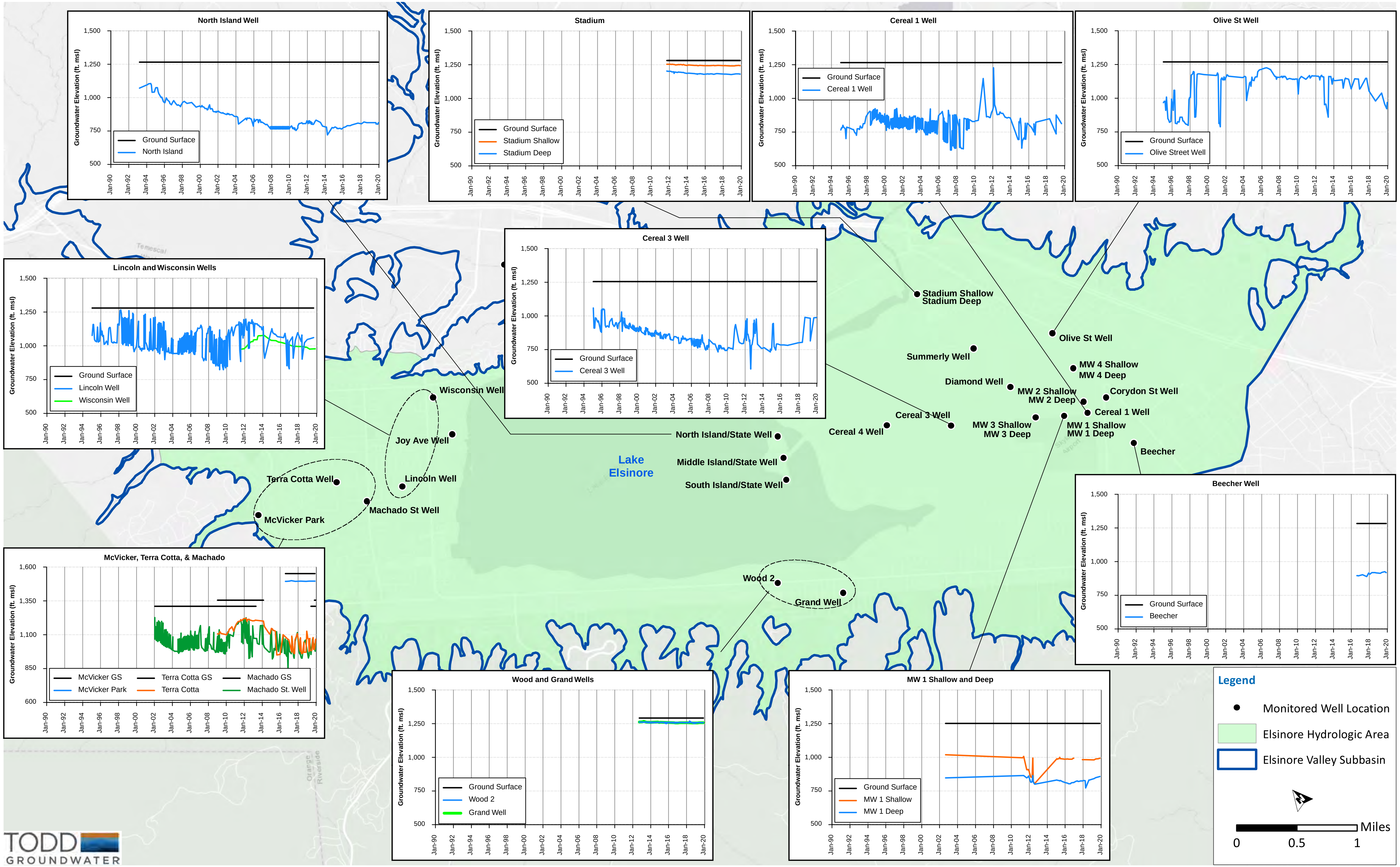

Figure 4.2 Representative Hydrographs Elsinore Area Wells

There are geographic variations in these trends, and some locations where groundwater elevations are affected by local geologic conditions. These include the water levels in the McVicker, Wood 2, MW 1 Shallow and Deep, and Stadium Shallow and Deep wells. These wells exhibit different groundwater elevation conditions, as described below:

- The McVicker Park well is in the far western portion of the hydrologic area near the edge of the Subbasin and water levels in this location are very stable and much higher than in other areas.
- The Wood 2 hydrograph shows consistently high groundwater elevations in this area west of Lake Elsinore on the edge of the Subbasin. This well is 600-ft deep with screen zones starting just above 200 ft but has a consistent depth to water of 30 to 35 ft below ground surface (bgs). This is likely related to a barrier to groundwater flow created by the Rome Fault or the high clay content in the subsurface in this area.
- The paired MW 1 Shallow and Deep wells (with shallow and deep screened zones in the same location) show downward vertical gradients with a head difference of nearly 200 ft (equivalent to a vertical gradient of about 0.363 ft/ft). The shallow screened interval in this well pair is 200 to 400 ft bgs while the deep screens are from 700 to 1,000 ft bgs. These vertical groundwater gradients are discussed in Section 4.1.5 below.
- The paired Stadium Shallow and Deep wells show declining groundwater elevations since monitoring began in late 2011. The hydrographs for these wells also indicate downward vertical gradients; in these wells, shallow water levels are about 60 ft higher than the levels in the deep well.

4.1.3.2 Lee Lake Hydrologic Area

Hydrographs for wells in the Lee Lake Area are shown on Figure 4.3. These hydrographs are from wells along the north side of Temescal Wash. There are currently no monitored wells in other parts of the hydrologic area. The hydrographs for the wells near the Temescal Wash show relatively consistent water levels over time. Groundwater elevations in these wells are generally around 1,100 ft-msl, with the exception of the upstream and upgradient Alberhill wells (Alberhill 1 and 2) where groundwater elevations are closer to 1,200 ft-msl. Water levels in all these wells are much more stable than are those in the Elsinore Area. There are some small apparent pumping effects in the Barney Lee Wells, as shown on Figure 4.3. The Barney Lee and Alberhill wells also show slight declines and then subsequent recovery from the drought in 2013 through 2015. The groundwater elevation fluctuations are small, representing steady groundwater elevation and storage conditions in this hydrologic area and a likely close connection to the Temescal Wash in this shallow aquifer.

4.1.3.3 Warm Springs Hydrologic Area

The Cemetery Well is the only well that has been consistently monitored recently in the Warm Springs Area. As shown on Figure 4.4, groundwater elevations in this well have been very consistent at about 1,250 ft-msl since monitoring began in early 2007. This trend indicates stable groundwater level and storage conditions in this portion of the Warm Springs Area.

4.1.4 Groundwater Flow

Figures 4.5 and 4.6 are groundwater elevation contour maps constructed to examine current groundwater flow conditions using data from Fall 2015 and Spring 2017, respectively. Contours were developed based on available groundwater elevation data for all wells. For the purposes of this discussion, the contours were not prepared assuming local faults (most notably the Rome Fault) as groundwater barriers; there is insufficient water level data on opposing sides of these faults to support contouring that reflects the effects of these faults. The Rome Fault probably causes some impedance to groundwater flow; however, this effect is likely to vary over the length of the fault and with depth (and relative groundwater elevations).

The groundwater elevation surfaces shown on Figures 4.5 and 4.6 show wet and dry year differences as the fall of 2015 was the end of the last year of a multi-year drought and spring 2017 followed a much wetter period.

Groundwater flow in the Subbasin is influenced by pumping and the limited connections between hydrologic areas. Within the Elsinore Area, groundwater elevations and flows are dominated by pumping depressions associated with water supply and aquifer storage and recovery (ASR) wells. These depressions are often more pronounced south of Lake Elsinore, but can also be significant north of the Lake, as shown in Figure 4.6. Groundwater elevations in the Lee Lake Area indicate that flow generally parallels the Temescal Wash, with flow from the southeast toward the northwestern boundary with the adjacent Bedford-Coldwater Subbasin. In the Warm Springs Area, there is only one monitored well, which shows generally consistent groundwater elevations at approximately 1,250 ft-msl. Assuming there is a connection, however limited, between the Warm Springs and Elsinore Areas, flow would be from Warm Springs into the eastern edge of the Elsinore Area.

For a historical perspective, Figure 4.7 shows groundwater contours from Spring 1995. Relative to Fall 2015 and Spring 2017 (Figures 4.5 and 4.6), the Spring 1995 map shows generally similar groundwater elevation and flow conditions to the recent maps. However, there were significantly fewer wells monitored in 1995.

4.1.5 Vertical Groundwater Gradients

Large vertical hydraulic gradients are observed at multi-depth monitoring sites the Elsinore Area. Near the lake and in the area south of the lake, the depth to water in the shallowest wells is typically a few tens of ft, whereas it is 200 to 500 ft in nearby deep wells. Even the paired monitoring wells with shallow and deep screened zones in the same locations show downward vertical gradients with head differences of 50 to nearly 200 ft (e.g., MW 1 Shallow and Deep and MW 2 Shallow and Deep). The shallow screened intervals in these wells are typically 200- to 400-ft deep while the deep screens are 700- to 1,000-ft deep. The maximum downward gradient approaches 1 ft/ft, which could suggest an unsaturated zone between the shallow and the deep aquifer units resulting in a perched shallow zone. Perched units would be unaffected by pumping and water levels in the deep aquifer units but appear to be influenced by water levels in Lake Elsinore.

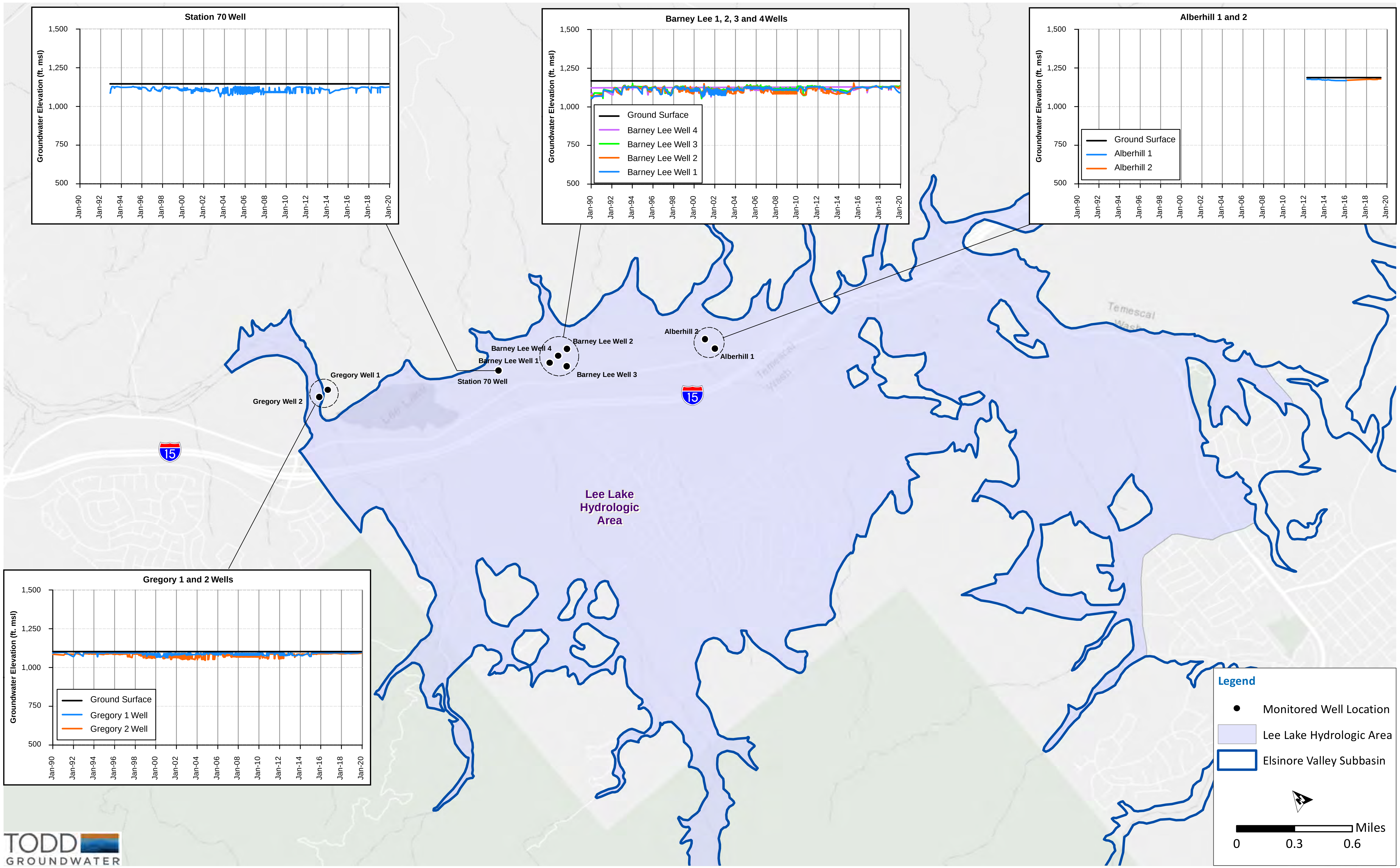

Figure 4.3 Representative Hydrographs Lee Lake Area Wells

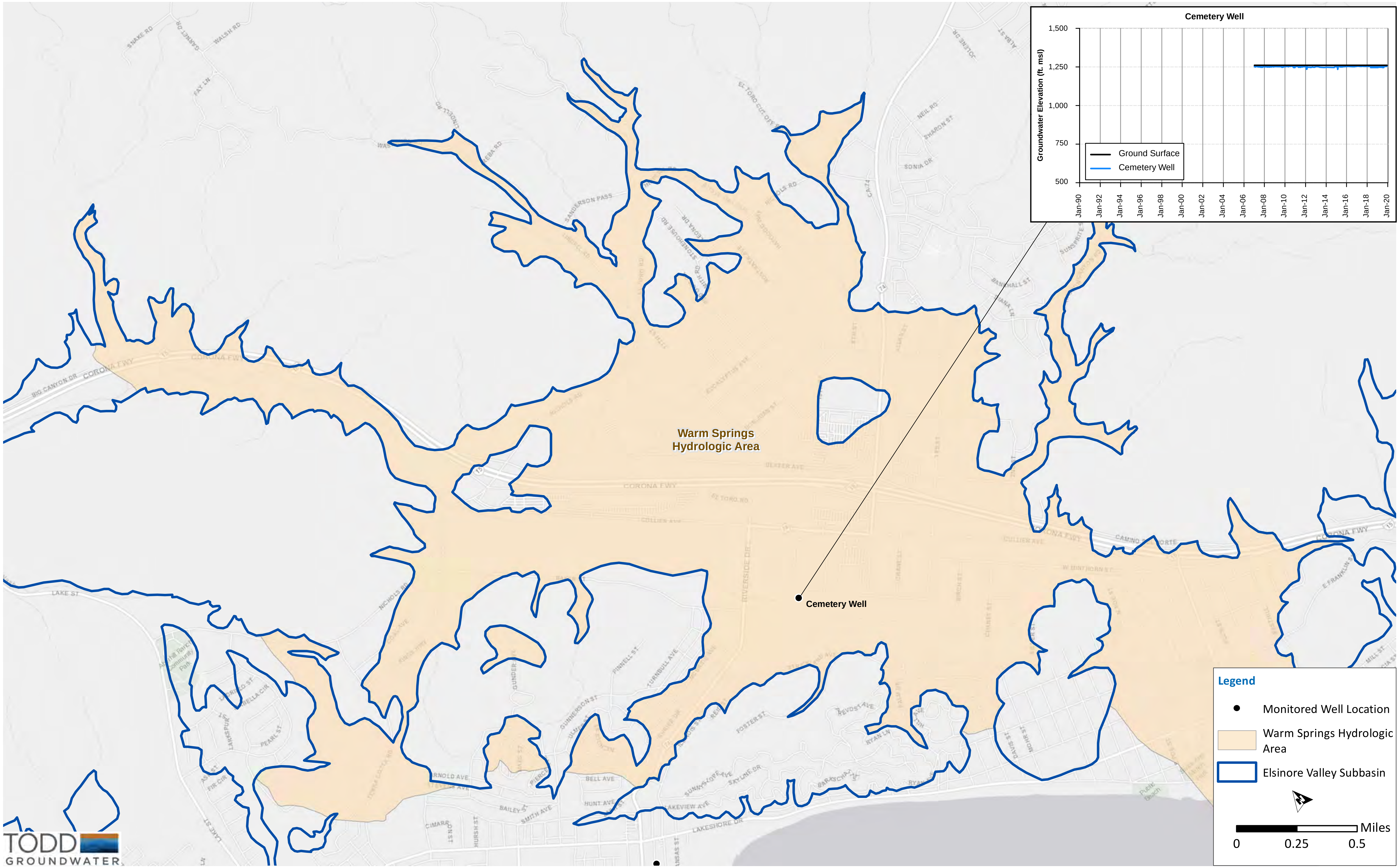

Figure 4.4 Representative Hydrographs Warm Springs Area Wells

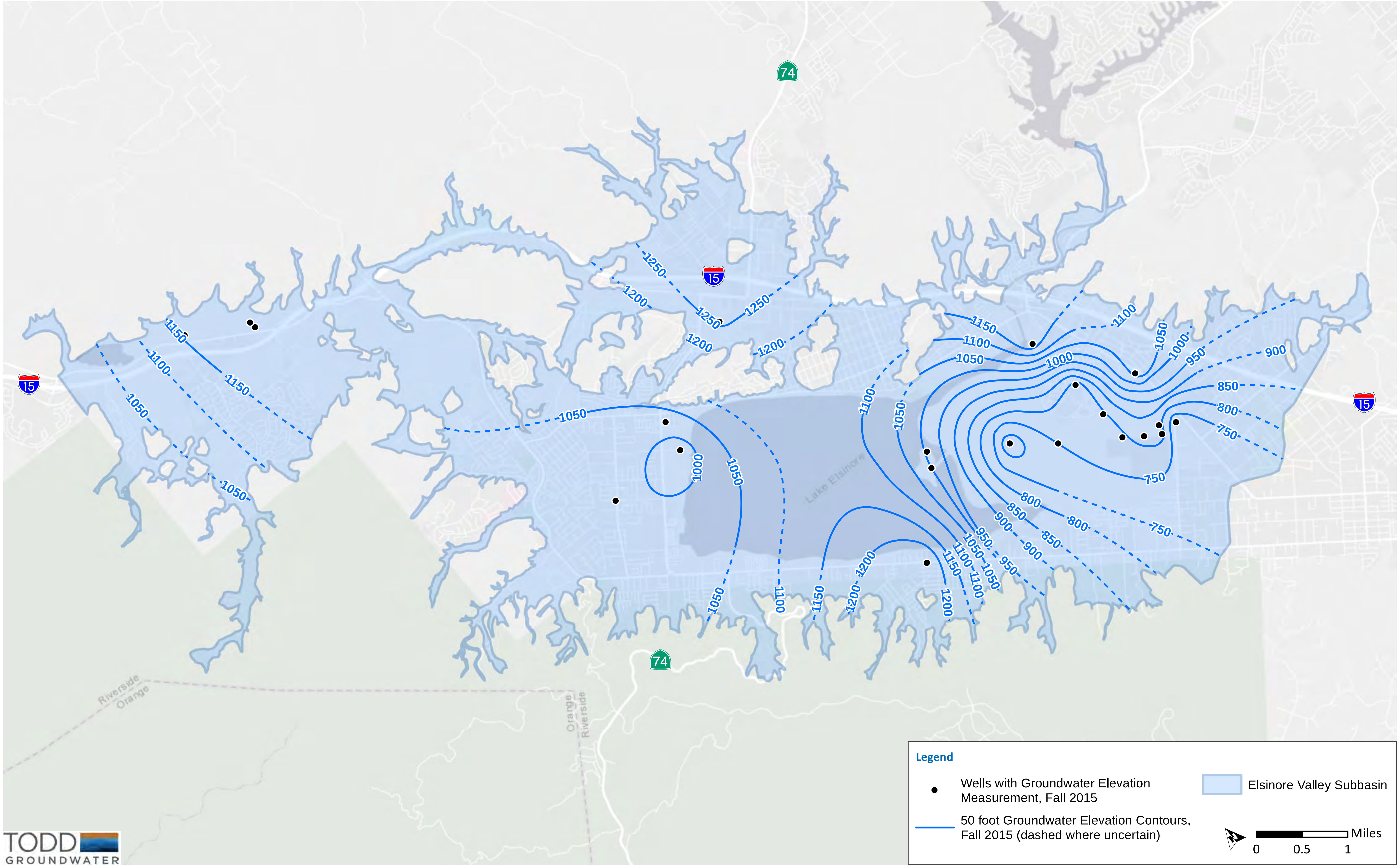

Figure 4.5 Groundwater Elevation Contours, Fall 2015

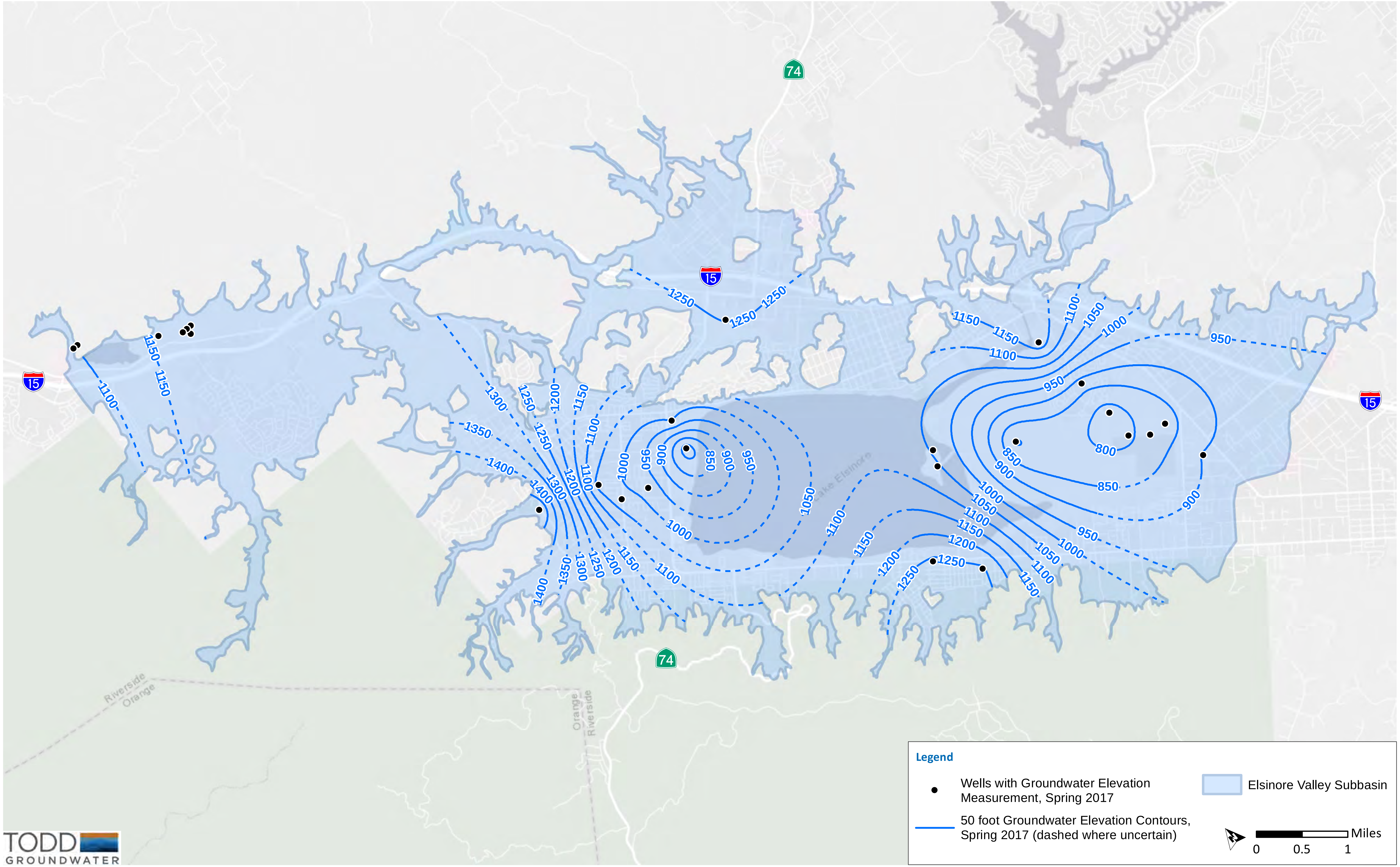

Figure 4.6 Groundwater Elevation Contours, Spring 2017

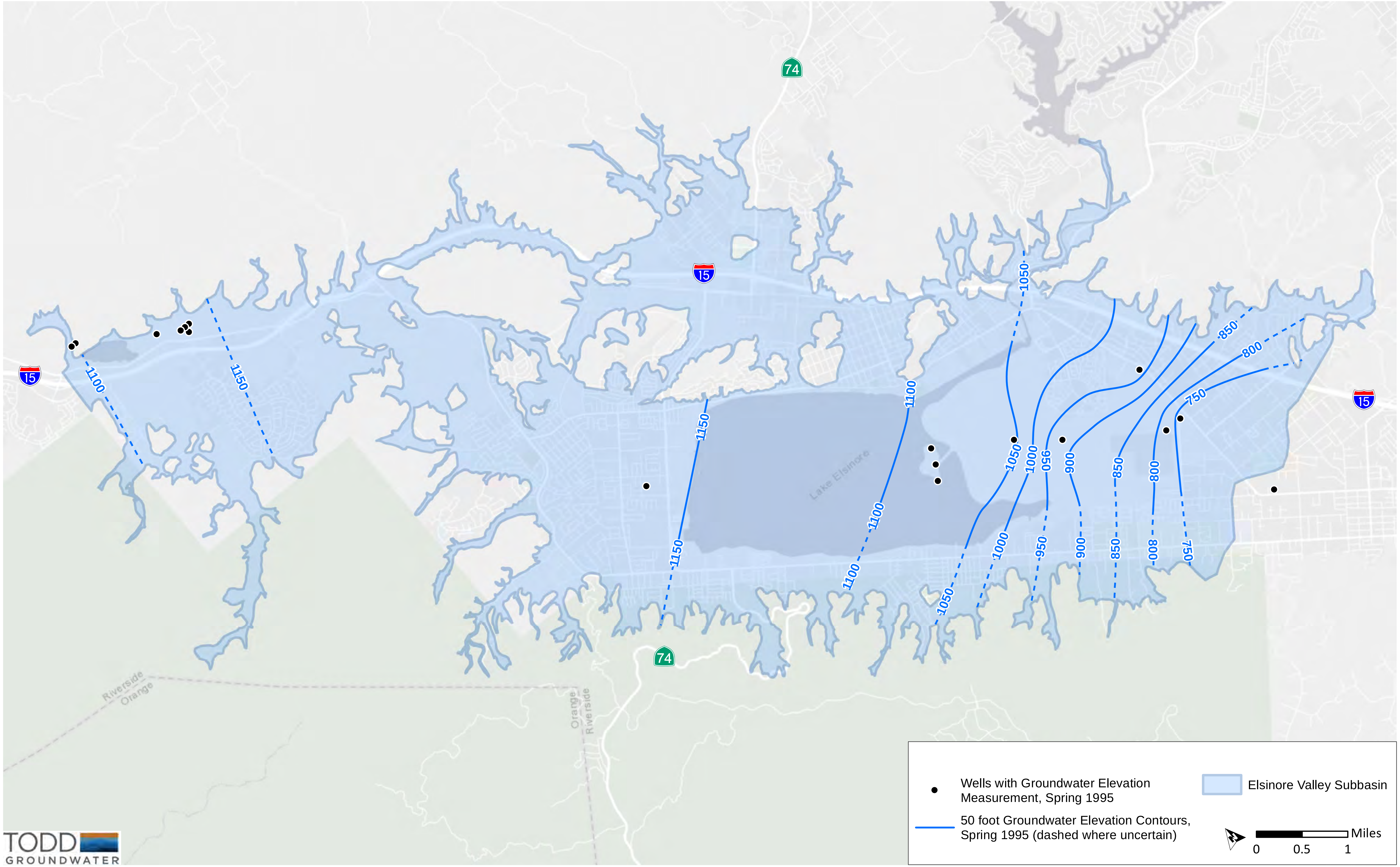

Figure 4.7 Groundwater Elevation Contours, Spring 1995

The situation is more complex around the edges of the Subbasin in the Elsinore Area, where groundwater transitions from thin, unconfined conditions in tributary stream valleys to the thicker sequences in the center of the Area. The Stadium well cluster is located near the San Jacinto River. While the screen depths of the shallow and deep wells are uncertain, the shallow well is reported be screened between 200 and 300 ft while the deep well screens are reported to be 600- to 700-ft deep. The depth to water in the shallow well is typically about 40 ft bgs and 60 ft above the water level in the deep well (see hydrographs on Figure 4.2). A similar situation is present at the McVicker Park well northwest of Lake Elsinore. It is also located between a tributary canyon—where a shallow water table is probably present at times in the channel alluvium along McVicker Creek—and the central part of the Elsinore Area. Depth to water in the well is fairly constant at about 55 ft. Along the west edge of the Subbasin, the Rome Fault appears to create a barrier to groundwater flow; deep wells in this area have shallow water levels. For example, the Wood 2 well is 600-ft deep but has a depth to water of 30 to 35 ft and the nearby Grand well has a similar depth to water.

Although data are sparse, wells in the Warm Springs and Lee Lake Areas do not indicate significant vertical gradients, and depths to water are relatively shallow along Temescal Wash regardless of screen interval. The sole well with water level data in the Warm Springs Area—the Cemetery Well—shows evidence of a hydraulic connection with the Temescal Wash, as described below in Section 4.11. In the Lee Lake Area, monitored wells have groundwater depths of 20 ft or less with no indication of vertical gradients.

Vertical head gradients are an important factor affecting the viability of riparian vegetation. As discussed in greater detail in Section 4.11, phreatophytic vegetation along streams generally survives droughts even when groundwater elevations in wells are tens of ft bgs for two or more years. This suggests that some shallow zones of saturation persist even when the head in deep aquifers declines.

4.2 Changes in Groundwater Storage

Change in storage estimates based on evaluation of groundwater elevation changes have not historically been completed for the Subbasin. 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 Subbasin. The volume of groundwater storage change over time in some basins is calculated by multiplying the groundwater elevation changes during a period by the storage coefficient. The Subbasin is geometrically complex, and this simplistic approach will not produce a reliable estimate of storage or changes in storage. Therefore, the numerical model will be used for storage change estimates, as described in Appendix G. 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 4.8. 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 4.8. 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 4.8.

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.

The following potential impacts can be associated with land subsidence due to groundwater withdrawals (Luhdorff & Scalmanini Consulting Engineers [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.
- Land fissures.

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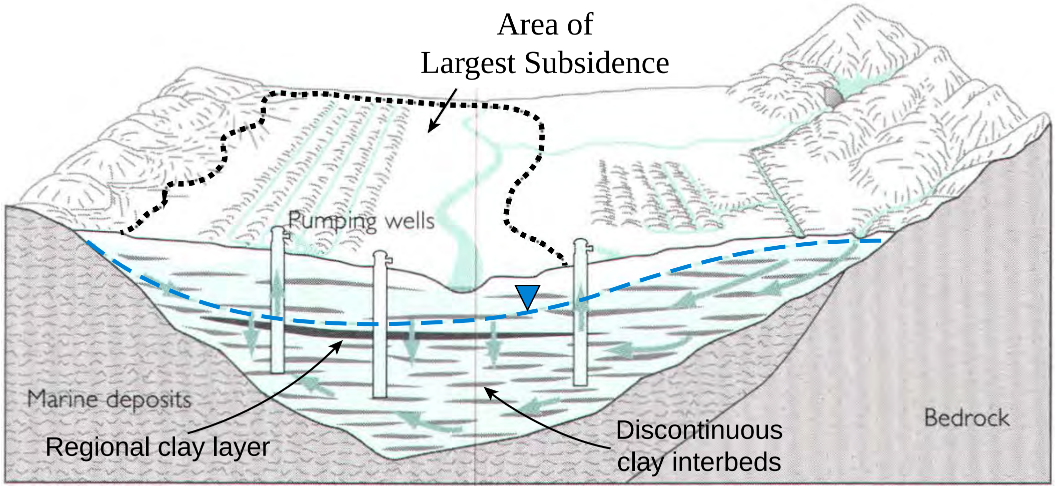
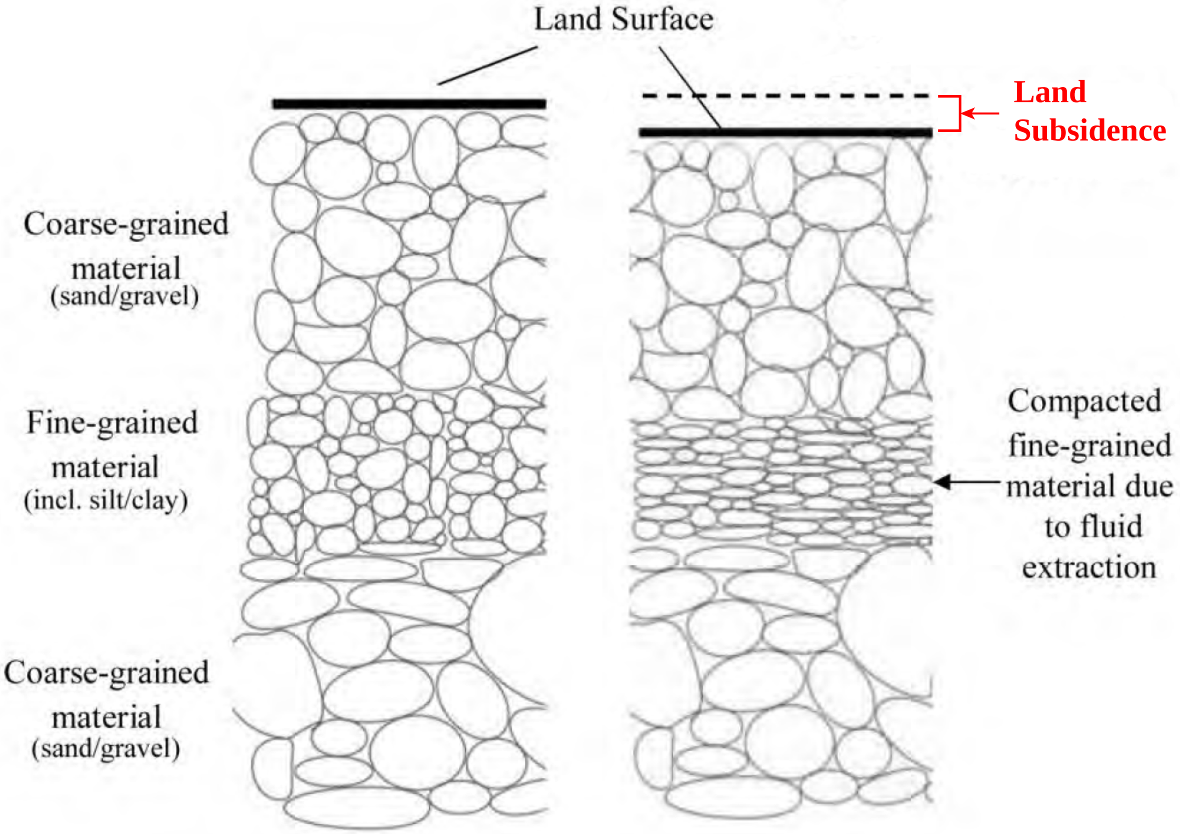
[1] Although extraction of groundwater by pumping wells causes a more complex deformation of the aquifer system than discussed herein, the simplistic concept of vertical compaction is often used to illustrate the land subsidence process (LSCE et al. 2014).



Source: Galloway et al., 1999.



After LSCE et al., 2014.

Figure 4.8 Concepts of Land Subsidence

Inelastic subsidence has not previously been a known issue in the Subbasin. Nonetheless, its potential was recognized in the 2005 GWMP (MWH 2005), which established a specific annual groundwater extraction quantity criterion to manage groundwater elevations to preclude and/or minimize the potential for ground settlement (i.e., inelastic land subsidence) and other negative effects of declining groundwater elevations. Local management of groundwater has been successful in meeting these objectives and there have been no reports of subsidence problems.

Direct measurements of subsidence have not been made in the Subbasin using specialized equipment (e.g., extensometers) or using repeated measurement of benchmarks at the ground surface. However, subsidence can be estimated using InSAR data from publicly available satellite imagery as described below.

4.3.1 Interferometric Synthetic Aperture Radar

InSAR data are provided by DWR on its SGMA Data Viewer (DWR 2020) and document vertical displacement of the land surface across the entire state of California from June 13, 2015 to September 19, 2019. The TRE Altamira InSAR Dataset, shown on Figure 4.9 shows mapping within the Subbasin for land surface deformation between 2015 and 2019. The TRE Altamira InSAR data shows subsidence, measured in ft, depicted with yellow to red tones indicating land subsidence as much as 0.09 ft (just over 1 inch) over the four years while green-blue tones indicate land rise of up to 0.03 ft within the Subbasin (nearly 0.4 inches). Most of the Subbasin is characterized by rises or declines between 0.025 to -0.025 ft (0.3 to -0.3 inches) over a period of four years, indicating a range of 0.07 to -0.7 inches per year. These land surface changes estimated from InSAR measurements are small and based on a dataset that is currently limited to a relatively short time period.

The areas of decline and rise are mostly focused on pumping centers. The most significant decline is centered on the pumping wells north of Lake Elsinore, and there is another area of decline between the Elsinore and Lee Lake Areas. The largest land surface rise is in the Elsinore Area just over 2 miles south of Lake Elsinore. The area of decline north of Lake Elsinore suggests a possible relationship to local groundwater pumping around the Joy and Lincoln wells. The vertical displacement of the ground surface around the Joy and Lincoln wells may correspond to groundwater elevation declines in these wells between June 2015 and September 2019 (Figure 4.2). Conversely, the area of greatest land surface rise does not correspond to increased groundwater elevations in nearby wells. Ground surface elevation changes can also result from the motion of faults, and the Subbasin is a relatively tectonically active area. However, the mapped faults do not appear to correspond to the vertical displacement patterns shown on Figure 4.9.

4.4 Groundwater Quality Issues

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.

Groundwater in the Subbasin may also be affected by human activities including agricultural, urban, and industrial land uses. State agencies with regulatory oversight for water quality in the Subbasin include the SARWQCB and the SWRCB DDW.

The quality of groundwater in the Subbasin has been described as variable, specifically with respect to TDS, nitrate (NO_3), and arsenic (MWH 2005, WEI 2000, 2002, and 2017, and SARWQCB 2019). Concentrations of these constituents vary both in space and time within the Subbasin, but groundwater quality is generally good in the areas where groundwater use is significant. Further assessment of water quality is presented in the following sections.

4.4.1 Monitoring Networks

4.4.1.1 State Water Board GAMA Program

The State Water Board GAMA Program (SWRCB 2020) is the primary source of groundwater quality data in the Subbasin. The GAMA program has water quality data from historical and ongoing monitoring of many wells within and surrounding the Subbasin. These data are submitted to the GAMA program by multiple local and regional agencies with responsibility for collection and analysis of groundwater quality. All available GAMA data were collected and incorporated into datasets for analysis in this GSP.

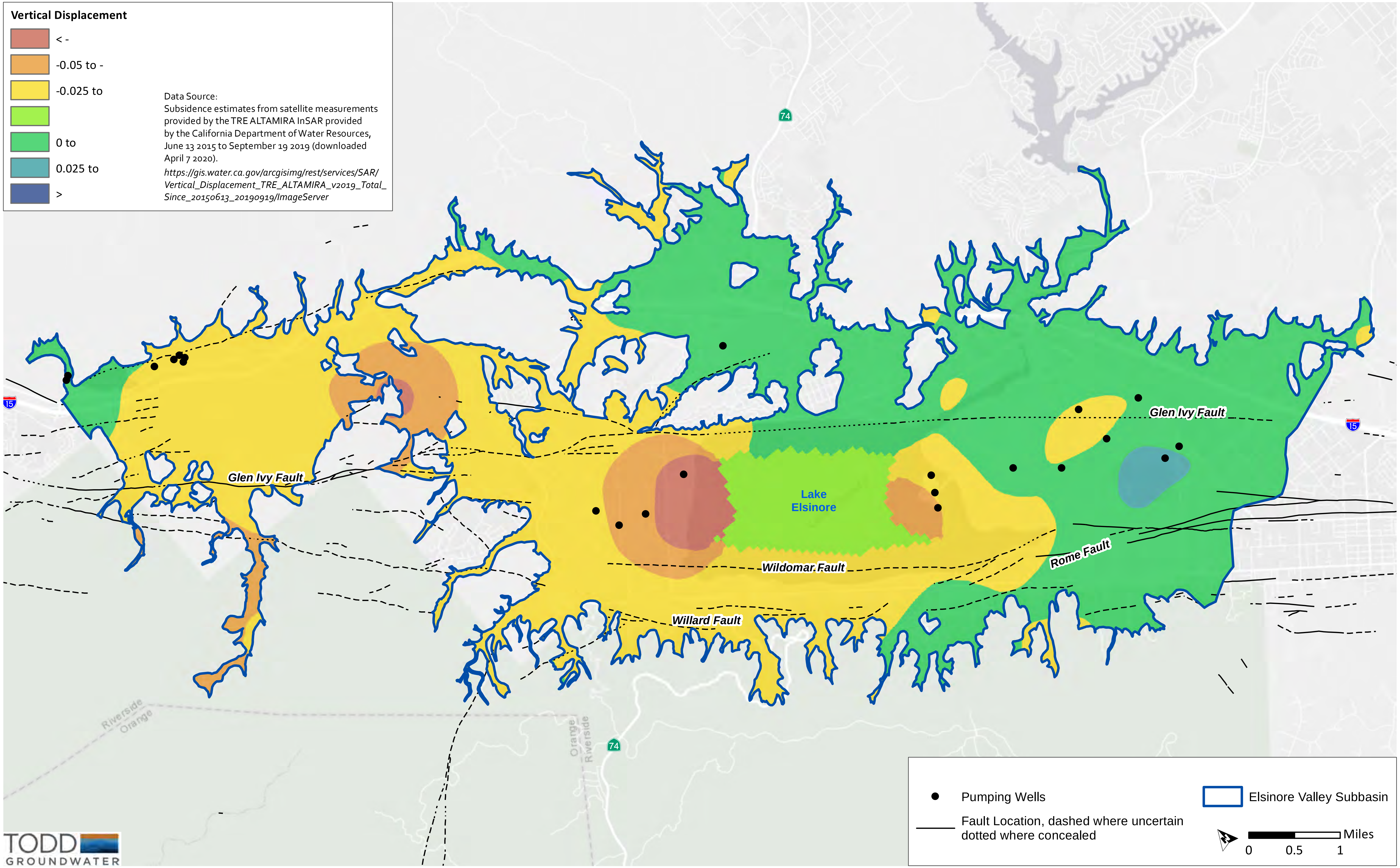
4.4.1.2 Division of Drinking Water

Two drinking water systems provide water supply to the Elsinore Area: the EVMWD (which includes the former Elsinore WD Country Club and Lakeland areas) and Neighbors Mutual Water Company (inactive). These two systems have reported water quality from a total of ten active wells. The Lee Lake Area has three drinking water systems—the Glen Eden Sun Club, Grace Korean Church, and Manteca Industrial Park—with a total of five active wells. The Warm Springs Area has one Drinking Water System, Elsinore Hills RV Park, with one active water supply well. Each system monitors and reports water quality parameters to SWRCB-DDW and is required to participate in the Drinking Water Source Water Assessment Program (DWSAP) to ensure wells are not subject to local contamination. The Sun Club well has reported nitrate in exceedance of the maximum contaminant level (MCL), and the system continues to monitor the well for additional problems.

4.4.1.3 Other Agencies

The SARWQCB lists one regulated site in the Subbasin, Villa Park Trucking a closed leaking underground storage tank site. 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. These data have all been collected and incorporated into datasets for this GSP.

Wells monitored for water quality in and around the Subbasin are shown on Figure 4.10.



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 April 7 2020).
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2019_Total_Since_20150613_20190919/ImageServer

Figure 4.9 Subbasin-Wide Subsidence Estimates from Satellite Measurements

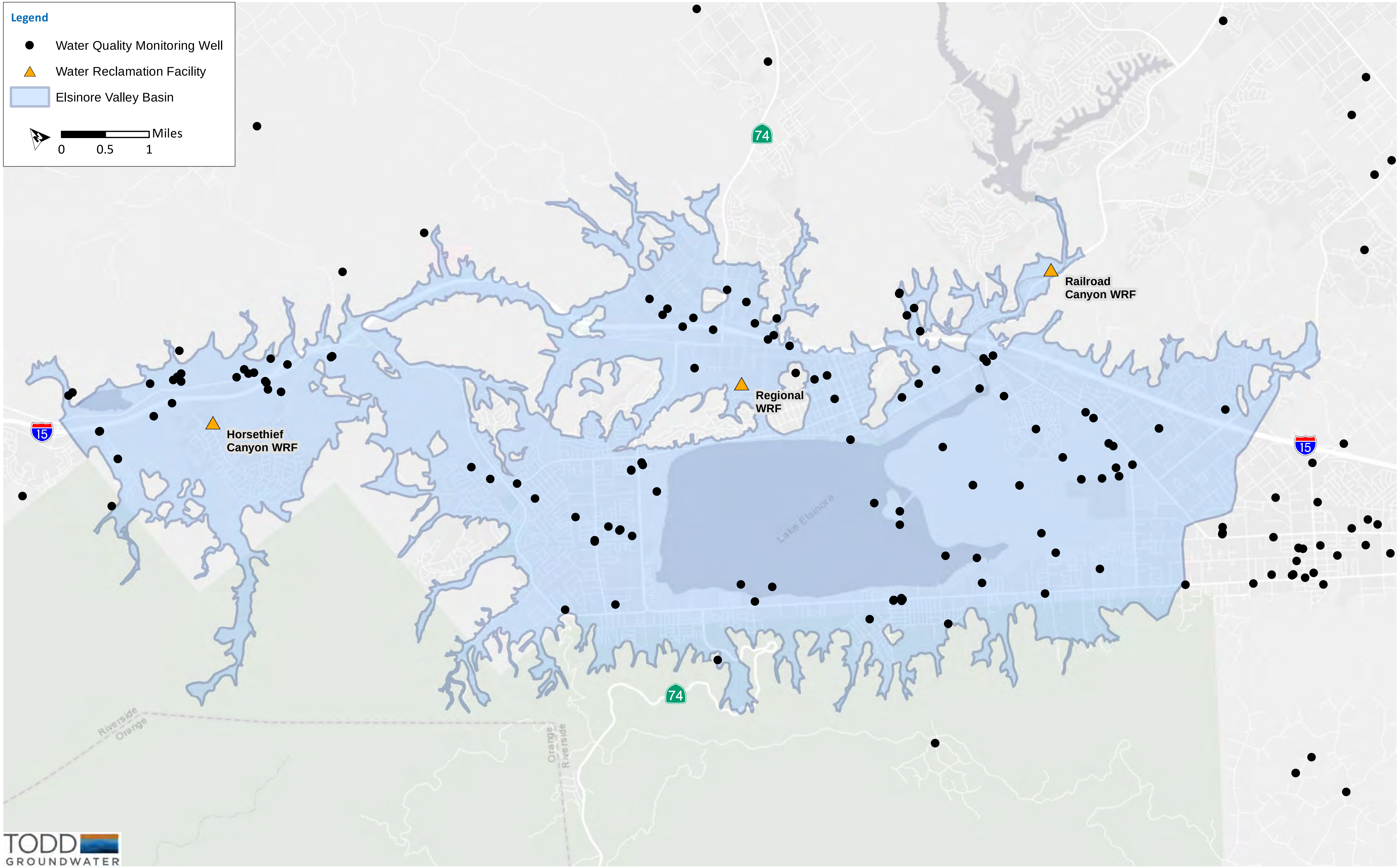


Figure 4.10 Wells With Water Quality Data

4.5 Other Studies

Multiple previous studies and several ongoing local and regional management programs have addressed groundwater quality in the Subbasin and surrounding areas. These have included historical efforts like the Elsinore Basin GWMP (MWH 2005) and current ongoing efforts by the SARWQCB and others to track and control salt and nutrient loading of groundwater in the Subbasin.

The SARWQCB manages several ongoing programs relating to water quality in the Subbasin, including programs with local agencies to control salinity in the Santa Ana River Basin. They are approaching this 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 SARWQCB in cooperation and collaboration with local agencies like EVMWD, EMWD, and others. These efforts have included WLA for surface waters in the Santa Ana River Watershed (WEI 2000 and 2002), antidegradation objectives and ambient TDS and nitrate monitoring and tracking in GMZs, and the Basin Plan (SARWQCB 2019).

Consistent with the 2013 SWRCB Recycled Water Policy, a SNMP was developed for the Upper Temescal Valley in 2017 (WEI). This SNMP was completed for two of the three original GMZs in the Subbasin, the Lee Lake and Warm Springs GMZs. One of the functions of this SNMP was to combine the Lee Lake and Warm Springs GMZs into the Upper Temescal Valley GMZ (WEI 2017).

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 protect beneficial uses. Beneficial uses of water and respective water quality objectives are defined by the SARWQCB. The report found TDS concentrations were highly variable across space and time, ranging from a low of 240 mg/L to a high of 1,500 mg/L, with no significant long-term trends 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 both irrigated agricultural land use and small domestic wastewater systems and hence reductions in nitrogen being added to the Subbasin in the form of fertilizers and untreated wastewater.

The SNMP recommended that the Regional Board adopt TDS and nitrate antidegradation objectives for the Upper Temescal Valley in a manner consistent with the 2004 Basin Plan amendment. The 2004 antidegradation objectives were based on historical ambient water quality for the period of 1954 to 1973. The SNMP proposed Antidegradation Objectives for TDS and Nitrate as 820 mg/L and 7.9 mg/L, respectively (WEI 2017).

EVMWD and the SARWQCB have also recently agreed upon revisions to the water quality goals relevant to the Elsinore Area through the Elsinore Maximum Benefit Proposal (EVMWD 2020). This proposal was recently accepted by the SARWQCB and will result in new water quality goals for TDS and Nitrate in the Elsinore Area.

4.6 Threats to Water Quality

The SARWQCB regulates sites that may negatively impact groundwater (see Figure 2.10). Sites that have been ordered to monitor groundwater in the Subbasin include one active landfill, one closed landfill, two open gas stations, and eight closed gas stations. Potential contaminants from the landfills could include volatile organic compounds (VOCs) and potential contaminants from the gas stations could be benzene, toluene, ethylene, xylene (BTEX), and methyl tert butyl ether (MTBE). Data on these constituents are included in the water quality database and detections above drinking water standards will be reported. From 2015 through 2017 there were 3 wells with detections of VOCs above health goals and 30 wells with detections of MTBE above health goals. However, all the of affected wells are monitored by the regulated facility with reporting to the regional board.

Wastewater from large-scale municipal sewage collection and treatment (shown as WRFs on Figure 4.10) and small-scale community water system and domestic septic systems also pose a potential risk to groundwater quality. The SARWQCB and the Riverside County Department of Environmental Health both have responsibility for wastewater treatment and discharge in the Subbasin. The SARWQCB regulates large-scale wastewater collection, treatment, and discharge while the Riverside County Department of Environmental Health regulates small scale and individual home-site wastewater systems.

4.7 Key Constituents of Concern

TDS and nitrate are the indicator salts and nutrients in the Subbasin and along with arsenic are the key constituents of concern (COCs) for the Subbasin.

4.7.1 Key Constituents in Groundwater

Table 4.1 shows current average concentrations for the COCs across the Subbasin. The values were developed by averaging all drinking water and ambient monitoring events that occurred from 2011 through 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 Subbasin.

Table 4.1 Average Constituent Concentrations by Area, 2015 to 2017

Hydrologic Area	TDS Concentration (mg/L)			Nitrate as N Concentrations (mg/L)			Arsenic Concentrations (µg/L)		
	SMCL = 500 mg/L			MCL = 10 mg/L			MCL = 10 µg/L		
	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
North Elsinore	130	1,390	517	0.7	4.9	2.3	1.2	9.2	4.4
South Elsinore	193	5,758	547	0.3	2.4	1.0	0	530	10.5
Lee Lake	236	1,200	649	0.21	19.4	6.1	0	6.0	2.0
Warm Springs	262	3,480	994	0.1	13.1	5.1	2.6	2.6	2.6

Abbreviations:
µg/L - micrograms per liter; SMCL - secondary maximum contaminant levels.

4.7.2 Total Dissolved Solids

As documented in Table 4.1, average TDS concentrations are around 500 mg/L in the Elsinore Area, nearly 650 mg/L in the Lee Lake Area, and nearly 1,000 mg/L in Warm Springs. These average TDS concentrations all exceed the SMCL for drinking water (500 mg/L). The maximum TDS concentrations from all sampled wells are shown geographically on Figure 4.11. Selected wells with long term data and their time concentration plots are shown in Figure 4.12. There are wells in all areas of the Subbasin that show increasing TDS trends. However, nearby wells often do not show similar trends. This could be an indication of vertical variations in water quality with depth. While total well depth and construction information are not available for all wells with TDS records, the wells in the Elsinore Area that do not show increasing trends are generally deep water supply wells. TDS enters and leaves the Subbasin through both surface and subsurface flows as well as occurring from the mineralization of groundwater. TDS can also be an indicator of anthropogenic impacts resulting from the infiltration of urban runoff, irrigation return flows, wastewater disposal, or other human activities.

4.7.3 Nitrate as Nitrogen

Elevated nitrate concentrations have been a recognized, long-term concern in the Subbasin. As shown in Table 4.1, current average nitrate as nitrogen concentrations are relatively low throughout the Subbasin; average nitrate concentrations in all areas are below the 10 mg/L MCL for nitrate as nitrogen. Figure 4.13 shows the maximum nitrate as nitrogen concentrations at each sampled well. Most of these wells have maximum nitrate concentrations below the 10 mg/L MCL. Local exceedances occur in the Warm Springs in Lee Lake area, but not in the Elsinore Area.

Nitrate is the primary form of nitrogen detected in groundwater and natural nitrate levels in groundwater are generally low. Elevated concentrations of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facility discharges. Isotopic analysis of nitrogen in the Subbasin found that some of the nitrate in groundwater is from septic systems (Sickman 2014). Given that these sources result from activities at or near the ground surface, shallow groundwater typically is characterized by higher concentrations than deep groundwater. Time concentration plots for selected wells are shown on Figure 4.14. As with TDS, some shallower wells show increasing nitrate concentration trends while other nearby wells do not. However, there are a limited number of monitored wells with long records that would be necessary to identify regional trends.

4.7.4 Arsenic

Arsenic is naturally occurring metalloid that leaches from aquifer materials into groundwater. Arsenic can enter groundwater from aquifer sediments when groundwater has low oxygen levels or a high pH (reducing conditions). Groundwater in this region frequently has high manganese and iron concentrations, which suggests that it has low oxygen levels or reducing conditions. Arsenic in Subbasin groundwater is likely derived from iron oxide on sediments, which dissolves in low-oxygen environments. For California public drinking water systems, the primary MCL for arsenic is 10 µg/L. Long-term exposure to arsenic has been linked to multiple forms of cancer, while short-term exposure to high doses of arsenic can cause other adverse health effects. Maximum arsenic concentrations of 10 µg/L or higher were measured in 25 wells in the Subbasin, including seven potable water supply wells. Recent maximum concentrations are shown geographically on Figure 4.15. All arsenic detections above the MCL are from wells within the Elsinore Area, and most are in the area south of Lake Elsinore. Wells in this area with elevated arsenic concentrations

(Cereal 3 and 4, Summerly, and Diamond) are treated at a centralized treatment facility. In addition, the Cereal 1 and Corydon Street wells utilize blending to mitigate slightly elevated arsenic concentrations. Time concentration plots of arsenic for frequently monitored wells are shown on Figure 4.16. The graphs on Figure 4.16 do not show any apparent trends in arsenic concentrations over time in the frequently monitored wells.

4.8 Other Constituents

A review of all available data was performed to identify other possible COCs. The water quality data from all sampled wells in the Subbasin was compared to relevant State and Federal water quality goals and/or regulatory limits to identify constituent detections exceeding the respective goal or limit. This assessment identified detections exceeding goals or limits in at least one well for each of the constituents listed in Table 4.2.

Table 4.2 Water Quality Goal Exceedance Summary

Chemical Constituent	Goal Concentration	Type of Goal
Aluminum	1,000 µg/L	MCL (California)
Arsenic	10 µg/L	MCL (California)
Barium	1 mg/L	MCL (Federal)
Boron	1 mg/L	California NL
Gross Alpha	15 pCi/L	MCL (Federal)
Iron	300 µg/L	Secondary MCL (Federal)
Manganese	50 µg/L	Academy of Sciences HAL
MTBE	13 µg/L	MCL (California)
Sodium	50 mg/L	California Action Level (NL)
Specific Conductance	1,600 µmhos/cm	Secondary MCL (Federal)
Sulfate	500 mg/L	Secondary MCL (Federal)
TDS	1,000 mg/L	Secondary MCL (Federal)
Vanadium	50 µg/L	USEPA RfD
Vinyl Chloride	0.5 µg/L	MCL (California)

Abbreviations:
µmhos/cm - micromhos per centimeter; Fe - iron; HAL - health advisory level; NL - notification level; pCi/L - picocuries per liter; RfD - reference dose; USEPA - Unites States Environmental Protection Agency.

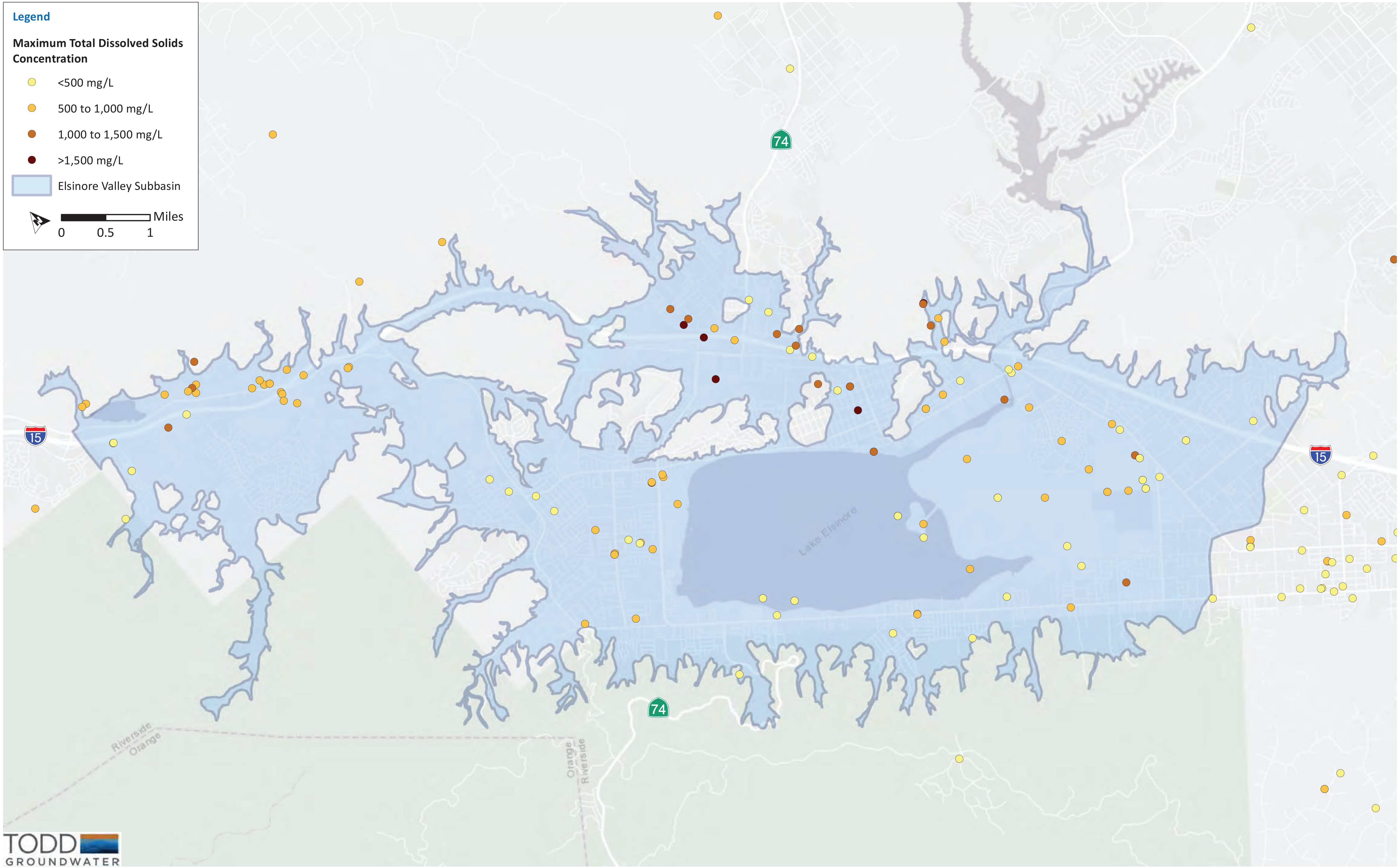


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Figure 4.11 Total Dissolved Solids Concentrations in Wells

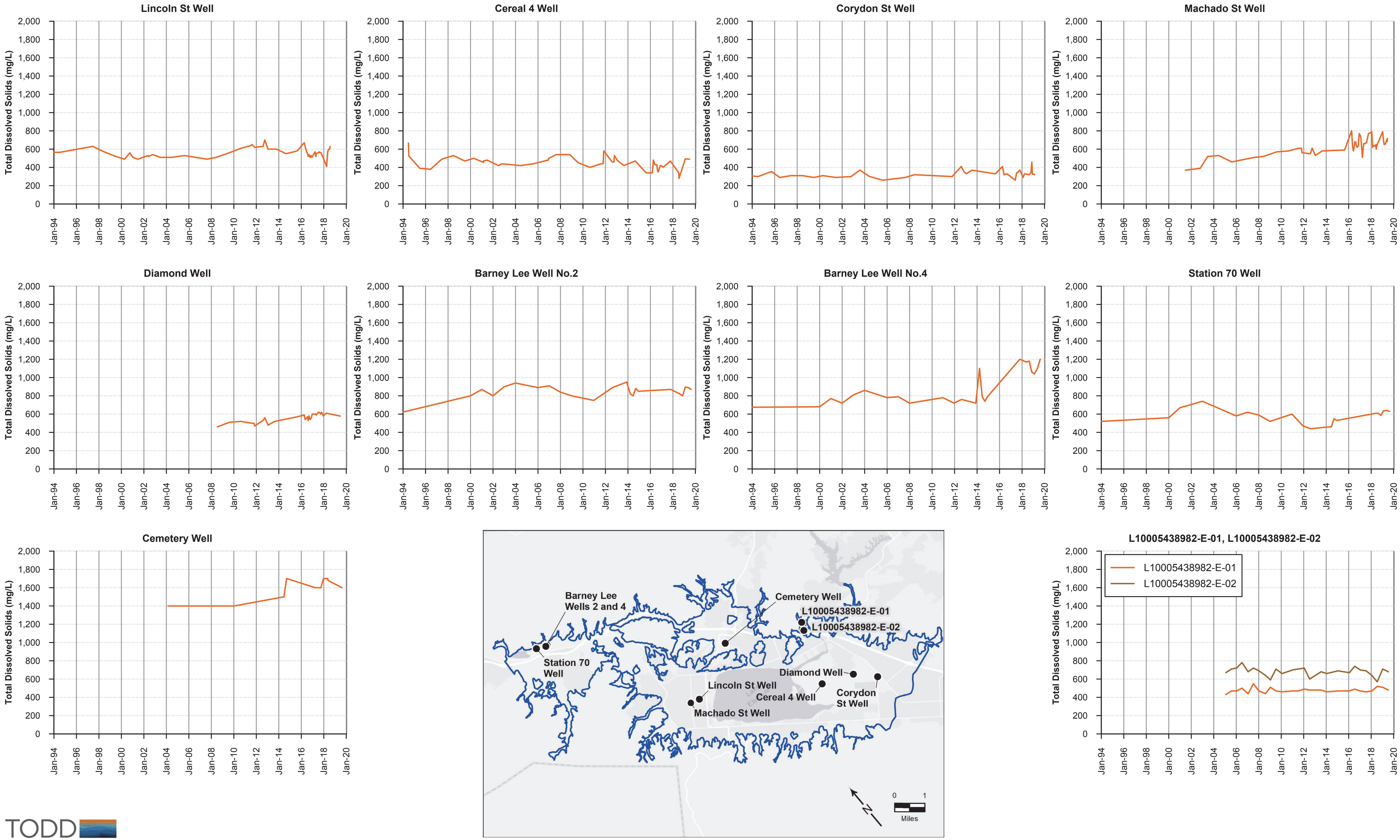


Figure 4.12 Total Dissolved Solids Concentrations Over Time

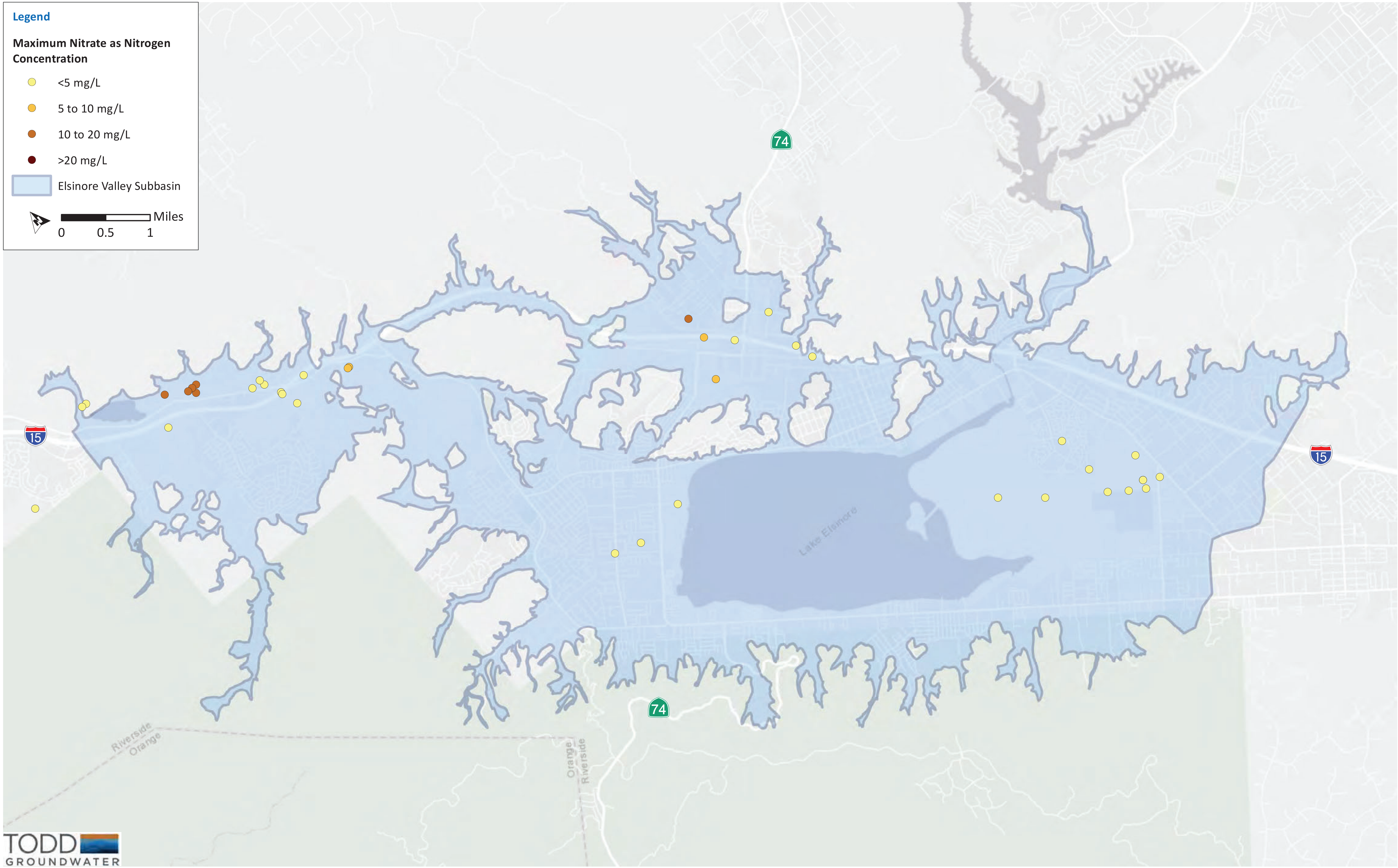


Figure 4.13 Nitrate as Nitrogen Concentrations in Wells

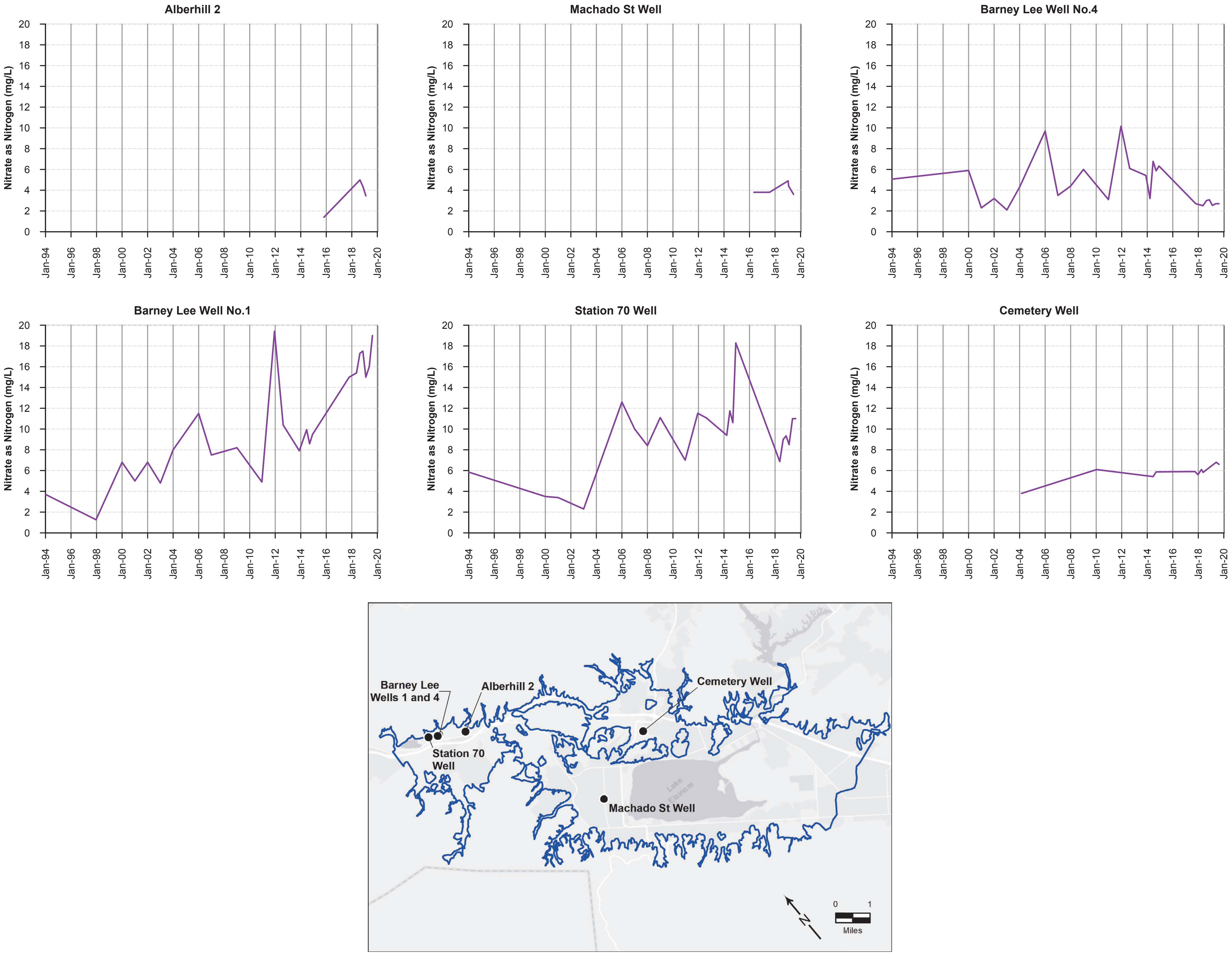


Figure 4.14 Nitrate as Nitrogen Concentrations Over Time

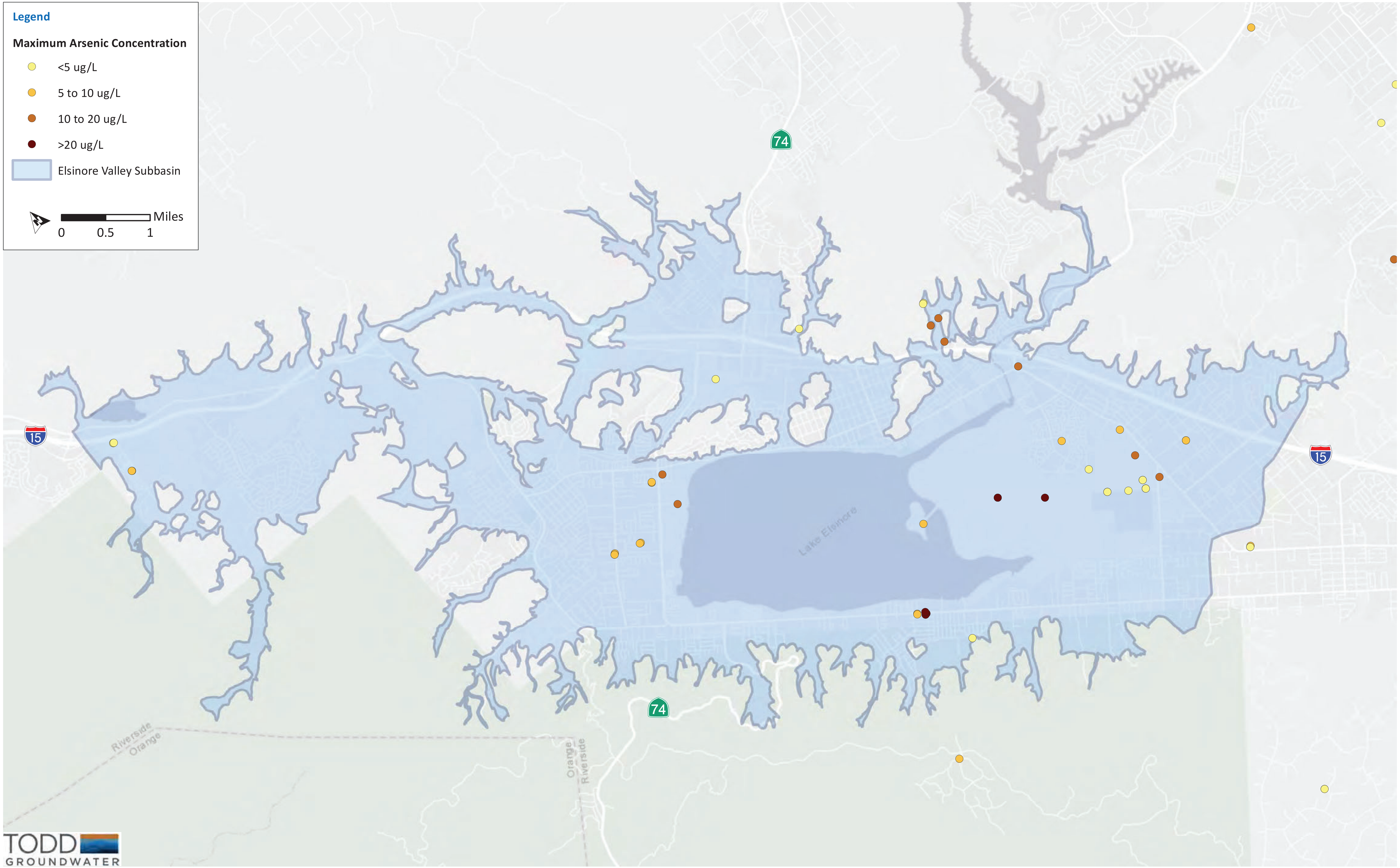


Figure 4.15 Arsenic Concentrations in Wells

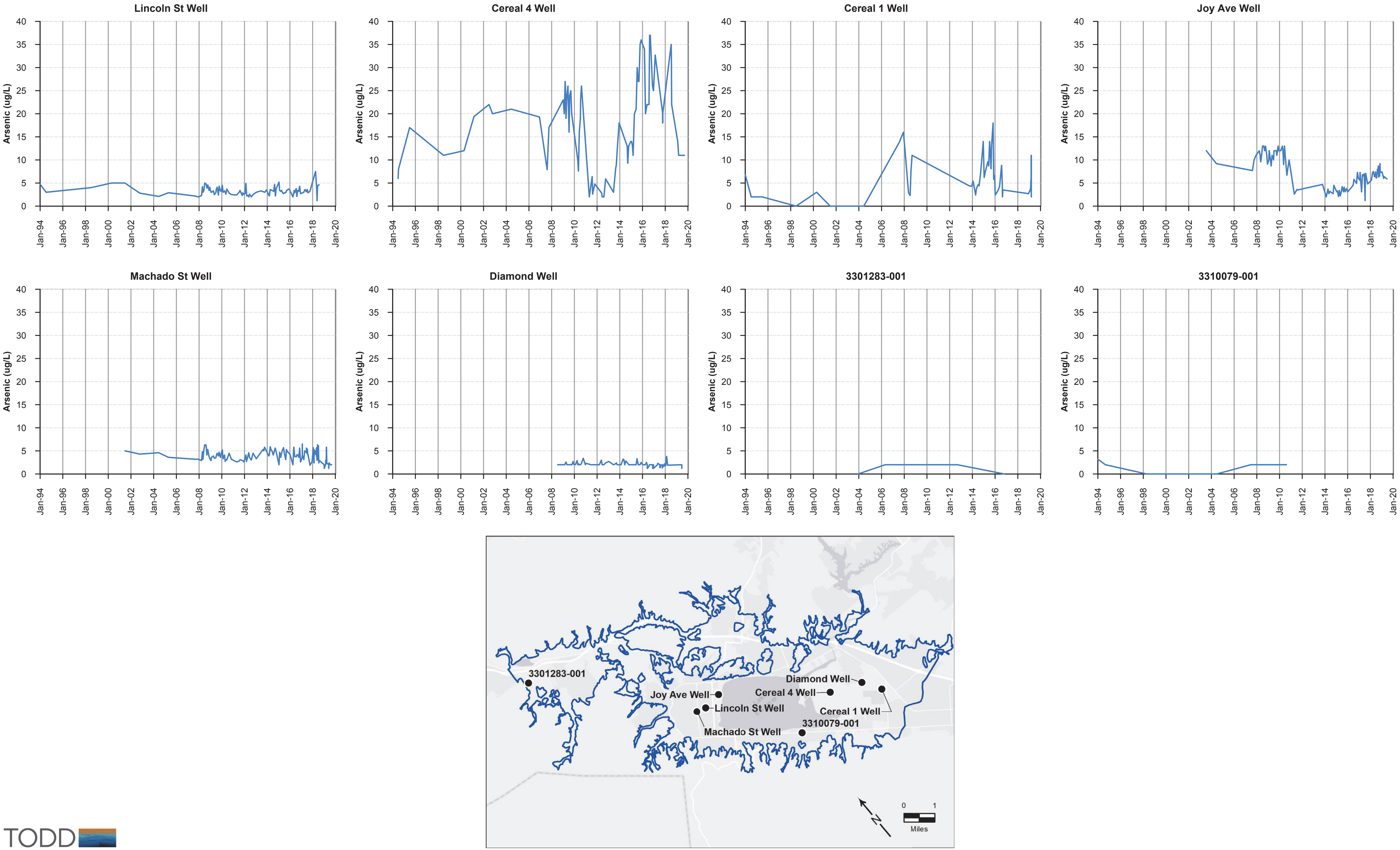


Figure 4.16 Arsenic Concentrations Over Time

While some of these constituents were only in exceedance at regulated facilities (e.g., MTBE and Vanadium) others are more prevalent across the Subbasin. The more commonly identified constituents are discussed below.

Iron. In natural water, iron is generally analyzed as total iron, which includes ferric iron and ferrous ion. Soluble ferrous ion is more common in groundwater under reducing conditions, occurring at concentrations ranging from 1.0 to 10 mg/L (Manaham 1991 and Hounslow 1995). The MCL is 300 µg/L, and no recent samples exceeded this limit; however, several potable supply wells have detected iron concentrations above the MCL in historical samples.

Manganese. Manganese is generally associated with iron under anaerobic conditions where the more soluble forms may occur. In general, if water has more than 0.20 mg/L, manganese will precipitate upon encountering an oxidizing environment. This will cause an undesirable taste, deposition of black deposits in water mains, water discoloration and laundry stains (Todd 1980 and WHO 2003). The MCL is 50 µg/L, and no recent samples exceeded this limit. One older potable well has had samples above the MCL. Anthropogenic sources include mining wastes, iron and steel manufacturing, cleaning oxidants, bleaching and disinfection (potassium permanganate), and as an organic compound used as an octane enhancer in gasoline (Methylcyclopentadienyl manganese tricarbonyl [MMT]) in North America (Canada and the United States) (WHO 2003).

These constituents should continue to be monitored to assess any trends that may be occurring in the Subbasin. However, arsenic, iron, and manganese are likely naturally occurring and may not be adversely affected by management actions in the Subbasin.

4.9 Vertical Variations in Water Quality

Generally, water quality monitoring programs in the Subbasin do not show a distinct difference of water quality in depth, in part because most of the ambient monitoring wells have long screens. Shallow wells are generally found near regulated facilities and therefore show high concentrations of constituents representing local contamination rather than regional trends. As noted in the TDS discussion, deep potable supply wells show more stable water quality than nearby wells with increasing trends but unknown depths, suggesting vertical variation in concentrations.

Impacts to shallow groundwater likely originate from some type of anthropogenic source at the ground surface such as wastewater disposal, commercial or industrial releases, and agricultural activities (concentration of salts, fertilizers, and soil amendments). Because almost all shallow water quality data in the Subbasin were compiled from regulated facility monitoring wells, regulated facilities are the only place that shallow groundwater could be evaluated. In some cases, impacts to shallow groundwater can be attributed to activities at the facilities; however, for some constituents, the correlation is unclear. In addition, because shallow groundwater data are missing in the remainder of the Subbasin, it is difficult to determine whether shallow impacts are widespread. These complications limit the evaluation of shallow groundwater in the Subbasin and impacts at regulated facilities.

4.10 Seawater Intrusion Conditions

The Subbasin is located approximately 30 miles inland from the Pacific Ocean and the lowest groundwater elevations within it are more than 1,000 ft-msl. No risk of seawater intrusion exists in the Subbasin.

4.11 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 and that the subsurface materials are fully saturated along the flow path.

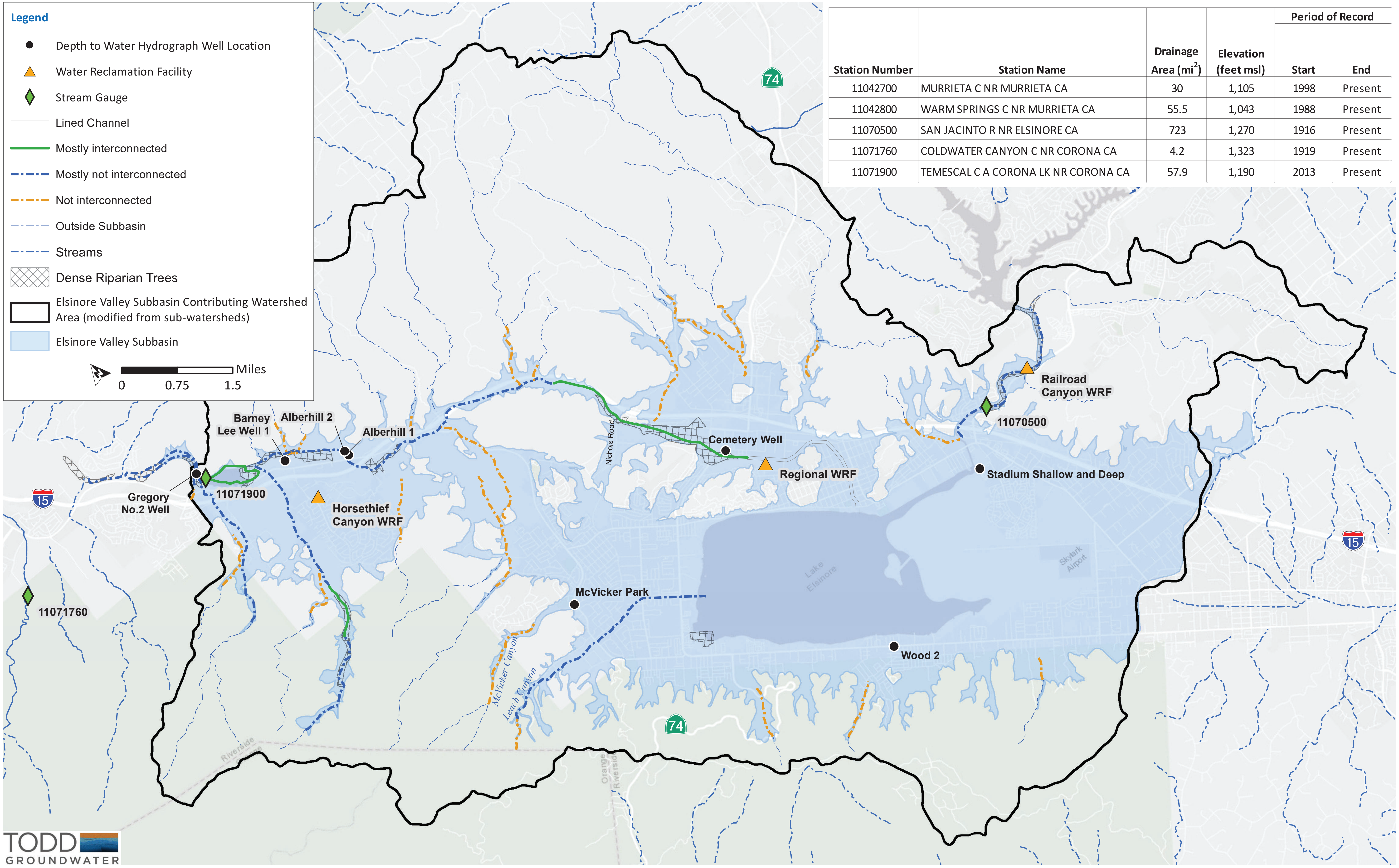
Gaining stream reaches are, by definition, interconnected with groundwater because groundwater seepage into the stream creates or increases stream flow. Losing reaches can be interconnected or not, depending on the depth of the water table beneath the stream bed. If the water table is more than perhaps 10 ft beneath the stream bed (dependent on soil texture), there is likely an unsaturated zone between the stream bed and the water table, which means they are hydraulically disconnected. Under that circumstance, further decreases in water table elevation—due to pumping, for example—do not affect stream flow. Percolation from the stream is determined solely by the depth of water in the stream and the thickness and permeability of the stream bed. In this arid region, water table depth can be inferred from riparian vegetation. Dense, tall, bright-green riparian vegetation—often extending some distance from the channel—are indications that the plants are phreatophytes with roots that reach the water table. Thus, vegetation can be used to infer whether riparian vegetation along a losing reach is interconnected with groundwater or not.

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.

The locations of interconnected surface water in the Elsinore Subbasin were identified on the basis of all three of these factors: stream flow, groundwater levels, and vegetation.

4.11.1 Stream Flow Measurements

Five USGS streamflow gaging stations provide a general characterization of the stream flow regime in the San Jacinto River, Temescal Wash, and smaller tributaries entering the Subbasin from the east and west. Their locations are shown in Figure 4.17, and daily flows during water years 2006 through 2020 are shown in Figure 4.18. The Elsinore Area is a broad topographic saddle in the Elsinore-Temecula Trough, located between Murrieta Creek, which flows south to the Santa Margarita River, and Temescal Wash, which flows north to the Santa Ana River. Lake Elsinore is a playa at the terminus of the San Jacinto River, which drains a roughly 750-square-mile area to the east of the Subbasin (see Figure 2.1 for regional setting). Railroad Canyon Dam is located on the San Jacinto River three miles upstream of Lake Elsinore and controls almost all flow in the river. Flow at the stream gauge located two miles below the dam is flashy and ephemeral, much like the flow regime in the small tributary streams. Most flow at the gauge is from infrequent spills over Railroad Canyon Dam, such as the series of large flow events in early 2017 and early 2019. Smaller events are generated by runoff from the unregulated watershed area between the dam and gauge.



Station Number	Station Name	Drainage Area (mi^2)	Elevation (feet msl)	Period of Record	
				Start	End
11042700	MURRIETA C NR MURRIETA CA	30	1,105	1998	Present
11042800	WARM SPRINGS C NR MURRIETA CA	55.5	1,043	1988	Present
11070500	SAN JACINTO R NR ELSINORE CA	723	1,270	1916	Present
11071760	COLDWATER CANYON C NR CORONA CA	4.2	1,323	1919	Present
11071900	TEMESCAL C A CORONA LK NR CORONA CA	57.9	1,190	2013	Present

Figure 4.17 Surface Water Features

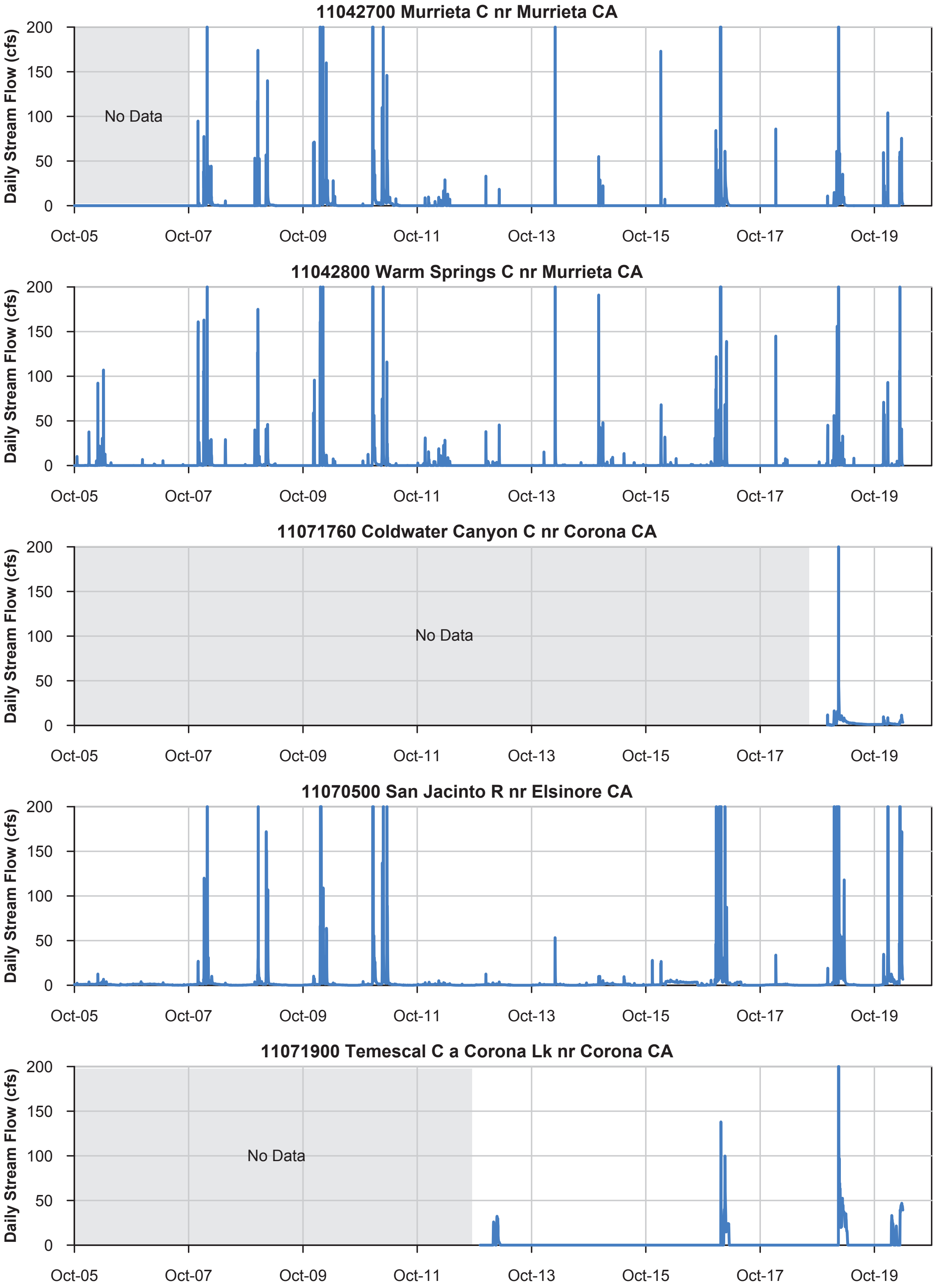


Figure 4.18 Local Stream Flow

Tributaries on the west side of the Subbasin drain the eastern slopes of the Santa Ana Mountains and receive nearly twice as much rainfall as tributaries on the east side of the Subbasin. Warm Springs Creek is located a few miles south of the Subbasin and drains a 56-square-mile watershed extending to the east. Its flow regime is assumed to be ephemeral, with events typically lasting between two days to two weeks. In all years there is zero flow for many months, usually May through November. Nearby Murrieta Creek has a slightly smaller watershed that drains a combination of valley floor area and small drainages to the east and west. Its flow regime is nearly identical to that of Warm Springs Creek. The only Santa Ana Mountain watershed with a gauge is Coldwater Canyon Creek, a 4-square-mile watershed located a few miles north of the Subbasin. The gauge has only one year of record, but that is sufficient to reveal a small but sustained base flow that recedes to about 1 cubic foot per second (cfs) at the end of the dry season. The presence of base flow in such a small watershed suggests that the relatively wet and steep watersheds draining the Santa Ana Mountains are more likely to provide year-round flow that would sustain riparian vegetation than would watersheds on the east side of the Subbasin.

Wastewater discharges have been a significant additional source of flow in Temescal Wash in recent decades. Prior to 2007, the Regional WRF discharged 8 to 9 cfs of treated effluent into Temescal Wash at a point about 2.3 miles downstream of Lake Elsinore. Starting in 2007, that discharge was decreased to 0.77 cfs (0.5 mgd) except during infrequent periods when lake levels were high. The remainder has been discharged into Lake Elsinore as part of a lake level management program. EWMD periodically discharges surplus recycled water to Temescal Wash at a location near the Regional WRF. During 2004 through 2011, those discharges were commonly during January through March and totaled 3,000 to 14,000 AFY, equivalent to 16 to 80 cfs over a 3-month period (WEI 2017). The discharges have become less common since then and are expected to become even less frequent in the future as EMWD increases its capacity to store and use recycled water.

The almost complete lack of base flow at any of the local gauges demonstrates that groundwater is not discharging into the waterways near the gauge locations. However, an inspection of high-resolution aerial photographs taken on 22 dates between 1994 and 2020 (Google Earth 2020) revealed surface ponds at five locations in and near the Temescal Wash channel between Highway 74 and about 1.5 miles downstream of Nichols Road (Figure 4.17), where the creek flows through a narrow alluvial gap between bedrock outcrops. The ponds include two large, excavated ponds west of the channel just below Highway 74, one small depression in the center of an expanse of herbaceous vegetation east of the channel 0.50 miles downstream of Highway 74, a string of what appear to be borrow pits along the west edge of the riparian area 0.53 to 0.93 miles downstream of Highway 74 and a series of pools in the channel 1.0 to 1.5 miles downstream of Nichols Road. The water levels in all of these water bodies rose and fell together, as evidenced in the aerial photographs. This indicates that they are all "water table" ponds that are exposures of the water table. Water levels were medium to high prior to 2013 except for November 2009, when they were low. During 2013 through 2018, the levels followed a seasonal pattern: medium-high in winter and low or medium-low in summer and fall. During the low periods, the natural depression in the herbaceous vegetation and the pools in the Wash channel dried up, whereas the man-made water bodies generally retained some water.

The rises and declines in pool water levels generally matched the rise and fall of water levels in the nearby Cemetery Well (Figure 4.19). Shallow piezometers were installed at five locations along this reach in 2007, and water levels were measured monthly during 2007 and 2008 (MWH 2008).

At all of the locations, the depth to water was 2 ft or less in March and less than about 5 ft in summer. Based on water levels, surface ponds and vegetation, this reach of Temescal Wash is considered interconnected with groundwater. Along the remaining reach down to Corona Lake, groundwater appears to be interconnected with the vegetation root zone but not with the stream channel.

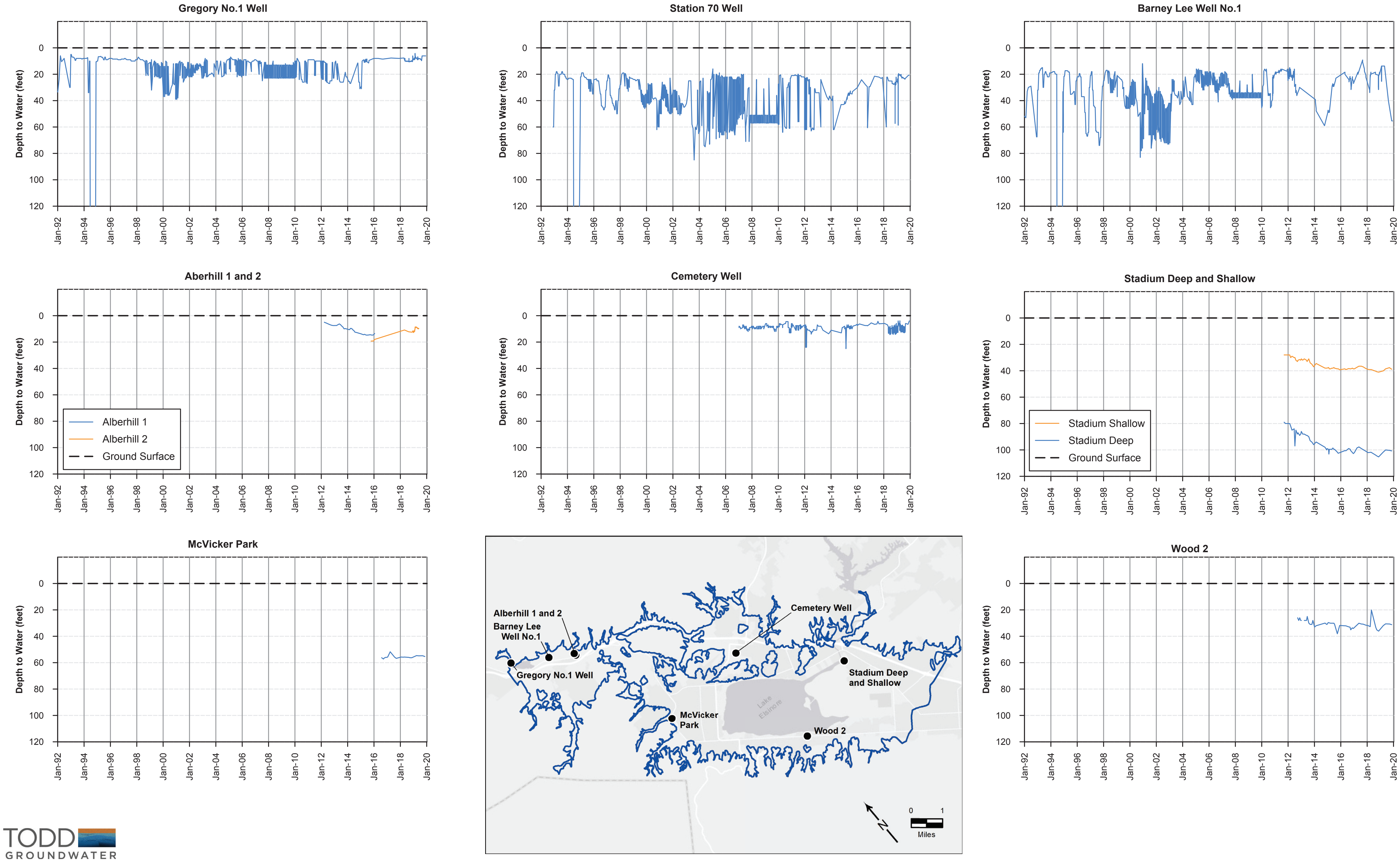
Historical aerial photographs also revealed a reach of Horsethief Canyon with bright-green vegetation in most of the photographs. It is located 2.15 to 2.65 miles upstream of the confluence with Temescal Wash. Based on the vegetation, the reach is considered interconnected.

4.11.2 Depth to Groundwater

Depth to groundwater provides a general indication of locations where gaining streams and riparian vegetation are likely to be present. Fortunately, several of the groundwater level monitoring wells are along Temescal Wash and the San Jacinto River. However, those wells are almost all 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 water table, which is the upper surface of the saturated zone. Because recharge occurs at the land surface and pumping occurs at depth, alluvial basins such as this one typically have downward vertical 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.

Large downward vertical hydraulic gradients are present in the Elsinore Area. Near Lake Elsinore and in the area south of the lake, the depth to water in shallow wells is typically a few tens of ft, whereas it is 200 to 500 ft in deep wells at the same locations. The downward gradients approach 1:1, which means an unsaturated zone might be present between shallow and deep aquifer materials (see Section 4.1.5). It is the deep aquifer units that are typically tapped by water supply wells. These large downward vertical gradients are probably the result of clay layers in the alluvium that were lakebed sediments deposited as Lake Elsinore waxed and waned over geologic time (see Chapter 3 above). Given the large magnitude of the downward gradients, the shallow aquifer units are for practical purposes perched and unaffected by pumping and water levels in the deep units. This means that Lake Elsinore and nearby wetlands and phreatophytic vegetation are sustained by surface water and not interconnected with the regional groundwater system.

The situation is more complex around the periphery of the Elsinore Area, where groundwater transitions from thin, unconfined conditions in tributary stream valleys to the deep, more segregated conditions in the center of the Area. Figure 4.19 shows hydrographs of depth to water in all of the monitored wells where depth to water is relatively shallow. The Stadium well cluster is located near the San Jacinto River in the zone where the Subbasin begins to deepen and groundwater conditions become more segregated. The screen depths of the shallow and deep wells are unknown, but the depth to water in the shallow well is typically about 40 ft bgs and 60 ft above the water level in the deep well. The depth to water is too large for there to be hydraulic connection between the water table and the river, and it is also beyond the depth reached by the roots of riparian vegetation (see further discussion below). Farther up the river, however, depth to water is probably smaller, based on the presence of a healthy riparian forest bordering the channel.



Gregory No.1 Well

Station 70 Well

Barney Lee Well No.1

Aberhill 1 and 2

Cemetery Well

Stadium Deep and Shallow

McVicker Park

Wood 2

Figure 4.19 Depth to Water (DTW) Hydrographs

A similar situation is present at the McVicker Park well northwest of Lake Elsinore. It is also located between a tributary canyon—where a shallow water table is probably present at times in the channel alluvium along McVicker Creek—and the central Subbasin area where water levels diverge. Depth to water in the well is fairly constant at about 55 ft. Along the west edge of the Subbasin, the Rome Fault appears to create a barrier to groundwater flow such that even deep wells have shallow water levels. For example, the Wood 2 well is 600-ft deep but has a depth to water of 30 to 35 ft. The nearby Grand well has a similar depth to water.

The Warm Springs and Lee Lake Areas do not appear to have significant vertical hydraulic gradients, have relatively thin alluvial sediments, and depths to water are relatively shallow along Temescal Wash. The sole well with water level data in the Warm Springs Area—the Cemetery Well—is located about 1,500 ft from Temescal Wash where the ground surface is about 15 ft higher than the creek bed. The depth to water is typically 10 ft, which could be consistent with a hydraulic connection with the creek. In the Lee Lake Area, wells are monitored at four general locations along the creek (Gregory, Station 70, Barney Lee, and Alberhill), and at all of those locations depth to water is commonly 20 ft or less. Allowing for 10 to 15 ft of elevation difference between the well head and the creek bed, the depths to water are consistent with a plausible interconnection with surface water. However, the lack of perennial flow in that area indicates that groundwater is not discharging into the creek. Hydraulic connection would only occur if and when base flow is present.

Creeks and rivers that lose water commonly form a mound in the water table beneath 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 ft more than groundwater elevations in wells 1,000 ft away when the river started flowing (Feeney 1994). A groundwater ridge up to 12 ft 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 ft (Thomasson et al. 1960). Given the low frequency and duration of flow events in Temescal Wash and the San Jacinto River, mounding sufficient to establish a hydraulic connection with surface water might not have time to develop. An exception may be the occasional EMWD treated wastewater discharges to Temescal Wash, which can be up to 50 cfs for sustained periods.

Even if the water table does not intersect the stream channel, it can provide water to phreatophytic vegetation if 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 ft in wells near stream channels was selected as a threshold for identifying possible phreatophyte areas. This depth allows for 10 to 15 ft of root depth, 5 ft of elevation difference between the water level in the well and the overlying water table, and 15 ft of elevation difference between the well head and the bottoms of the creek channel. By this criterion, the roots of riparian vegetation likely reach the water table along

Temescal Wash where it passes through the Warm Springs and Lee Lake Areas. In the Warm Springs and Lee Lake Areas, no water level data are available for wells away from Temescal Wash, but in the adjacent Bedford-Coldwater Subbasin, ground surface rises much more rapidly than the water table with distance from the Wash, leading to depths to water of 10 ft to over 100 ft.

Along the Railroad Canyon reach of the San Jacinto River between Canyon Lake Dam and I-15, groundwater appears to not be connected to surface water (based on the absence of base flow at the gauge) but connected to the riparian vegetation root zone (based on the presence of dense, riparian tree canopy).

In summary, there are four regions of possible perennial or seasonal interconnection of groundwater and surface water in the Subbasin:

- Shallow, perched groundwater in the central, confined part of the Elsinore Area that is connected to Lake Elsinore but not to the underlying deep aquifer. This aquifer functions as a subsurface extension of the lake and is not a significant source of water supply. Groundwater levels in the aquifer are determined by lake level, which is determined by its surface water balance. Pumping and water levels in the principal (deep) aquifer underlying the lake do not affect the perched aquifer.
- Along tributary stream channels as they approach the Elsinore Area—especially along the western side of the Area—where groundwater discharge from fractured bedrock likely supports a shallow water table in the thin alluvial deposits and probably also supports sustained stream base flow during the wet season. These are losing reaches, possibly perched above the principal aquifer and in any case far from the effects of pumping at water supply wells.
- The reach of Temescal Wash between Highway 74 and 2.85 miles downstream of Nichols Road. Natural and man-made ponds along this reach are exposures of the water table and within a few ft of the ground surface.
- A short (0.5 mile) reach of Horsethief Canyon about midway along the reach that crosses the Subbasin. Visible persistent mesic herbaceous vegetation is the primary evidence for the presence of a very shallow water table that is likely connected to the stream at times.

These conclusions will be further assessed through additional study during GSP implementation.

4.11.3 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 historical photographs are indicated by a crosshatch pattern in Figure 4.20. The figure also shows the distribution of vegetation classified as Natural Communities Commonly Associated with Groundwater (NCCAG) by DWR in association with other organizations including The Nature Conservancy. Multiple historical vegetation surveys were used to prepare detailed statewide mapping of NCCAG vegetation that is accessible on-line (DWR et al. 2020). The extent of NCCAG vegetation along Temescal Wash and the San Jacinto River is much greater than the extent of dense riparian vegetation. The NCCAG mapping also includes patches along ephemeral stream channels where shallow groundwater is not likely present, such as tributaries entering Temescal Wash from the west in the Lee Lake Area. Thus, some of the vegetation in the NCCAG polygons is probably not relying on groundwater.

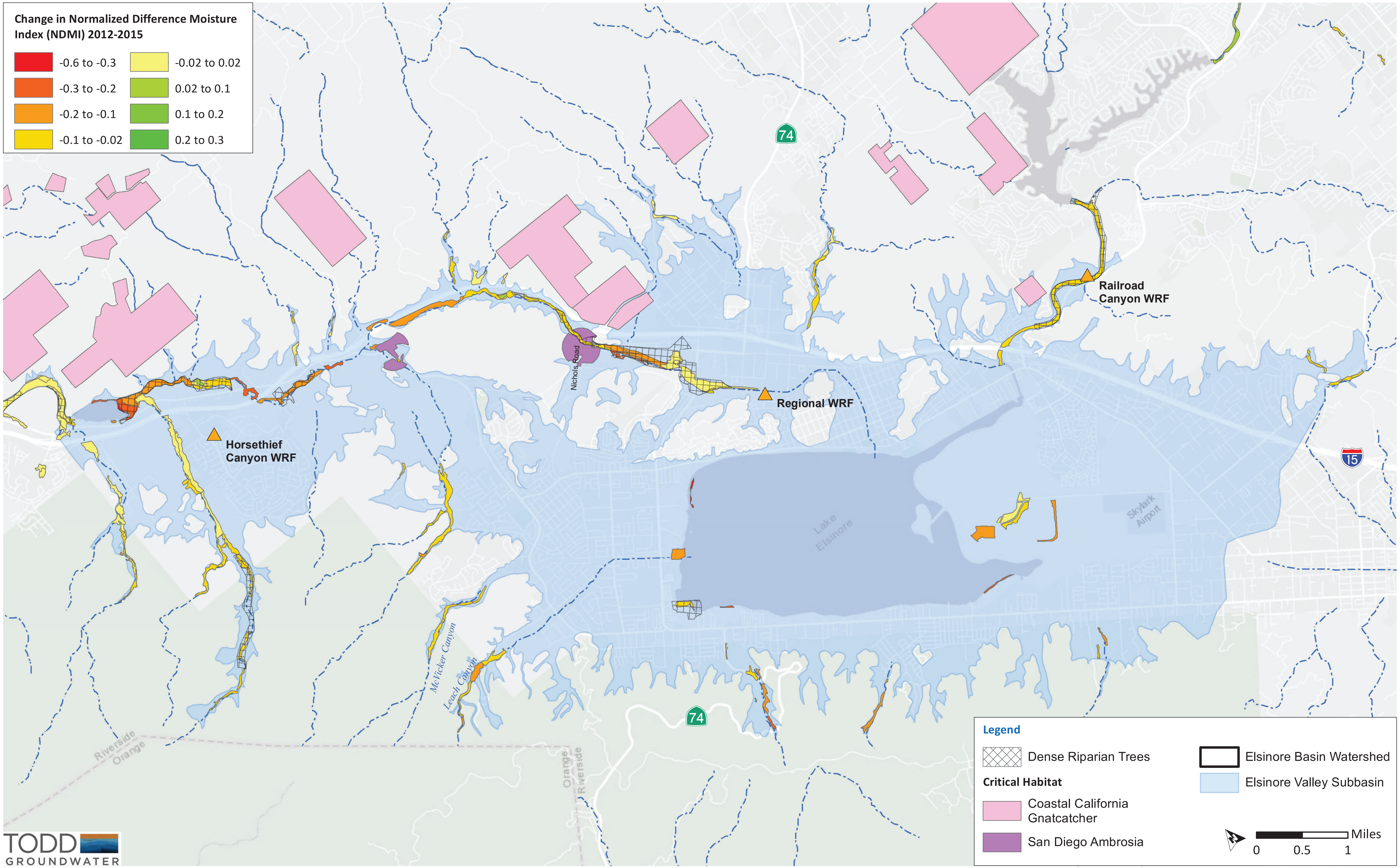


Figure 4.20 Riparian Vegetation and Critical Habitat

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 will 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. Groundwater levels declined 5 to 20 ft over that period in most of the wells with shallow water levels along Temescal Wash during that period then recovered during the following 1 to 2 years (see Figure 4.19). Some of the hydrographs show downward spikes that result from drawdown when the well (or a nearby well) was pumping, such as the Gregory, Station 70, and Barney Lee wells. The static water levels are most relevant to vegetation, which are the points without drawdown along the top edge of the hydrograph.

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 through 2018 to assist with the identification of GDEs (Nature Conservancy 2020). In Figure 4.20, 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. Most of the mapped polygons are orange or red, indicating more moisture stress in 2015 than 2012.

Patches of dense riparian vegetation along Temescal Wash were also examined in high-resolution aerial photographs (Google Earth 2020) for dates during the growing season over the 2012 to 2018 period to look for signs of tree mortality. Significant tree mortality was observed at the upstream end of Corona Lake, near the Temescal Canyon Road bridge, and downstream of Bernard Street. The tree canopy has not recovered since then. Therefore, the drought conditions during 2012 through 2015 stressed and, in some cases, killed riparian trees.

The correlation between groundwater levels and vegetation health does not necessarily prove causality, because vegetation may utilize other water sources such as rainfall. Rainfall was also far below average during the drought. Rainfall at Elsinore during water years 2013 through 2016 averaged 5.96 inches, or 56 percent of the long-term average. Wastewater discharges also decreased at about the same time the drought began. Normal discharges from the Regional WRF decreased from 8 to 9 cfs to 0.77 cfs beginning in 2007. That decrease was offset by large wet-season discharges of surplus recycled water by EMWD. However, those discharges decreased substantially beginning in 2012 and were absent during 2014 through 2016.

Herbaceous wetland vegetation also appeared to die back during the drought, but it appears to have subsequently recovered. This is visible in aerial photographs at the natural depression pond downstream of Highway 74, at the in-channel pools downstream of Nichols Road, and along the interconnected reach of Horsethief Canyon. At the first two of those locations, the water table remained shallow enough to produce surface ponding in winter. In summary, groundwater levels along the entire reach of Temescal Wash downstream of the Regional WRF and along the San Jacinto River between Railroad Canyon Dam and about I-15 appear to be shallow enough to support phreatophytic riparian vegetation.

4.11.4 Wetlands

The NCCAG vegetation mapping tool also includes a wetlands map. Most of the wetland polygons are along Temescal Wash and the San Jacinto River coincident with riparian vegetation polygons. To support wetlands, groundwater must be at or within about 3 ft of the ground surface. Except for the seasonally ponded reach of Temescal Wash and the middle reach of Horsethief Canyon, groundwater levels do not appear to be that close to the surface (based on well water levels and the presence of wetland vegetation in aerial photographs). Other mapped locations are along small stream channels and usually coincide with areas mapped as having riparian vegetation. In two circumstances, those areas may be associated with a shallow but perched water table. One of those groups consists of polygons located along the shore of Lake Elsinore and channels in the area immediately south of the lake (formerly part of the lake). Wetland vegetation in those areas is likely supported by the shallow, perched water table associated with the lake that is much higher than—and for practical purposes not hydraulically coupled with—the deep groundwater system tapped by water supply wells. The second group consists of polygons along small streams where they first enter the groundwater basin. These reaches obtain small amounts of inflow from groundwater discharging from bedrock farther upstream. Percolation along the losing reaches where the stream enters the basin supports short reaches of riparian vegetation.

There are very few mapped off-channel wetlands, and they are in areas where the water table is too deep to discharge at the ground surface and support wetlands. The wetland vegetation in those areas is seasonal and likely sustained by local accumulations of winter and spring rainfall runoff.

The Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) was reviewed for additional information regarding plant species that might be affected by groundwater (Riverside County Regional Conservation Authority 2020). Two large regions mapped as *narrow endemic plants* and *criteria area species* partially overlap the Subbasin. However, those categories together contain 16 upland plant species, some of which are associated with vernal pools or seasonal inundation, but none of which depend on groundwater. One of the species, San Diego ambrosia (*Ambrosia pumila*), is federally listed as threatened. Critical habitat areas for that species include a small area immediately adjacent to Temescal Wash but not the channel itself (Figure 4.20). The listing document noted that “periodic flooding may be necessary at some stage of the plant population's life history (such as seed germination, dispersal of seeds and rhizomes) or to maintain some essential aspect of its habitat, because native occurrences of the plant are always found on river terraces or within the watersheds of vernal pools” (United States Fish and Wildlife Service [USFWS] 2010). This species appears to rely on seasonal surface inundation but not groundwater.

Therefore, the few small areas mapped as wetlands outside the Temescal Wash and San Jacinto River channels would not be affected by pumping and groundwater levels. Similarly, no listed plant species or plant species protected under the MSHCP depends on groundwater.

4.11.5 Animals Dependent on Groundwater

Animals that can 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 Subbasin 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. No habitat areas for arroyo toad or red-legged frog are located within the Subbasin. The western edge of a very large habitat area for burrowing owl overlaps the eastern edge of the Subbasin. 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 Subbasin are shown on Figure 4.20. The habitat polygons are all in upland areas unaffected by groundwater pumping or levels.

The Upper Santa Ana River Habitat Conservation Plan (SARHCP) also covers the Temescal Wash watershed and differs from the MSHCP primarily in providing Endangered Species Act compliance for an additional set of activities related to water infrastructure construction and operation (ICF 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 Bell's 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 1 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.

Chapter 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 SGMA requires that water balances be prepared for the groundwater system and surface water system of a basin. If a basin contains multiple MAs, separate balances must be developed for each of them. Furthermore, water budgets must be developed for three 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 three water budget analysis periods, describes the boundaries and general characteristics of three MAs within the Subbasin, 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, which is the period simulated by the numerical groundwater model. The model is described in Appendix H 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, ET 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 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 (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 Elsinore Subbasin. The quintile divisions for precipitation during 1899 to 2020 at the Station ELS are shown in Table 5.1.

Table 5.1 Water Year Type Classification

Water Year Type		Range as Percent of Mean	Precipitation Range (inches)(1)
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

Note:
(1) 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 Subbasin. 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 yield. 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 DWR states should be used for determining year types (DWR 2016). 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 Subbasin were selected from within the 1990 through 2019 modeling period. Ideally, each period is characterized by average precipitation and relatively constant land and water use. In the Subbasin, urbanization has been gradual throughout the 1990 to 2019 period. Major changes in water operations included separating the Back Basin area from the rest of Lake Elsinore around 1997 and shifting most discharges at the Regional Wastewater Reclamation Facility from Temescal Wash to Lake Elsinore beginning in 2007 for the purpose of raising lake levels. 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 2019). 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 later.

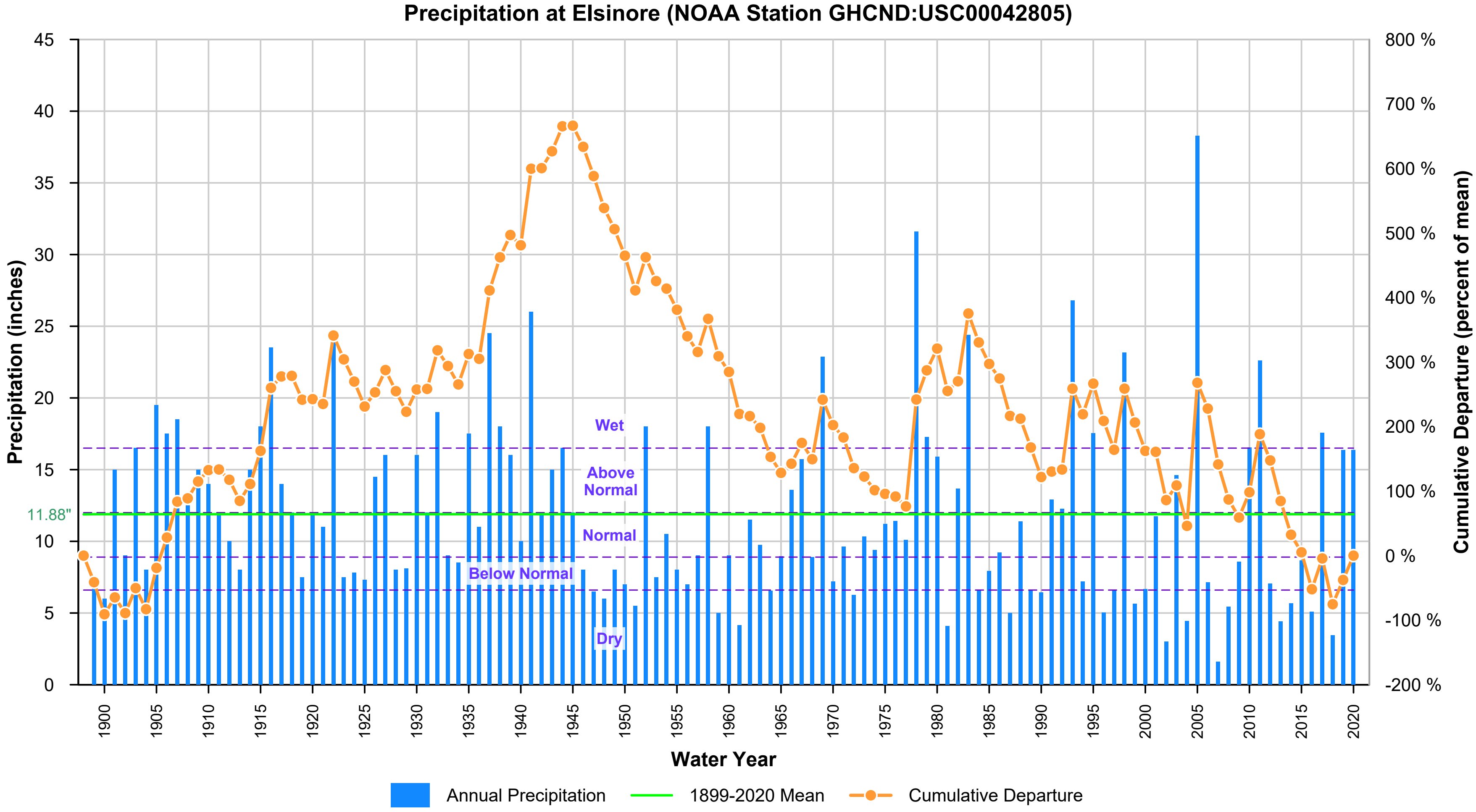


Figure 5.1 Cumulative Departure of Annual Precipitation at Lake Elsinore

5.4 Management Areas

As defined in the GSP regulations, an 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 Subbasin has been divided into three MAs. They are described below, and their boundaries are shown in Figure 5.2.

5.4.1 Lake Elsinore Management Area

The Lake Elsinore MA is the deep structural graben and valley surrounding Lake Elsinore. It is the location of most of the pumping in the Subbasin. Land use is now mostly urban, with some remaining areas of natural vegetation. It is connected to the Warm Springs MA by surface flow down Temescal Wash and subsurface flow through narrow gaps of alluvium between bedrock outcrops. It is connected to the Lee Lake MA by subsurface flow through similar gaps in the bedrock.

5.4.2 Warm Springs Management Area

The Warm Springs MA is relatively shallow hydrogeologically and has little groundwater pumping. Land use has been steadily converting from natural vegetation to urban residential. Temescal Wash flows through this MA providing surface water connectivity between the Elsinore and Lee Lake MAs. Subsurface flow enters this MA from the Elsinore MA through alluvial gaps between bedrock outcrops. Subsurface outflow to the Lee Lake MA might occur through the channel deposits associated with Temescal Wash where it crosses a bedrock outcrop between the MAs.

5.4.3 Lee Lake Management Area

The Lee Lake MA is downstream and downgradient from the Lake Elsinore and Warm Springs MAs. Lee Lake (sometimes referred to as Corona Lake) was formed by a dam on Temescal Wash at the downstream end of the MA. Reduced subsurface permeability between this MA and the adjacent Bedford-Coldwater Subbasin forces some of the groundwater outflow up into the Wash. A number of groundwater production wells are located along the Wash near Lee Lake, where groundwater levels are consistently shallow. Land use includes industrial, clay mining and residential development, both of which have expanded substantially during the past 25 years.

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[1]. 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 depend on current groundwater levels. These include surface and subsurface inflows from tributary areas, percolation from stream reaches within the Subbasin, groundwater discharge to streams, potential subsurface flow from the neighboring basin/subbasin and between MAs, the locations and discharges of flowing wells, consumptive use of groundwater by riparian vegetation, and

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[1] Water balance values are shown to nearest AF to retain small items, but entries are probably accurate to only two significant digits.

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[2], infiltration, runoff, ET, 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 442 "recharge zones" delineated to reflect differences in physical characteristics as well as basin and jurisdictional boundaries. Simulation of watershed areas outside the Subbasin provided estimates of stream flow and subsurface flow entering the Subbasin. 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 H and the model code is available on request.

5.5.2 Groundwater Model

A numerical groundwater flow model of Elsinore MA utilizing Visual MODFLOW Pro 3.0 (Waterloo Hydrogeologic 2002), a graphical interface to USGS MODFLOW, was previously prepared by MWH for the GWMP (2005), with updates and revisions in 2013 (Kennedy Jenks) and 2016 (MWH/Stantec), and simulated water years 1961 through 2001. For this GSP, the model was revised, expanded to include the Warm Springs and Lee Lake MAs and calibrated based on a simulation of water years 1990 to 2018. Estimates of some model inputs for prior years are uncertain due to lack of data. It was decided that simulating the post-1989 period would provide the greatest model accuracy.

The revised and updated model uses the MODFLOW 2005 code developed by the 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 H.

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 Subbasin from tributary watersheds, San Jacinto River between Canyon Lake Dam and Lake Elsinore, and Temescal Wash from Lake Elsinore to the downstream end of the Subbasin).

Surface water inflows to the San Jacinto River and Temescal Wash were obtained from stream gage records, lake spill events and wastewater discharges. 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, ET 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.

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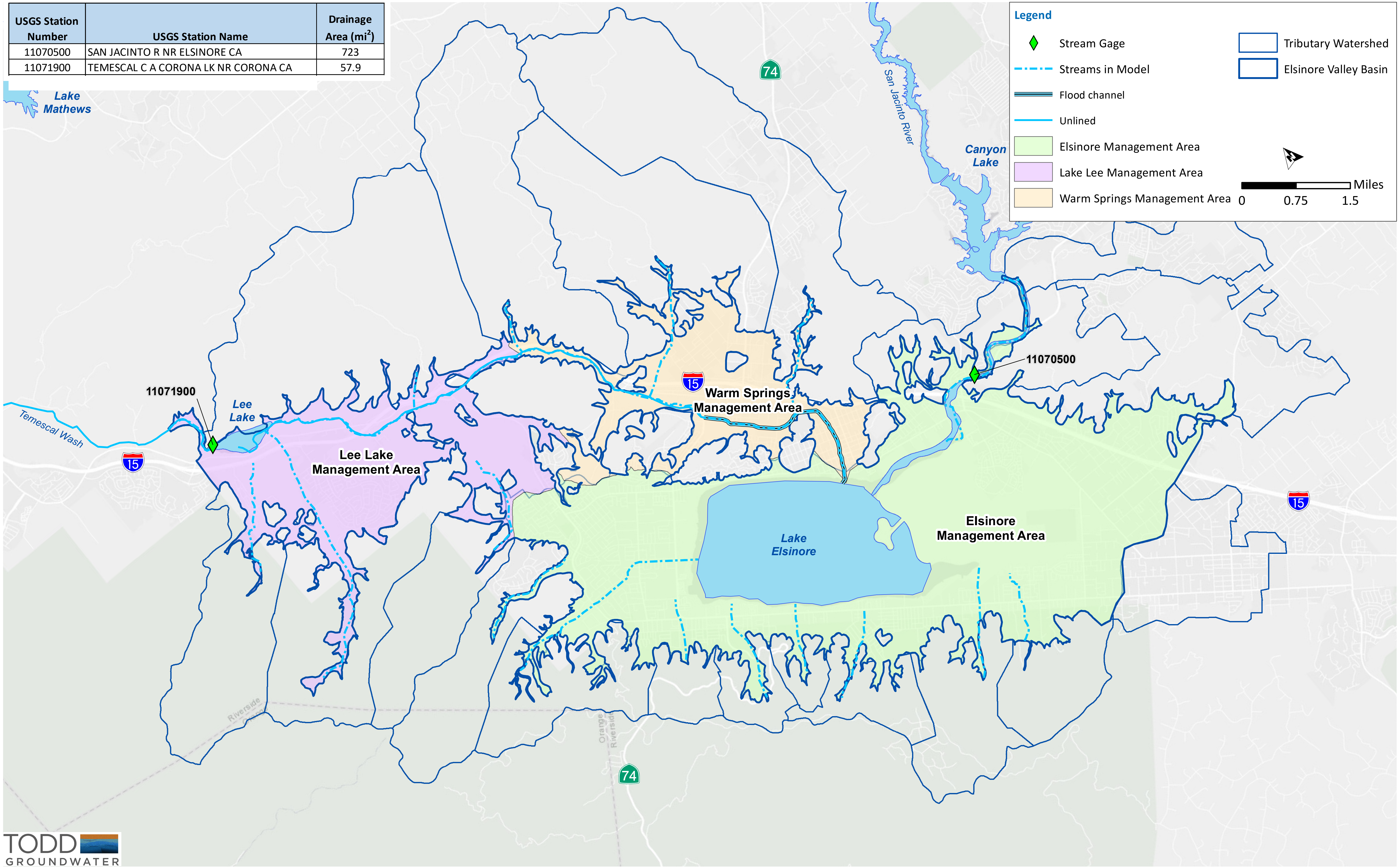
[2] Interception refers to precipitation that does not reach the soil, but instead falls on (and is intercepted by) plant leaves, branches, and plant litter, and is subject to evaporation loss.



USGS Station Number	USGS Station Name	Drainage Area (mi^2)
11070500	SAN JACINTO R NR ELSINORE CA	723
11071900	TEMESCAL C A CORONA LK NR CORONA CA	57.9

TODD GROUNDWATER

carollo

Figure 5.2 Management Areas and Hydrologic Features

5.5.2.2 Groundwater Module

The MODFLOW groundwater model is constructed to cover the entire Elsinore Groundwater Subbasin. 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 ft horizontal grid spacing to provide sufficient resolution to resolve hydraulic gradients, well drawdown cones, and groundwater-surface water interactions in the Subbasin.

The Subbasin extends up a number of narrow 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 Subbasin is based on the mapped depth to consolidated rock. The elevation of surface features and streambed elevations have been derived from GIS files developed from the local topography and stream information.

The only commercial irrigation in the Subbasin is for citrus groves in the Lee Lake MA, which have decreased in size since the 1990s due to urban development. Irrigation pumping is estimated for those areas by the rainfall-runoff-recharge model, and pumping is assigned to a hypothetical irrigation well at the center of each irrigated recharge zone. Urban irrigation is supplied by the municipal water system, which uses imported water and local wells. Well extractions are known and are entered directly into the model. All major pumpers in the Subbasin report their annual production to WMWD, which was the source of data for several additional 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 Subbasin water budget.

5.5.3 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 two scenarios are prescribed:

- **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.

Chapter 8 summarizes the results of groundwater modelling for these scenarios with the proposed projects included.

5.5.3.1 Baseline Scenario

Specific assumptions and data included in the baseline simulation are as follows:

- 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 H for discussion of model calibration).
- 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.
- The simulation is of a 50-year period, as required by SGMA regulations.
- Small stream inflows and bedrock inflow simulated for 1993 to 2017 of the calibration simulations were repeated twice to obtain 50 years of data.
- Monthly spills from Canyon Lake and Lake Elsinore during 1993 to 2017 were assumed to repeat twice.
- M&I and rural domestic pumping were assumed to remain at existing levels. Initial estimates were obtained by calculating average pumping for each calendar month during 2009 through 2018 and applying those averages in every year of the future simulation.
- The initial estimates of municipal pumping from the Elsinore MA were adjusted to reflect the two conjunctive use projects that are currently in place. The Metropolitan Water District Conjunctive Use Program (MWDCUP) has a capacity of 4,000 AFY and the Santa Ana River Conservation and Conjunctive Use Program (SARCCUP) has a capacity of 1,500 AFY. Both would operate on similar schedules; that is, water would be recharged at those rates for three years during wet periods and extracted from the basin over several years during droughts. Over the long run, recharge and extraction would balance. Recharge would be in-lieu, which means that EVMWD would reduce pumping by 4,000 AFY in exchange for an equal increase in use of imported water. Conversely, during droughts pumping would increase and use of imported water would decrease.
- Wastewater percolation and recycled water discharges to Lake Elsinore and Temescal Wash were assumed to continue as under the current lake level management program. Specifically, EVMWD's Regional WRF was assumed to provide a constant discharge of 0.5 mgd to Temescal Wash, with the remainder going to Lake Elsinore except in years when lake levels are high (hydrologic years corresponding to 1993-1995, 1998, 2005-2006 and 2011). In those years, discharge that would have gone to the lake was assumed to go to the Wash. EMWD discharges of excess recycled water to Temescal Wash typically occur in relatively wet years. For the baseline scenario, EMWD was assumed to discharge in the 70 percent wettest years of the simulation in amounts equal to EMWD's average annual discharge and seasonal discharge pattern during 2009 to 2018.
- Municipal use of imported water was also assumed to remain at existing levels, as represented by historical use during 2009 to 2018. Total use inside the Subbasin was estimated to equal 84 percent of total EVMWD use based on the percentage of developed areas within the EVMWD service area that are inside the Subbasin. Average values for each month of the year were assumed to repeat every year of the baseline simulation. The monthly pattern of municipal use is from the Water System Master Plan (MWH 2016) and is applied to imported water and groundwater.

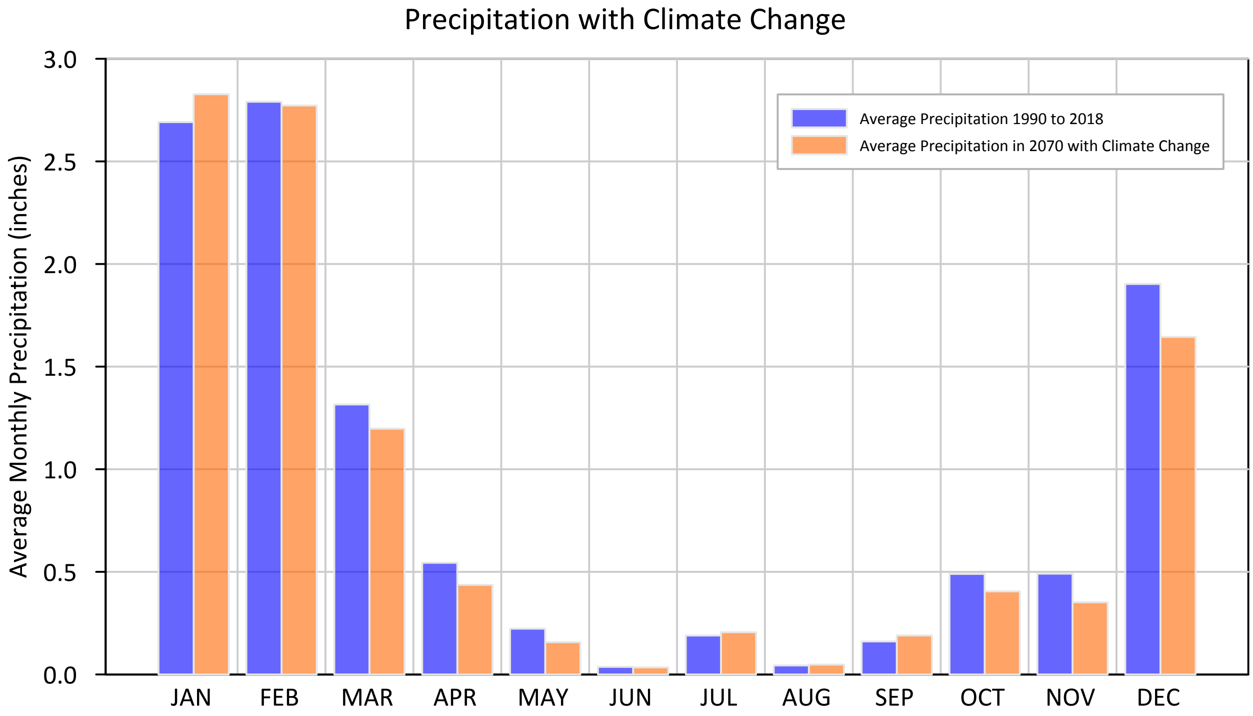
Simulated baseline water balances for the MAs are presented in Sections 5.6 and 5.7, where they are compared with historical and current water balances.

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. Specific assumptions and data include the following:

- Rainfall and reference ET 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 groundwater model (Appendix H). DWR prepared a unique set of multipliers for each 4-square-kilometer cell of a grid covering the entire state. Fourteen grid cells overlie the Subbasin and its tributary watershed areas. For each recharge analysis polygon in the rainfall-runoff-recharge model, multipliers from the nearest grid cell were used. The climate in 2070 is expected to be drier and warmer than it presently is. Figure 5.3 compares average monthly precipitation and ET 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.
- San Jacinto River flows were multiplied by a similar set of multipliers developed by DWR. The streamflow multipliers were not applied to smaller streams entering the Subbasin because their flows are simulated by the rainfall-runoff-recharge model, which already accounted for climate change via the precipitation and ET multipliers.
- Projected land use in 2068 is shown in Figure 5.4 and was developed on the basis of population projections, land use designations in the Riverside County General Plan (Riverside County 2015), assumed urban infill, locations of specific proposed development projects, the EVMWD service area and topography. A comparison of land use acreage by land use category and MA for 1990, 2018, and 2068 is shown in Table 5.2. Conversion of grassland to residential land use was the dominant change in all three MAs and also occurred in tributary watershed areas.
- Total EVMWD water use in 2068 was estimated to be 50,542 AFY. This is based on extrapolation of projected increases in water use from 2020 to 2045 developed during EVMWD's current UWMP update process (EVMWD 2021). EVMWD has separately estimated that buildout water demand would be 80,000 AFY (Gastelum 2021). Overall, this represents an increase in EVMWD water use by a factor of 1.93 over the baseline assumption. The increases are not uniform throughout the area, however. Based on land use, the increase in the Lee Lake MA is by a factor close to 3.0.
- Average annual groundwater pumping in the Elsinore MA was assumed to equal the current estimate of sustainable yield over the long run, which is 6,500 AFY. Conjunctive use operations are superimposed on this average, with the result that pumping decreases to 1,000 AFY in wet years and increases to 12,000 AFY in dry years. This range of fluctuations (+/- 5,500 AFY) reflect the combined capacities of the MWDCUP and SARCCUP conjunctive use programs. Over the course of the 2019 to 2068 simulation, there were 14 wet years, 22 normal years and 15 dry years.
- Municipal pumping in the Elsinore MA was distributed among existing wells according to their percentages of total production during the 2010 to 2018 period.
- Municipal pumping was assumed to increase by 1,000 AFY in the Lee Lake MA (with two new wells) and by 910 AFY in the Warm Springs MA (with three new wells).

- All remaining municipal water use was assumed to be obtained from imported water, except for local recycling of reclaimed water for irrigation. Pursuant to the conjunctive use programs, annual use varied by +/- 5,500 AFY in the opposite direction of the increases and decreases in municipal groundwater pumping.
- The water pipe leak rate was assumed to decrease from 8 percent of delivered volume to 5.6 percent, based on analysis presented in the Water Conservation Business Plan (MWM 2018) and System Optimization Review Plan (Water Systems Optimization [WSO] 2020).
- Pumping at some non-municipal wells was eliminated due to land use conversions (for example, at wells City-2, Grand, Barney Lee 1-4, Gregory 1-2, and Station 70) and pumping for citrus grove irrigation in the Lee Lake MA was similarly reduced in proportion to the reduction in crop acreage.
- Wastewater generation will roughly double by 2068. At the Regional WRF, the mandated 0.5 mgd discharge to Temescal Wash was assumed to continue. The amount of effluent currently discharge to Lake Elsinore for lake level management was assumed to remain the same. Existing amounts of wastewater generation in years with high lake levels (hydrologic years 1993-1995, 1998, 2005 to 2006, and 2011) that are discharged to the Wash were similarly assumed to continue. Future increases in WRF inflow during April to November was assumed to be entirely recycled for urban landscape irrigation. Future increases during December through March were assumed to be discharged to Temescal Wash.
- EMWD was assumed to increase its internal capacity to store and recycle reclaimed water but not enough to quite keep up with increased wastewater generation. EMWD was assumed to discharge 8,000 AFY (about 75 percent of the average amount discharged during 2005 to 2008) and only in the eight wettest years of the 50-year simulation.
- On an average annual basis, the resulting inflows to Temescal Wash consisted of the continuous mandated discharge (560 AFY), continuation of existing discharges when lake levels are high (1,600 AFY), winter discharges of future increased wastewater generation (2,150 AFY), and wet-year discharges of EMWD wastewater (1,280 AFY). These averages can be misleading; the discharges would be highly variable over time. In the dry months of most years, the required minimum discharge would be the only inflow to the Wash, and in winter of wet years when lake levels are high, all four discharges would be occurring simultaneously.
- At Horsethief Canyon WRF in the Lee lake MA, future increases in wastewater generation were assumed to be entirely recycled for irrigation during April through November and entirely percolated in ponds during December through March, as is the current typical practice.
- All existing septic systems were retained in the baseline and the growth plus climate change simulations. Connecting those users to the sewer systems that will be built in urban growth areas will be simulated as a separate project.
- Bedrock inflow and surface inflow from tributary streams along the perimeter of the Subbasin 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 Subbasin, which was routed to small streams, Lake Elsinore and Temescal Wash.



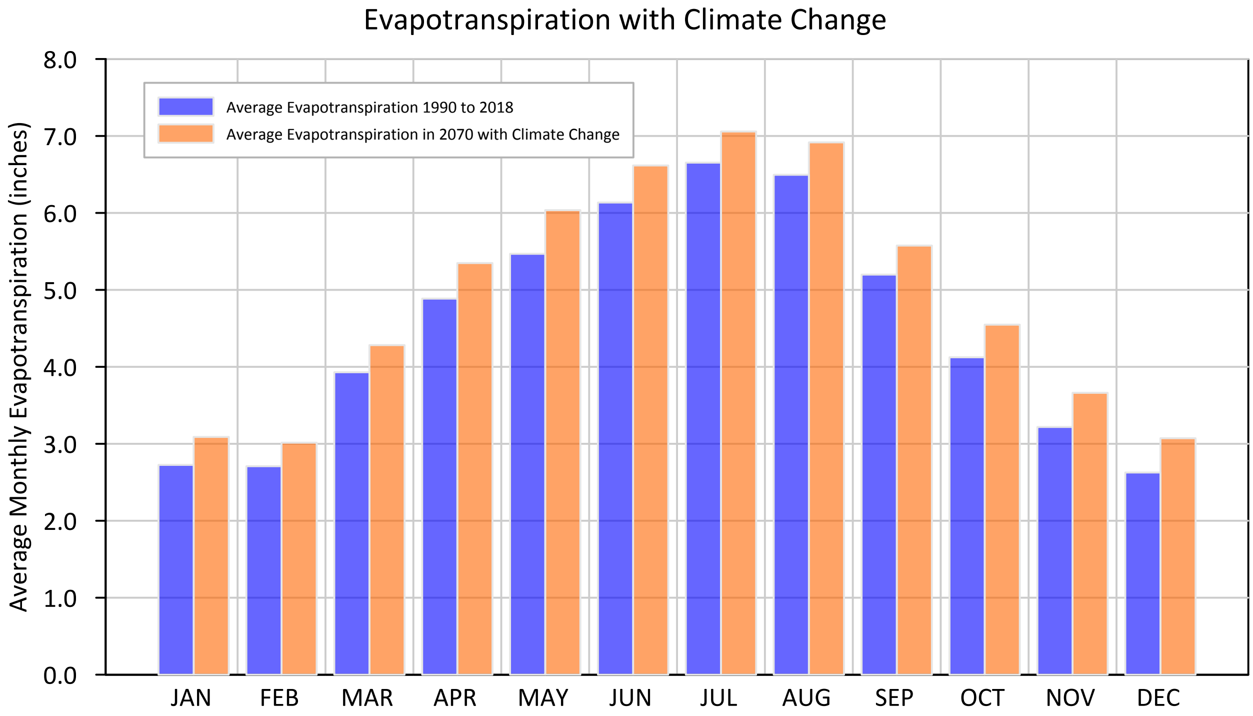


Figure 5.3 Effect of Climate Change on Precipitation and Evapotranspiration

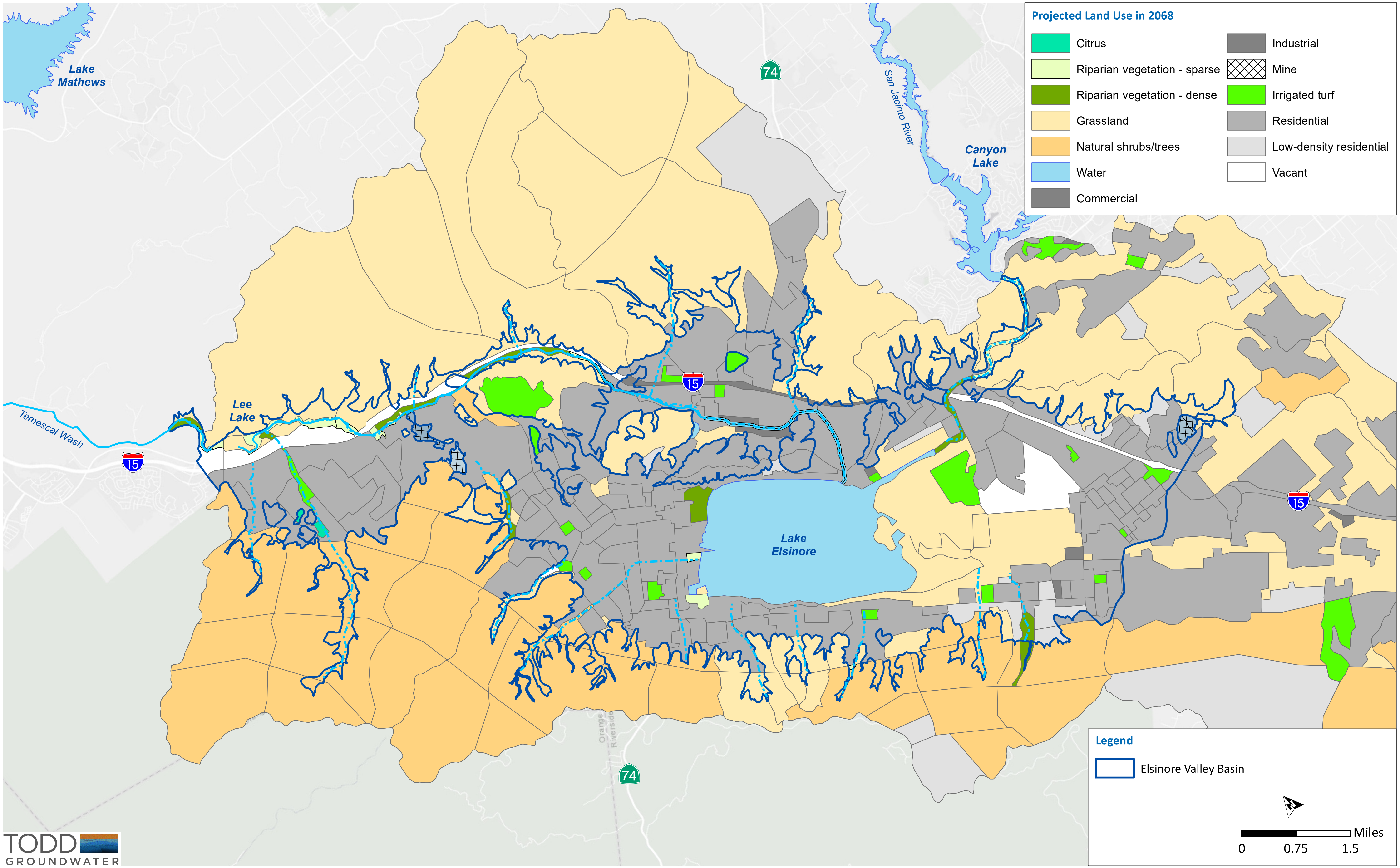


Figure 5.4 Projected Land Use in 2068

Table 5.2 Elsinore Subbasin Land Use in 1990, 2018, and 2068

Land Use	Elsinore Area			Warm Springs Area			Lee Lake Area			Tributary Watersheds		
	1990	2018	2068	1990	2018	2068	1990	2018	2068	1990	2018	2068
Citrus	0	0	0	0	0	0	272	109	18	22	22	8
Grassland	5,977	4,895	2,795	1,639	1,554	407	2,338	1,220	535	28,091	26,419	24,900
Shrubs/Trees	332	332	312	0	0	0	726	726	365	14,519	14,219	14,182
Dense riparian	47	47	47	234	234	21	158	158	158	74	74	74
Sparse riparian	187	187	187	0	0	0	118	118	68	168	168	168
Open water	0	0	0	0	0	0	0	0	0	0	0	0
Low-density residential	1,837	882	536	481	481	0	0	0	0	2,025	1,959	1,872
Residential	1,474	4,673	7,325	0	0	2,276	343	712	2,760	400	2,357	4,014
Turf	10	327	395	15	37	37	0	0	50	72	118	413
Commercial	88	280	27	382	436	0	0	0	0	7	7	7
Industrial	27	27	27	176	176	176	0	0	0	40	77	40
Quarry	0	0	0	0	0	0	0	911	0	47	396	138
Vacant	201	599	599	79	79	79	400	400	400	385	33	33

5.6 Surface Water Balance

This section describes and quantifies the water balance of creeks and rivers that cross the Subbasin. 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). For the Elsinore MA, historical lake elevations provided the primary basis for calibrating the model and confirming that estimated inflows and outflows were consistent. Figure 5.5 shows measured and simulated Lake Elsinore elevations during 1990 to 2018. Gaged flows near Interstate Highway 15 were used as the San Jacinto River inflows to Lake Elsinore. The under-simulation of high lake levels in the early 1990s probably results from errors in the simulated runoff from small tributaries. Global adjustments to raise the simulated runoff in those years cause overprediction of lake levels later in the simulation period. The over simulation of water levels beginning around 2010 coincided with the start of groundwater pumping into Lake Elsinore and could be associated with errors in that variable. The lake level calculations do account for the change in the elevation-area-volume relationship that occurred when the southern part of the lake (Back Basin) was removed by levee construction around 1997. Although the match between simulated water levels is not perfect, it is considered sufficiently accurate for the purposes of this GSP because Lake Elsinore is not hydraulically coupled to the primary aquifer in the Elsinore MA.

Key features of the surface water balances for each MA 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 Elsinore MA during 1990 to 2018 are shown in Figure 5.6 (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 I. Inflow occurs predominantly in wet years. Outflow is primarily to evaporation from Lake Elsinore and is relatively steady from year to year. Surface outflow occurs rarely, when the lake level rises above the outlet channel elevation at 1,255 ft North American Vertical Datum of 1988 (NAVD88). During 1990 to 2018, there were spills in 1993 and 1995, and a near spill in 2005. In this MA only, total inflows do not necessarily balance total outflows in each year. The difference is absorbed by storage changes in Lake Elsinore.

There were some differences in the Lake Elsinore MA surface water balances between the baseline and growth plus climate change simulations. The decreases in inflows from the San Jacinto River and small tributary streams resulted from climate change. Total inflows do not equal total outflows for these scenarios, reflecting the combined uncertainty in estimating the budget terms independently. In reality, there would be no long-term increase or decrease in lake level. Water budget imbalances would likely be absorbed by changes in the amount of recycled water discharged to the lake or the frequency and volume of spills.

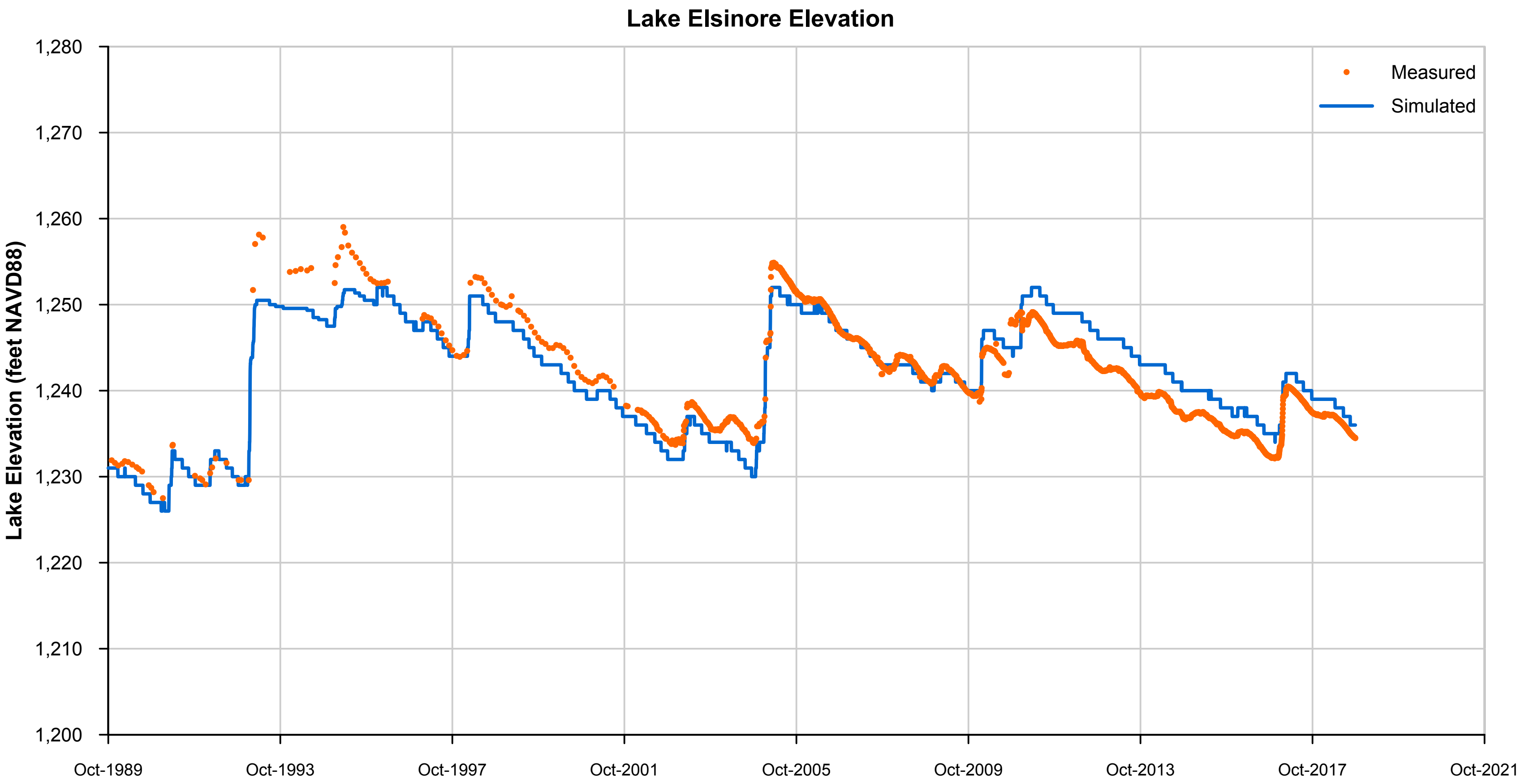
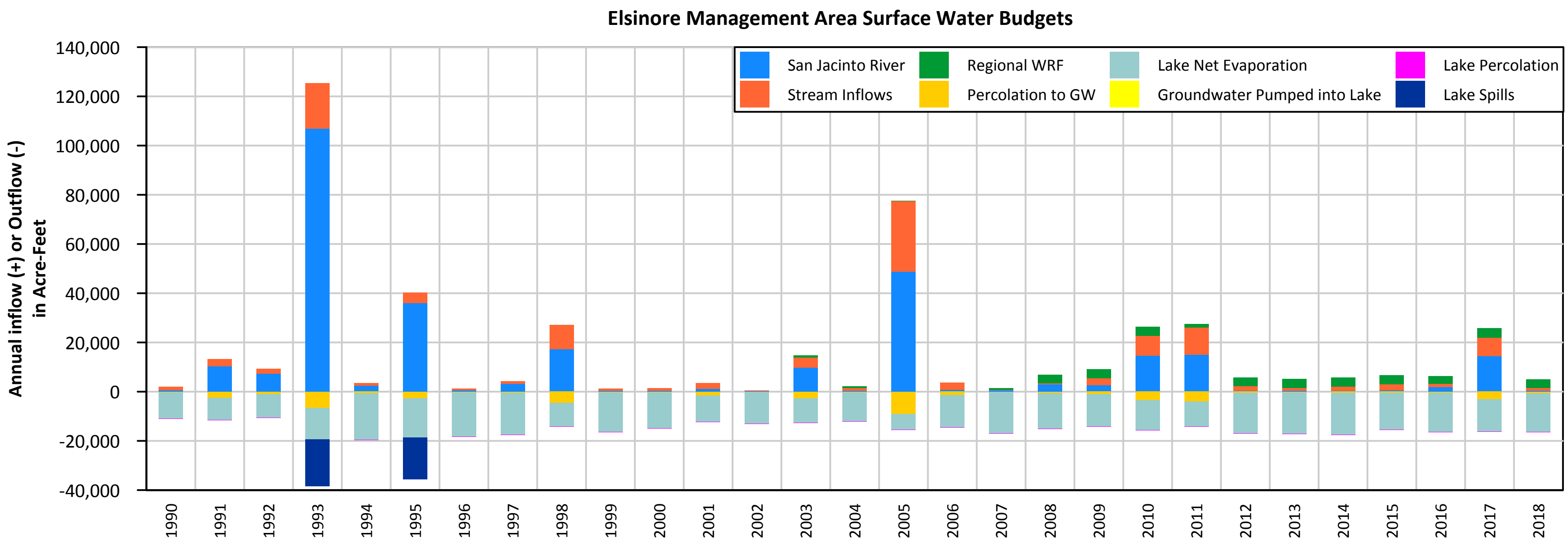
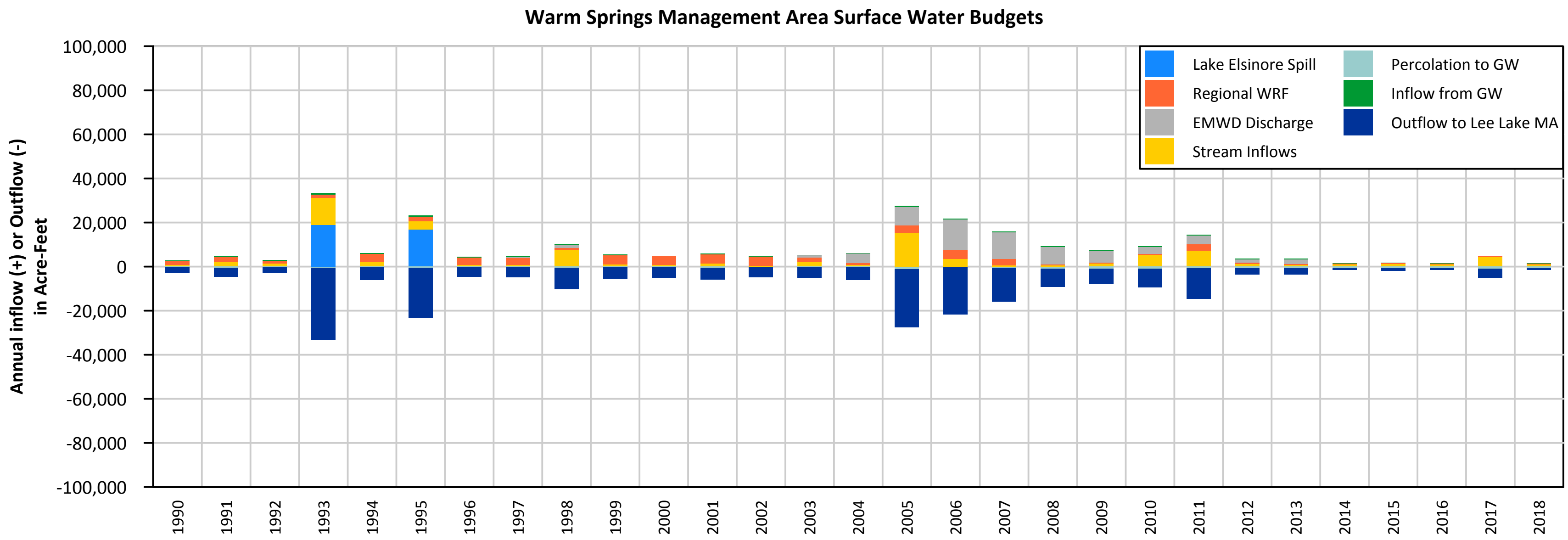
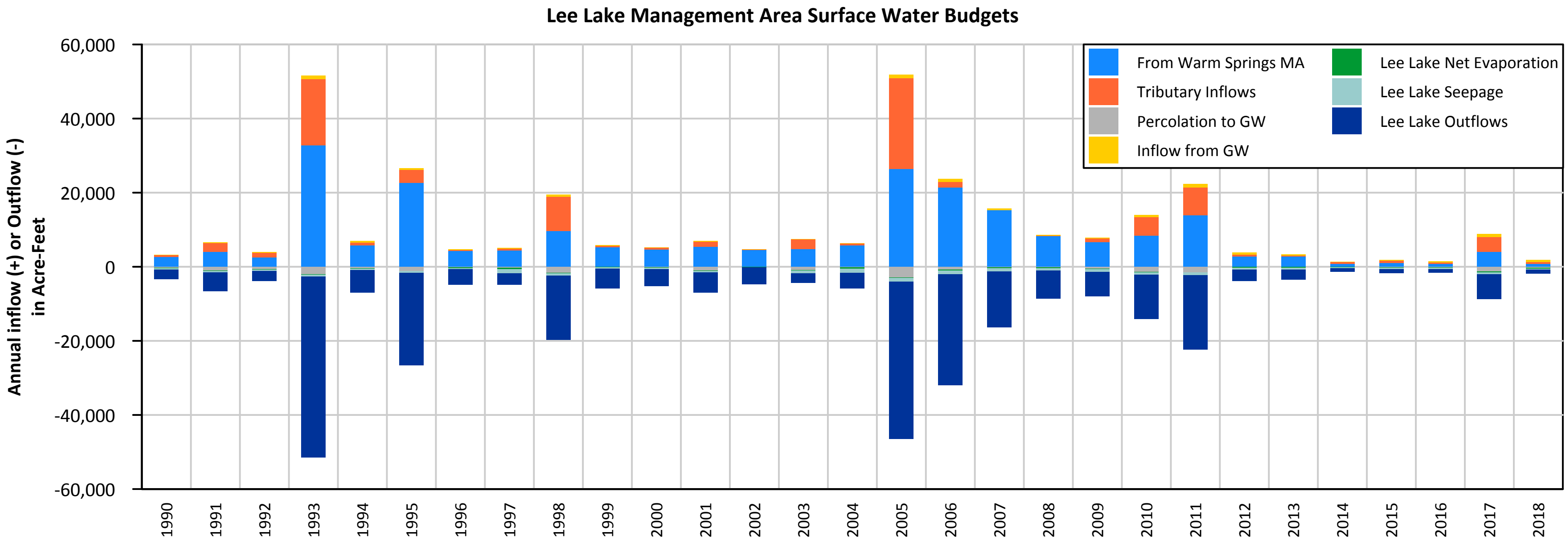


Figure 5.5 Measured and Simulated Lake Elsinore Elevation, 1990-2018


Elsinore Management Area Surface Water Budgets


Warm Springs Management Area Surface Water Budgets


Lee Lake Management Area Surface Water Budgets

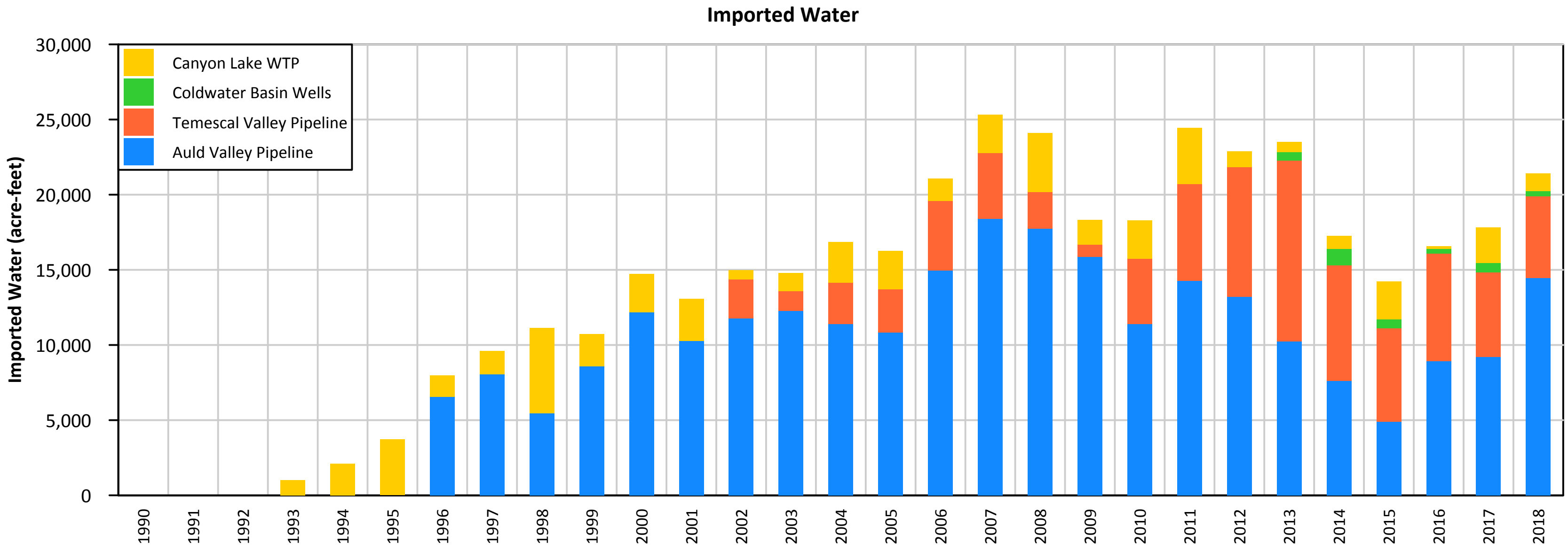

Imported Water

Figure 5.6 Annual Surface Water Budgets, 1990-2018

Table 5.3 Average Annual Surface Water Budgets

Inflow or Outflow	Elsinore MA					Warm Springs MA					Lee Lake MA				
	Model 1990 to 2018	Historical 1993 to 2007	Current 2010 to 2013	Baseline 2019 to 2068(1)	Growth + Climate Change 2019-2068(1)	Model 1990 to 2018	Historical 1993 to 2007	Current 2010 to 2013	Baseline 2019 to 2068(1)	Growth + Climate Change 2019 to 2068(1)	Model 1990 to 2018	Historical 1993 to 2007	Current 2010 to 2013	Baseline 2019 to 2068(1)	Growth + Climate Change 2019 to 2068(1)
Inflows															
San Jacinto River or Temescal Wash	10,374	15,250	7,592	11,287	10,371	1,241	0	0	1,440	1,440	8,022	9,782	6,956	8,903	9,494
Tributary Inflow	4,206	5,121	5,473	4,585	3,041	2,837	3,120	3,656	3,082	3,417	3,037	3,764	3,340	3,347	4,289
Wastewater Discharges	1,361	161	3,080	4,104	4,104	4,219	6,810	3,766	4,664	5,584	0	0	0	0	0
Groundwater Flow into Streams	123	138	171	117	137	295	344	309	335	261	356	344	610	598	599
Total Inflows	16,064	20,671	16,316	20,093	17,654	8,593	10,273	7,731	9,521	10,702	11,415	13,890	10,906	12,848	14,382
Outflows															
Stream Percolation	1,694	2,048	2,008	1,798	1,699	571	438	775	682	1,208	672	796	729	739	828
Net Lake Evaporation	13,605	13,665	13,978	13,983	15,381	N/A	N/A	N/A	N/A	N/A	155	189	145	159	175
Lake Percolation	97	101	104	101	101	N/A	N/A	N/A	N/A	N/A	552	683	593	579	521
Surface Outflows(2)	4,476	4,476	0	1,440	1,440	8,022	9,782	6,956	8,903	9,494	10,043	12,222	9,447	11,191	12,857
Total Outflows(3)	19,872	20,290	16,090	17,322	18,621	8,593	10,221	7,731	9,585	10,702	11,422	13,890	10,914	12,669	14,382

Notes:

(1) The 50-year future baseline simulation uses historical hydrology for 1993-2017 two times in succession.

(2) The historical and future baseline periods included two spill years for Lake Elsinore, whereas the current period included none.

(3) The imbalances between total inflows and total outflows in the Elsinore MA are partly attributable to net changes in lake storage. Future lake levels are not expected to rise or decline over the long run. The annual change in surface water storage is negligible in the Warm Springs and Lee Lake MAs. The imbalances between total inflows and total outflows reflect uncertainty in estimating the individual items and combining daily analysis for some items with monthly results from the groundwater model for others.

Annual surface water balances for the Warm Springs and Lee Lake MAs are also shown in Figure 5.6 (middle graphs). Total inflows equal total outflows in each year because there is little storage capacity in the stream channels (and Lee Lake itself is small). Tributary stream inflows are greater for the growth plus climate change scenario because of increased runoff from urban development in both MAs and in tributary watersheds. This more than compensated for the decrease in discharge from undeveloped watersheds, which decreased due to climate change. Recycled water discharges to Temescal Wash in the Warm Springs MA were greater under the growth plus climate change scenario because of the large increase in wastewater generation and the continuing need to discharge to the Wash in winter and in years when Lake Elsinore levels are high. Flows to and from groundwater reflected changes in surface inflow and in groundwater pumping. Surface inflow in the growth plus climate change scenario was higher on average because of reclaimed water discharges and urban runoff. Percolation from streams increased because of the additional flow and because of increased groundwater pumping, which also decreased groundwater flow into streams.

A substantial amount of water is imported into the Subbasin. It is delivered directly to users and does not flow into streams or lakes. Imports began in 1993, and annual amounts since then are shown in Figure 5.6 (bottom graph). The largest sources of imported water are SWP water delivered to EVMWD through the TVP, and Colorado River Water delivered to the southern part of Elsinore MA via the AVP. Water from both of those sources is purchased from the MWDSC. Since 2013, a much smaller amount has been imported from wells in the Coldwater portion of the Bedford-Coldwater Subbasin, which adjoins the northern boundary of the Lee Lake MA, and an even smaller amount is obtained from Canyon Lake Reservoir to serve developed areas near the lake. Imports tend to be high in wet periods and low during droughts; they have ranged from 14,000 to 25,000 AFY during the past 15 years.

5.6.1 Inflows to Surface Water

5.6.1.1 Precipitation and Evaporation

Precipitation and ET 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. Precipitation and evaporation to and from the surface of lakes are relatively large fluxes. The one-dimensional rates are multiplied by current lake surface area to obtain volumetric flows that are subtotaled as net evaporation in the water budget table. The evaporation rate from Lake Elsinore and Lee Lake was assumed to equal reference ET because the ratio of lake evaporation to pan evaporation is similar to the ratio of reference ET to pan evaporation (both about 0.8).

5.6.1.2 Tributary Inflows

Tributary inflows to the Elsinore MA are from the San Jacinto River and watersheds in the Santa Ana Mountains along the west side of the MA (see Figure 5.2). For the San Jacinto River, measured flow at the gage (USGS Station 11070500) near Highway I-15 was used for the surface water budget. This is more accurate than summing independent measurements of spills from Canyon Lake Dam, inflows from tributaries (primarily Cottonwood Creek), riparian ET, and percolation losses between the dam and the gage because of the cumulative uncertainty of combining multiple terms, many of which are not measured. Those processes and measurements are included separately in the groundwater model. Percolation losses between the gage and Lake Elsinore were assumed to be 20 cfs or current daily flow, whichever is less, based on channel lengths, widths, bed texture, and calibration to measured increases in Lake Elsinore water level in wet years. Surface inflows to the Elsinore MA from eight Santa Ana Mountain watersheds were estimated in the rainfall-runoff-recharge model. For the surface water budget calculations, percolation losses between the basin boundary and the lake for each stream was assumed to be 20 cfs or the current daily flow.

The rainfall-runoff-recharge model was similarly used to estimate surface flow in tributaries along the east sides of the Warm Springs and Lee Lake MAs.

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 in the Elsinore MA was assumed to flow into the lake, while runoff from Warm Springs and Lee Lake MAs are assumed to flow into Temescal Wash.

5.6.1.4 Island Well Pumping

Since 2007, water from the two "State" wells on the shore of Lake Elsinore have pumped water into the lake as part of the lake level management program. Pumping began at 1,945 AFY in 2007 and decreased thereafter, with annual amounts less than 200 AFY since 2016. This pumping is expected to phase out in the future.

5.6.1.5 Wastewater Discharges

Treated effluent from the Regional WRF was discharged into Temescal Wash prior to 2007. Since then, most of the discharge has been into Lake Elsinore as part of a program to stabilize lake levels. A minimum discharge of 0.5 mgd (0.77 cfs) is required to be discharged to the Wash at all times; but when lake levels are high, discharges revert to the Wash. In addition, excess recycled water from EMWD service area east of the Subbasin is discharged to Temescal Wash near the outlet of Lake Elsinore. These discharges are primarily during wet years, when demand for recycled water within EMWD is low and the EMWD system storage is full.

5.6.1.6 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 near the downstream ends of the Warm Springs and Lee Lake MAs. 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

Net evaporation from the surface of Lake Elsinore is the largest surface water outflow from the Elsinore MA, accounting for more than 95 percent of total outflow in dry and normal years. Average annual evaporation is about 54 inches[3] while average rainfall is about 11 inches, hence there is net average evaporation loss of 43 inches every year. Lee Lake is much smaller, and net evaporation averages about 200 AFY compared to 11,600 AFY for Lake Elsinore.

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[3] Lake Elsinore evaporation rate was assumed to equal the reference ET rate at the CIMIS station in Temecula. This assumes that the ratios of ET and lake evaporation to pan evaporation both equal their typical values of 0.8.

5.6.2.2 Surface Water Percolation to Groundwater

In wet years, percolation from streams along the reaches between the Subbasin boundary and Lake Elsinore is a significant outflow of surface water from the Elsinore MA. Percolation capacities for the San Jacinto River and each of the small tributary streams were estimated based on calibration of the water budget model to observed increases in lake level in wet years. In the Warm Springs and Lee Lake MAs, percolation from Temescal Wash to groundwater occurs when the water level in the wash is higher than the nearby water table. This flow can go at various rates in either direction depending on the relative water levels. Accordingly, estimates of surface water-groundwater exchange in these MAs were obtained from the groundwater model. In the Warm Springs MA, where there is little groundwater pumping, percolation from streams to groundwater is approximately balanced by groundwater seepage into other reaches of the stream network, and both flows are a small percentage of total surface water flow through the MA (on the order of 5 percent).Stream percolation losses in the Lee Lake MA are about four times greater than in the Warm Springs MA and also about 40 percent greater than the amount of groundwater discharge into streams. Both of these characteristics can be explained by the presence of significant groundwater pumping in the Lee Lake MA, which tends to increase stream percolation losses and decrease groundwater discharge to streams. This tendency was confirmed in the growth plus climate change scenario, in which pumping in both MAs was increased by 900 to 1,000 AFY and net stream percolation increased also.

Lake Elsinore is underlain by substantial thicknesses of clay and other fine-grained sediments. Leakage has historically been considered negligible. The surface water budget and groundwater model both include a relatively minor amount of leakage through the lakebed clays (about 100 AFY), which is within the range of uncertainty for lake evaporation (which would have a similar effect on simulated lake levels).

In the Warm Springs and Lee Lake MAs, tributary streams are higher than the water table along most of the reaches from the Subbasin boundary to Temescal Wash. Percolation along those reaches is determined by the surface area and permeability of the stream bed, as well as the amount of flow entering from the tributary watersheds. Small flow events are entirely absorbed before reaching Temescal Wash. Temescal Wash is hydraulically coupled to groundwater along most of its length in both MAs. This means that seepage across the stream bed can be from groundwater or to groundwater, depending on whether the surface water elevation is lower or higher than the adjacent water table. 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 Subbasin

Spills from Lake Elsinore can be significant in magnitude but are rare (only two years with spills since 1990). Spills commence when the lake level rises above the elevation of the Wasson Sill in the Temescal Wash channel. Surface water outflow from Warm Springs MA to Lee Lake MA is estimated by the groundwater model because groundwater tends to seep into Temescal Wash and/or its channel deposits through the narrow alluvial gap between the MAs. Surface outflows from Lee Lake—which is near the downstream end of the Lee Lake MA have been measured by a gage (USGS Station 11071900) at the dam since 2012. Because of drought conditions, significant outflows have occurred only for 1 to 3 months in 2013 and 2017 since the gage began operating.

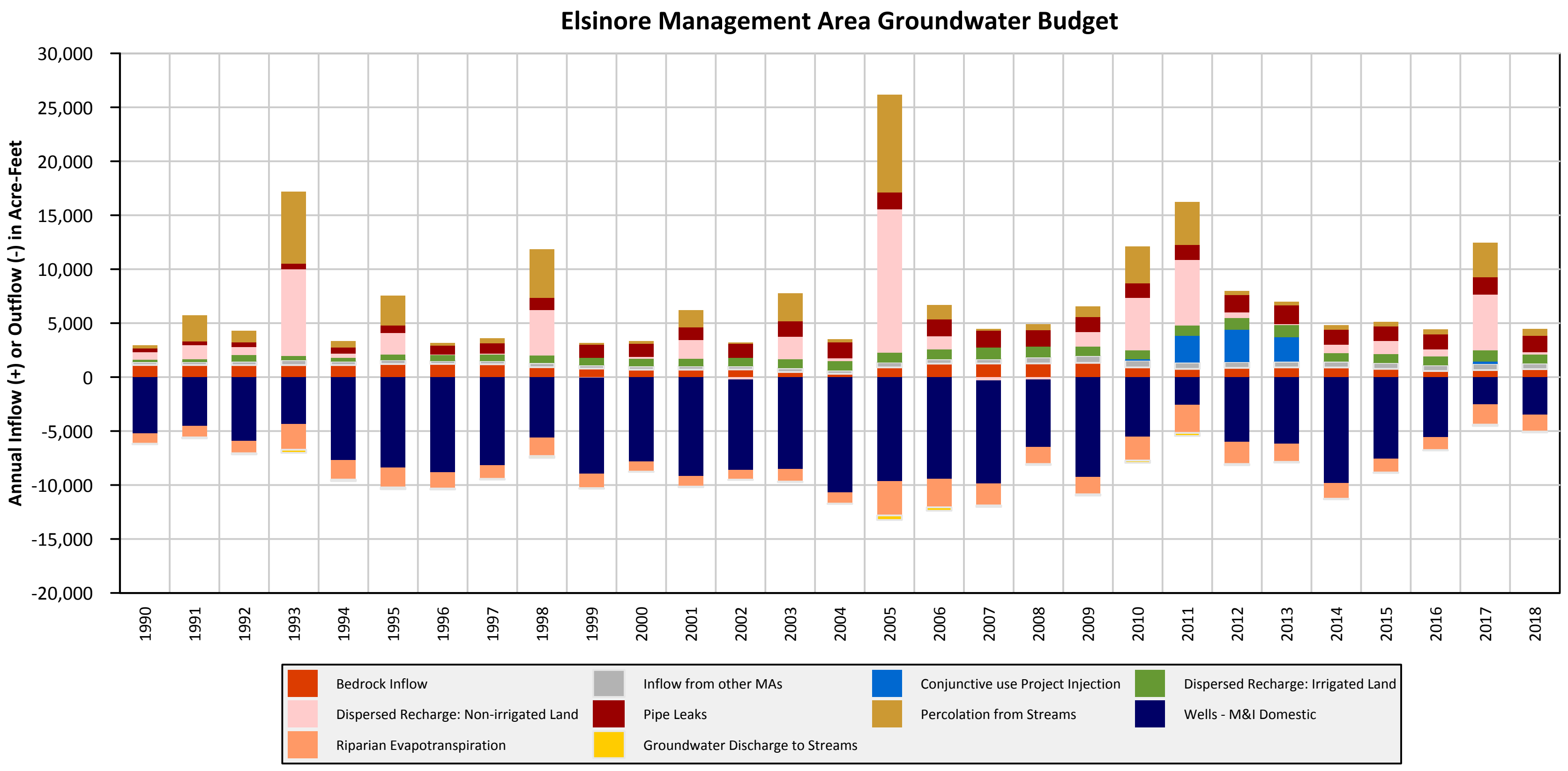
However, simulation results indicate that outflows were likely larger and more common during 1990 to 2012 because that period included more normal and wet years.

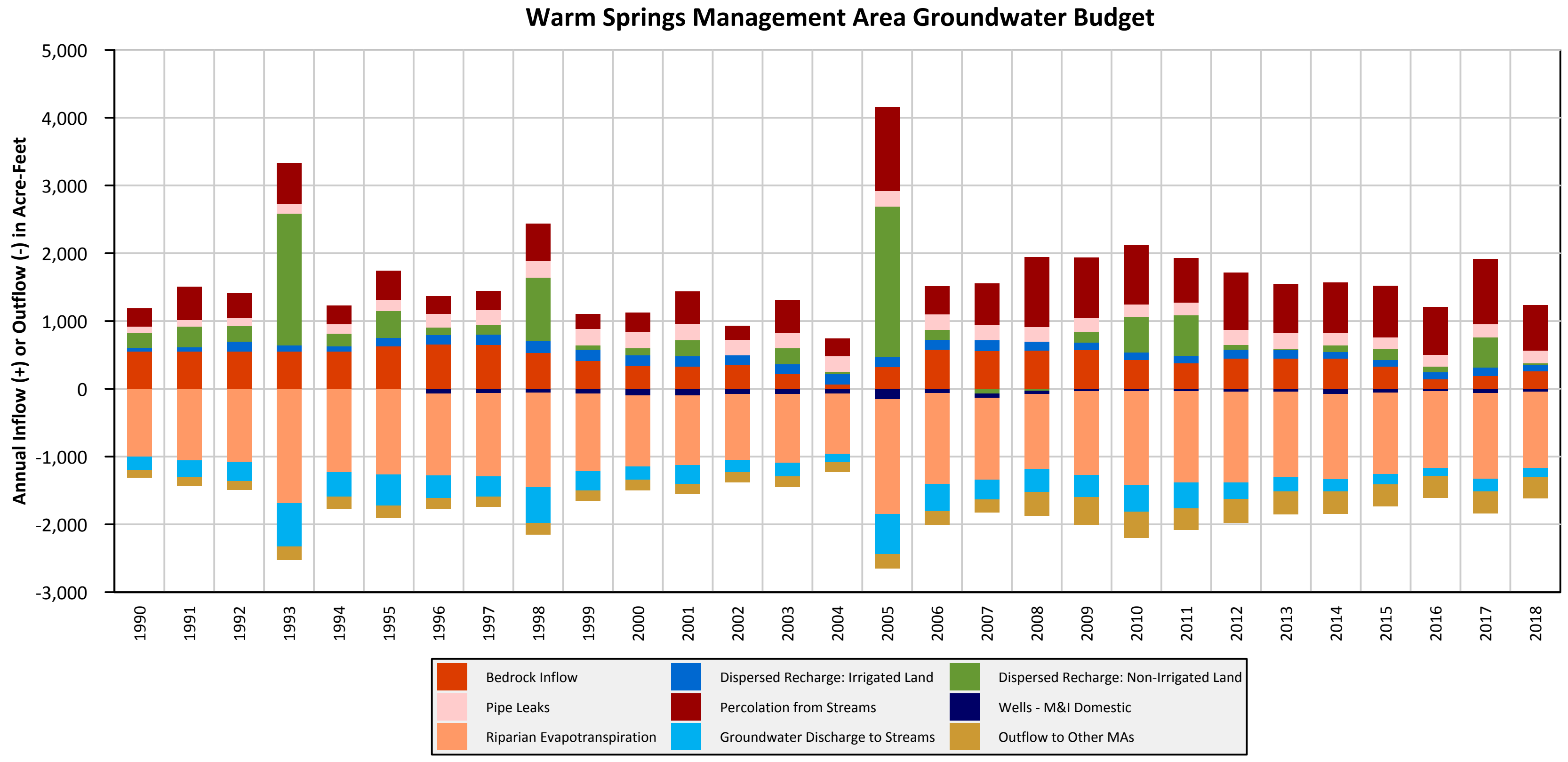
5.7 Groundwater Balance

Annual groundwater inflows and outflows for each MA for the 1990 to 2018 model simulation period are shown as stacked bars in Figure 5.7. 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 5.8 and for the growth plus climate change simulation in Figure 5.9. 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 I. Highlights of the water budgets are described below, followed by additional information on methods used to quantify each budget item.

In the Elsinore MA, the baseline water budget differs from the historical and current water budgets by generally small amounts that reflect the up-to-date land use and longer hydrologic averaging period. Using the baseline simulation as most representative of current long-term water budget conditions, the four major sources of recharge on an average annual basis are percolation from streams, dispersed recharge in non-irrigated areas, dispersed recharge in irrigated areas, and pipe leaks. These are of similar magnitudes, followed by slightly smaller inflows from septic systems and subsurface inflow from bedrock tributary watersheds. Groundwater pumping accounts for 72 percent of outflows, followed by riparian vegetation ET (27 percent). Simulated urban growth and climate change increased bedrock inflow slightly due largely to urbanization in some tributary watersheds. Total dispersed recharge increased somewhat, shifting substantially from recharge in non-irrigated areas to recharge in irrigated areas (urban landscaping). On a per-acre basis recharge in irrigated areas is greater than in non-irrigated areas not only because of deep percolation of applied irrigation water but because shallow-rooted turf does not capture and transpire infiltrated rainfall as deeper-rooted natural vegetation does. Groundwater pumping was about the same in the growth plus climate change scenario, and riparian ET and groundwater discharge to streams increased slightly in response to the overall increase in total inflows.

In the Warm Springs MA, the major sources of recharge are stream percolation and dispersed recharge on non-irrigated lands, followed by subsurface inflow from bedrock uplands. The major outflow is riparian ET (72 percent), followed by much smaller outflows to Temescal Wash and Lee Lake MA (via the subsurface). Stream percolation nearly doubled under the growth plus climate change scenario due to increased surface inflows from local urban runoff, runoff from urbanized areas in tributary watersheds and reclaimed water discharges to Temescal Wash. Bedrock inflow increased due to tributary area urbanization. Recharge from pipe leaks and irrigated areas both more than doubled. Overall, average annual inflows increased by 48 percent relative to the baseline scenario. Groundwater pumping increased by 916 AFY, which was supplied by the increase in recharge and a reduction in groundwater discharge to streams. Riparian ET and subsurface outflow remained more or less unchanged.


Elsinore Management Area Groundwater Budget


Warm Springs Management Area Groundwater Budget

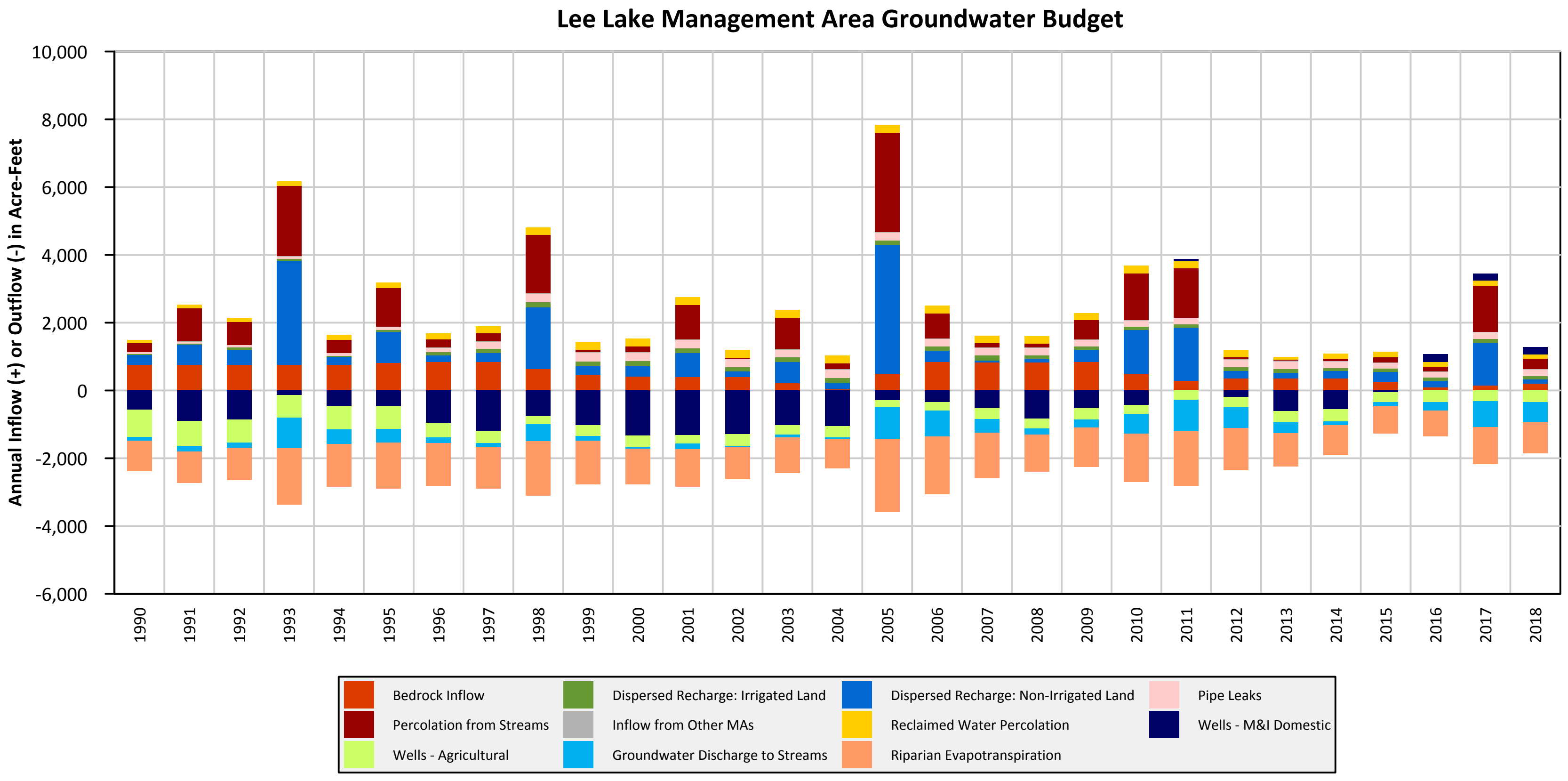
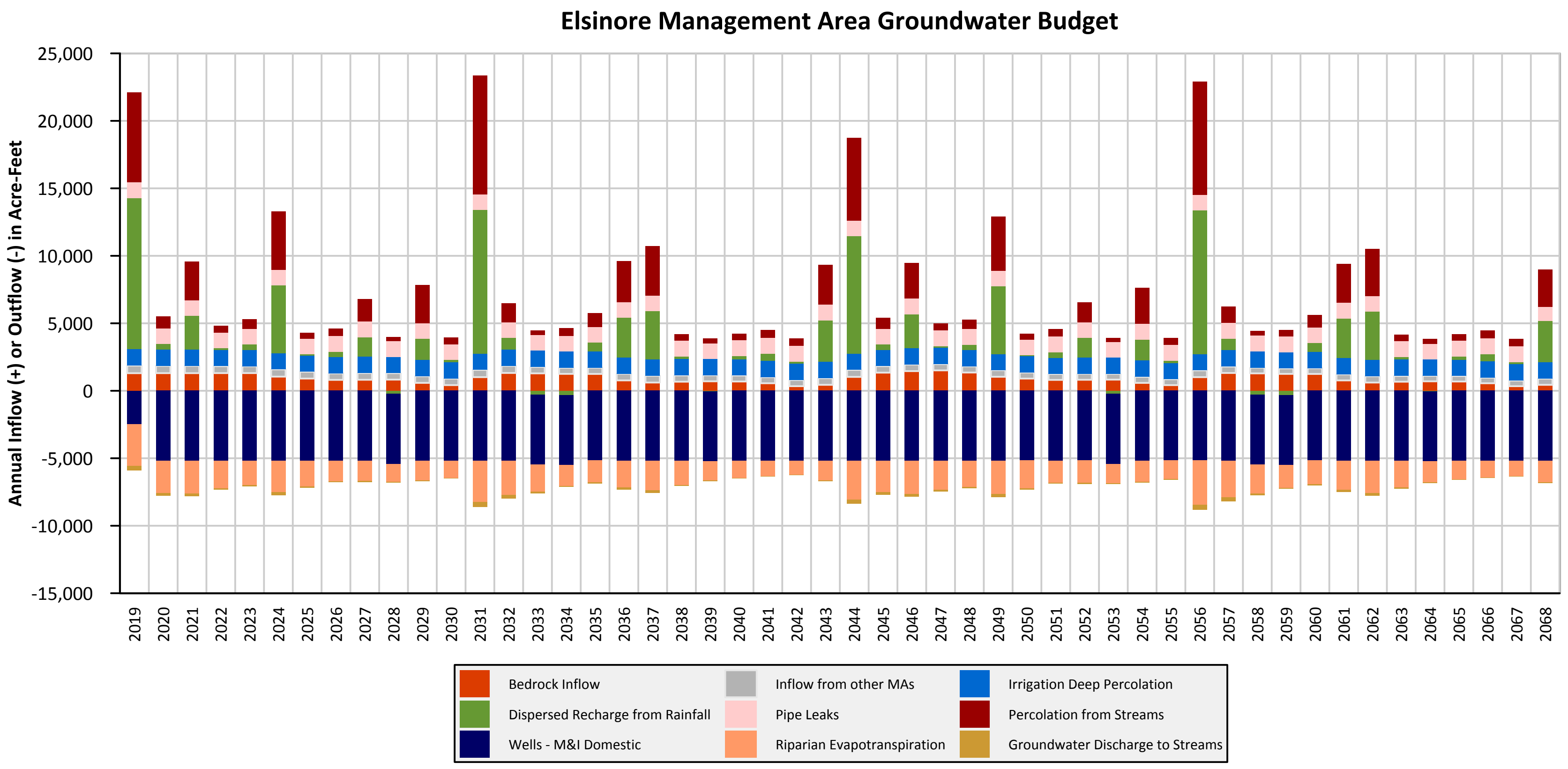
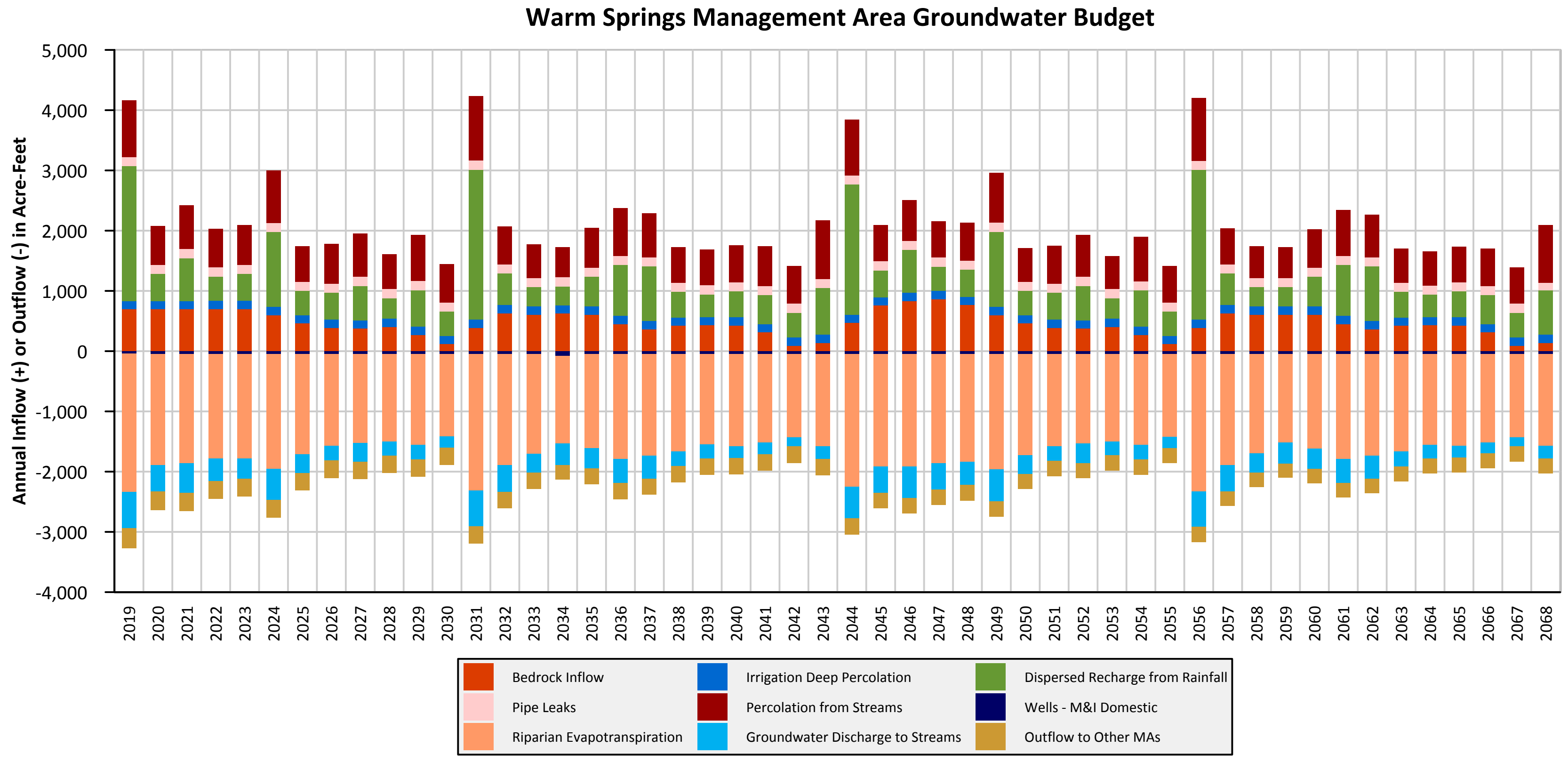

Lee Lake Management Area Groundwater Budget

Figure 5.7 Annual Groundwater Budgets, 1990-2018





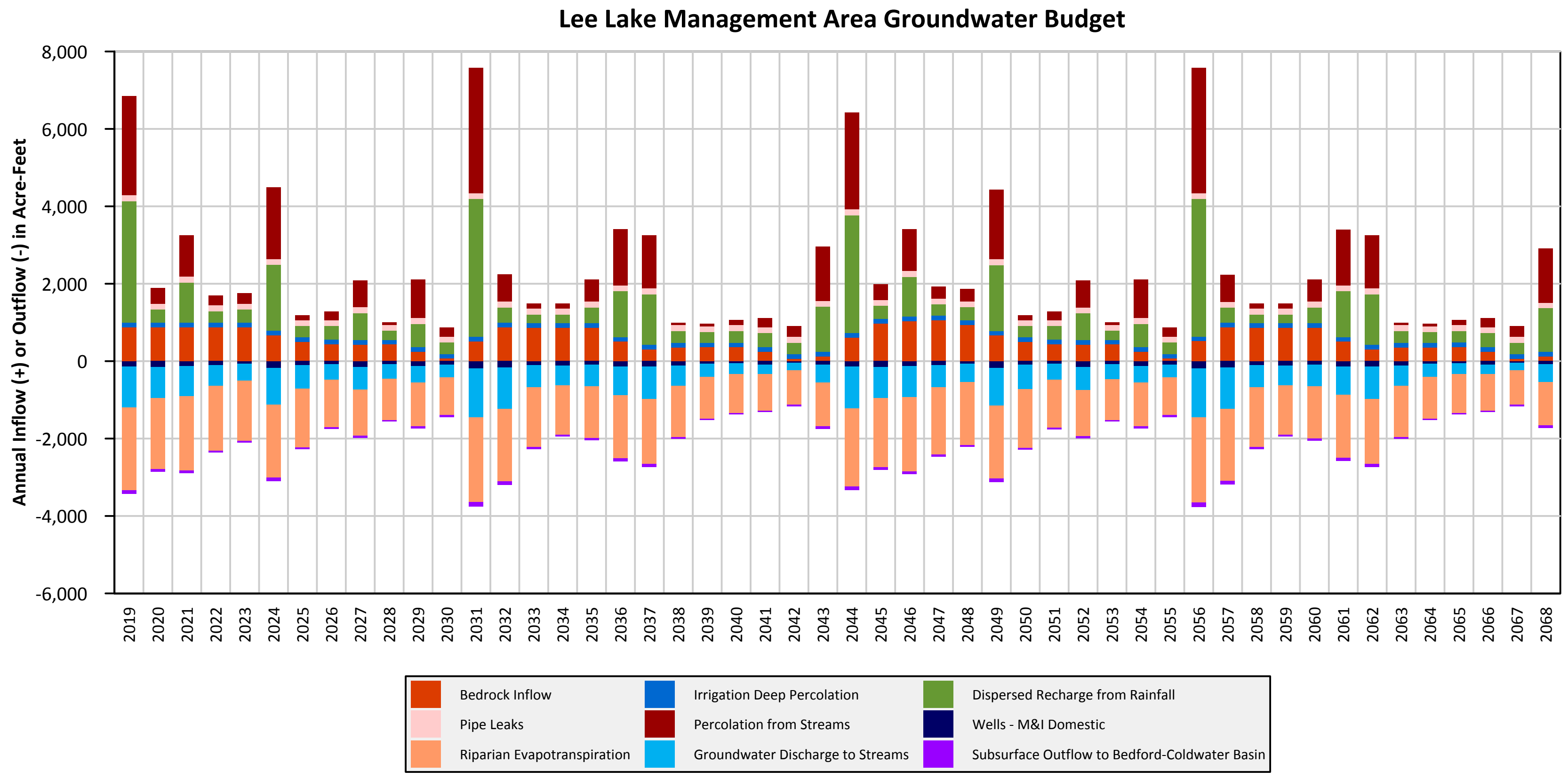
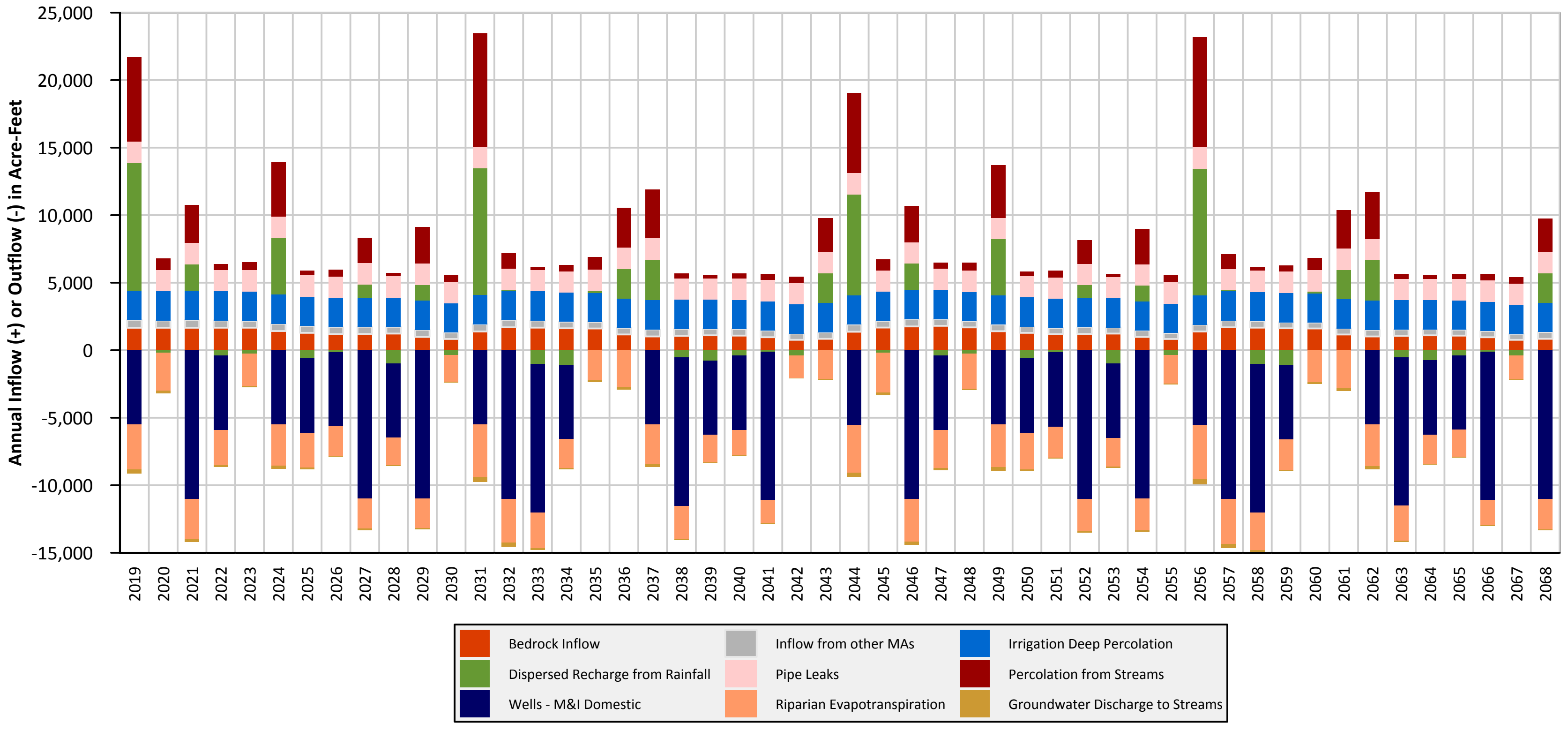
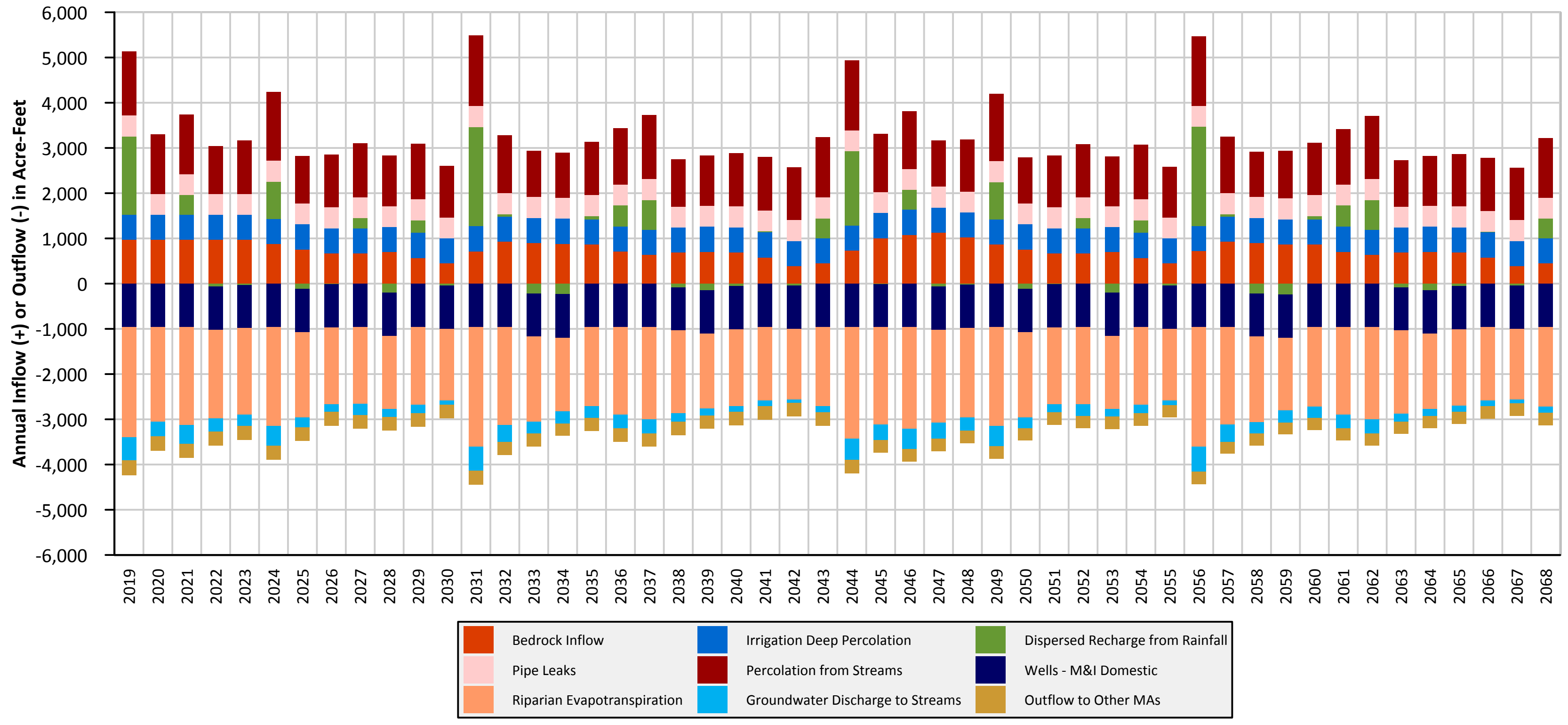


Figure 5.8 Annual Groundwater Budgets, Baseline Scenario

Elsinore Management Area Groundwater Budget



Warm Springs Management Area Groundwater Budget



Lee Lake Management Area Groundwater Budget

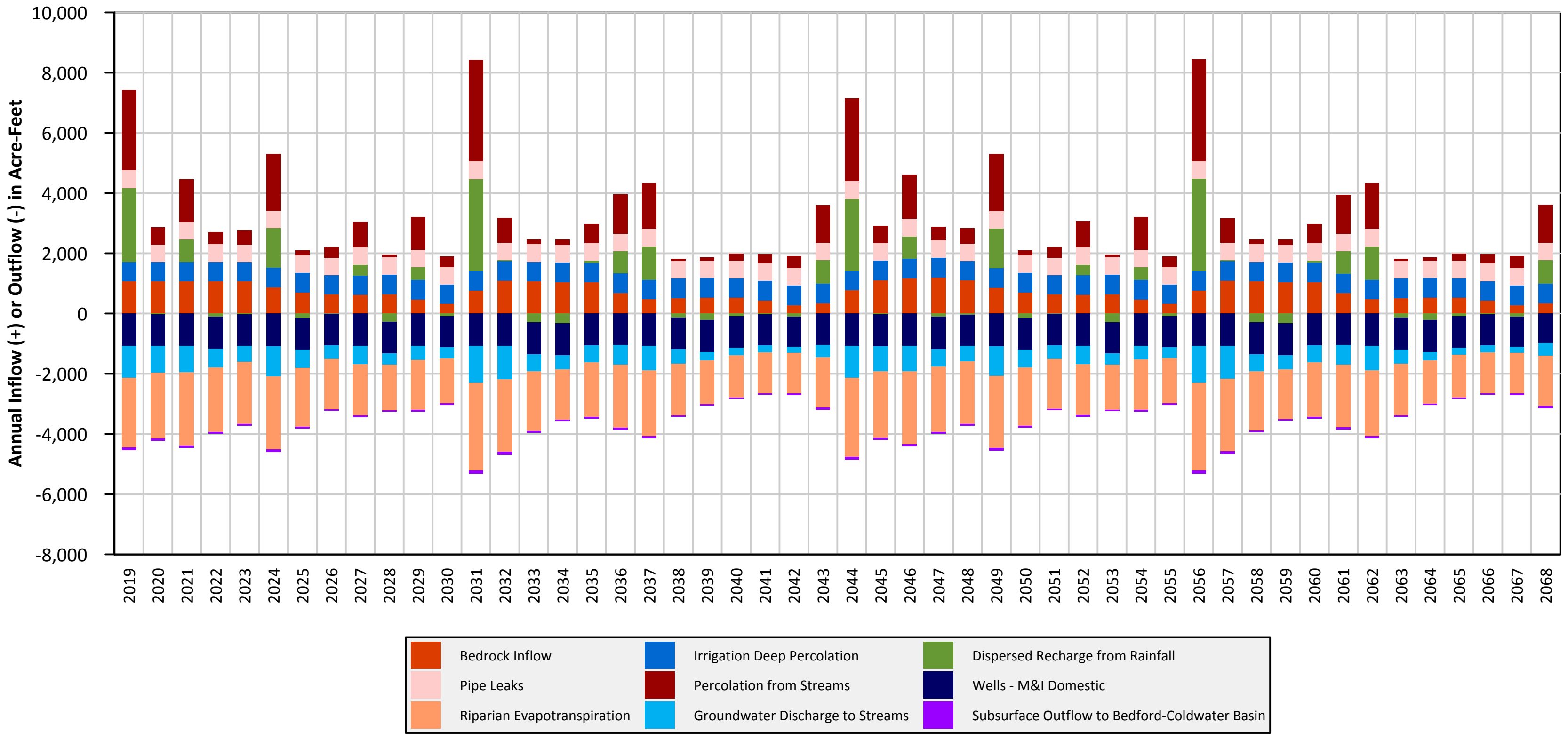


Figure 5.9 Annual Groundwater Budgets, Growth Plus Climate Change Scenario

Table 5.4 Groundwater Budgets for Historical, Current, and Future Periods

Water Balance Items	Elsinore MA						Warm Springs MA						Lee Lake MA					
	Model	25-Year	Historical	Current	Baseline	Growth +Climate Change	Model	25-Year	Historical	Current	Baseline	Growth +Climate Change	Model	25-Year	Historical	Current	Baseline	Growth +Climate Change
	1990-2018	1993-2017	1993-2007	2010-2013	2019-2068(1)	2019-2068(1)	1990-2018	1993-2017	1993-2007	2010-2013	2019-2068(1)	2019-2068(1)	1990-2018	1993-2017	1993-2007	2010-2013	2019-2068(1)	2019-2068(1)
Groundwater Inflow																		
Subsurface inflow from external basin	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Percolation from streams	1,694	1,790	2,048	2,008	1,798	1,699	571	591	438	775	682	1,208	672	690	796	729	739	828
Bedrock inflow	925	909	923	854	916	1,298	434	427	449	425	467	751	524	509	581	372	540	732
Dispersed recharge: non-irrigated land	1,934	2,129	2,187	2,887	1,762	1,059	331	353	445	305	682	246	695	748	867	813	769	368
Dispersed recharge: irrigated land	761	803	714	986	1,209	2,160	125	131	143	119	138	553	100	107	113	104	121	653
Pipe leaks	1,200	1,282	1,145	1,538	1,160	1,583	196	207	215	204	148	461	185	200	200	205	152	581
Reclaimed water percolation or injection	0	0	0	0	0	0	0	0	0	0	0	0	181	192	205	180	163	489
Septic system percolation	916	915	918	904	918	918	179	179	179	178	178	179	9	9	9	9	4	9
Leakage from lake	95	104	115	104	98	98	0	0	0	0	0	0	240	231	286	124	1	0
Conjunctive use project injection(2)	280	324	0	1,975	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inflow from other management areas	428	441	352	580	473	498	0	0	0	0	0	0	14	14	13	17	14	15
Total inflow	8,232	8,697	8,403	11,838	8,334	9,313	1,836	1,887	1,869	2,006	2,295	3,398	2,621	2,702	3,072	2,553	2,504	3,677
Groundwater Outflow																		
Subsurface outflow to external basin	0	0	0	0	-1	-4	0	0	0	0	0	0	-40	-41	-43	-41	-57	-61
Wells - M&I and domestic	-7,086	-7,455	-8,343	-5,076	-5,120	-5,724	-50	-57	-64	-38	-47	-958	-587	-596	-814	-291	-113	-1,057
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	-390	-350	-376	-296	-297	-53
Groundwater discharge to streams	-123	-129	-138	-171	-117	-137	-295	-307	-344	-309	-335	-261	-356	-371	-344	-610	-598	-599
Riparian evapotranspiration	-1,617	-1,686	-1,640	-2,124	-1,915	-2,551	-1,213	-1,237	-1,225	-1,333	-1,668	-1,893	-1,191	-1,235	-1,323	-1,315	-1,439	-1,908
Outflow to bedrock	-1	-1	0	-1	-1	-4	0	0	0	0	0	0	-1	-1	-1	-1	0	0
Outflow to other management areas	-3	-3	-5	0	0	0	-230	-240	-170	-347	-265	-285	-14	-13	-15	-14	0	0
Total outflow	-8,830	-9,274	-10,127	-7,372	-7,154	-8,420	-1,789	-1,841	-1,803	-2,027	-2,314	-3,397	-2,579	-2,608	-2,916	-2,567	-2,504	-3,678
Net Change in Storage																		
Inflows minus outflows	-598	-577	-1,723	4,466	1,180	893	46	46	66	-21	-20	0	41	94	156	-14	0	-2

Notes:

(1) The 50-year future simulations use historical hydrology for 1993-2017 two times in succession.

(2) Historical and current conjunctive use recharge was by injection wells. In the Growth Plus Climate Change simulation recharge is by in-lieu variations in M&I pumping.

In the Lee Lake MA, three major sources of recharge were of similar magnitudes: dispersed recharge in non-irrigated areas, percolation from streams, and bedrock inflow. The largest outflow was riparian ET (57 percent), followed by groundwater discharge to streams (24 percent). Future growth and climate change substantially altered the water budget. Percolation from streams increased due to increased surface inflows and increased groundwater pumping. Bedrock inflow increased due to urbanization in some tributary areas. Predictably, dispersed recharge in non-irrigated areas decreased by about half, but that was more than offset by large increases in recharge from irrigated lands and from pipe leaks. Overall, average annual total inflows increased by 47 percent. One-fourth of the 1,000 AFY increase in municipal pumping was offset by a decrease in agricultural irrigation pumping. The rest was supplied by capturing some of the increase in recharge. Riparian ET and subsurface outflow increased slightly in spite of the increase in pumping.

5.7.1 Inflows to Groundwater

Inflows to the groundwater flow system in all three MAs are dominated by natural processes that vary widely depending on hydrologic conditions. Rainfall recharge is the most variable inflow and is only significant in wet years. Recharge from stream percolation also varies considerably from dry years to wet years. 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 deep percolation, pipe leaks and septic percolation 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 ET and deep percolation. Simulation is on a daily basis. In recharge zones with irrigated crops—which includes urban landscaping and the small amount of commercial irrigation (citrus) in the Lee Lake MA—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. Water pipe leaks were estimated as the percentage of unaccounted for water listed in the 2015 Urban Water Management Plan (8 percent of delivered water), 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 (442 zones used in total) to obtain volumetric flow rates, and those are subtotaled by MA.

Figure 5.10 shows a map of average annual dispersed recharge during 1993 to 2017. 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. Within the Subbasin, 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 Subbasin, a higher percentage of deep percolation was assigned to base flow than in watersheds on the west side of the Subbasin 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 the San Jacinto River, Temescal Wash and small streams emanating from 18 watersheds around the periphery of the Subbasin. Percolation is affected by groundwater levels where the water table is equal to or higher than the elevation of the stream bed. This is the case along most of the San Jacinto River and 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 Subbasin.

5.7.1.3 Recycled Water Percolation

The only wastewater treatment plant in the Subbasin with percolation ponds is the Horsethief WRF in the Lee Lake MA. Even there, most of the wastewater is recycled for irrigation. Most wastewater from the Regional WRF in the Warm Springs MA is now discharged to Lake Elsinore to help stabilize lake levels except in wet years when lake levels are already high. A minimum discharge of 0.5 mgd to Temescal Wash is required at all times. In wet years and in all years prior to 2007, flows were discharged to Temescal Wash near the facility. Discharges by EMWD of recycled water originating outside the Subbasin occur in many normal to wet years and are also to Temescal Wash near the Regional WRF. Wastewater from the Canyon Lake WRF is entirely recycled for irrigation.

5.7.1.4 Subsurface Groundwater Inflow

Three types of subsurface inflow are listed separately in the water balance tables. All of them are simulated by the model as head-dependent flows that vary depending on simulated groundwater levels and subsurface permeability near the boundary. These flows are extracted from the groundwater model using the Zone Budget post-processing utility program. Subsurface flow to or from external basins is physically possible between the Elsinore MA and the Temecula Valley Basin and between the Lee Lake MA and the Bedford-Coldwater Subbasin. A second type of subsurface flow is between MAs. The third type of subsurface flow occurs where the Subbasin abuts upland tributary watersheds; small amounts of subsurface inflow result from recharge percolating through fractured bedrock in tributary watershed areas. This process is simulated by the rainfall-runoff-recharge model.

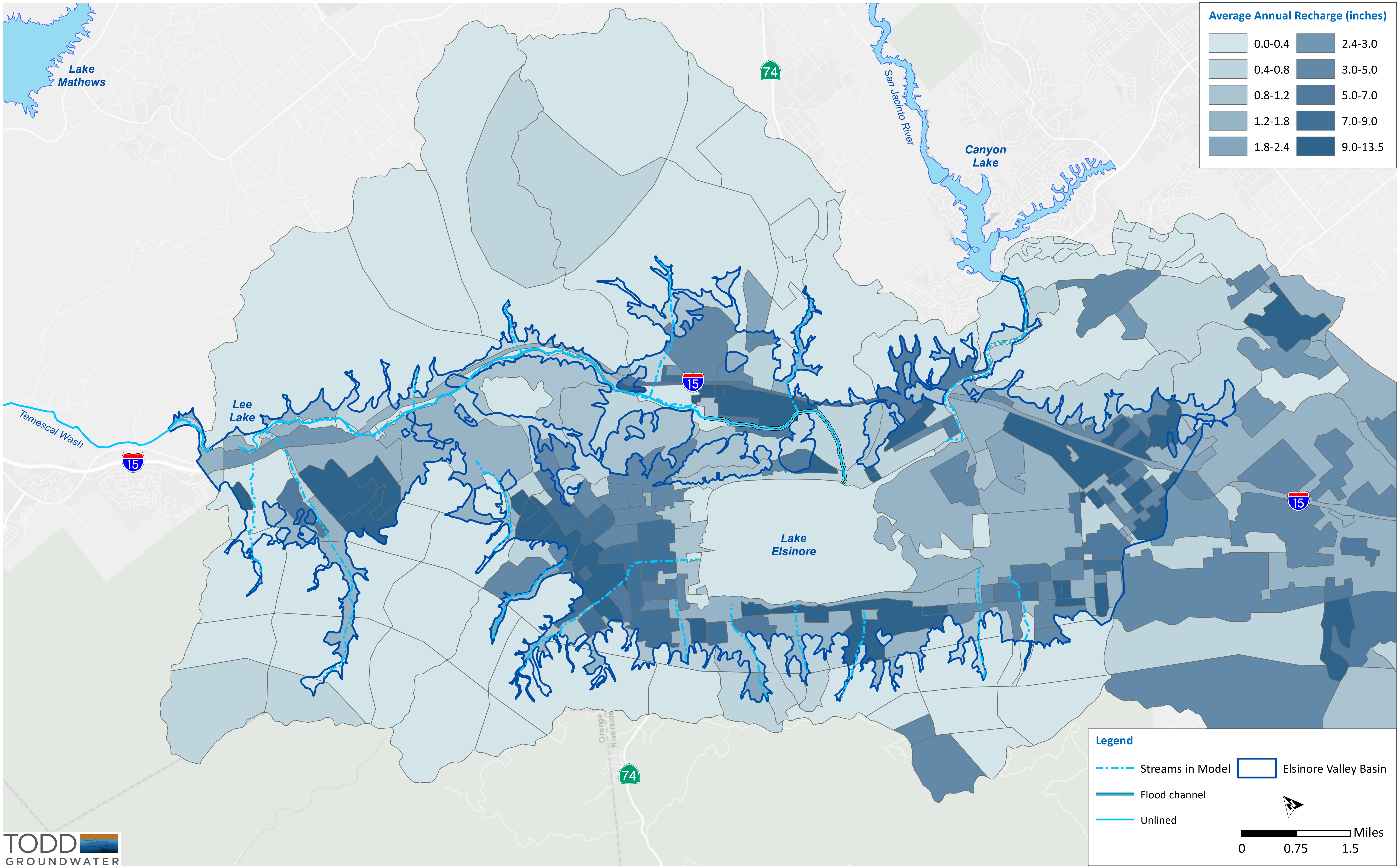


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Figure 5.10 Average Annual Dispersed Recharge, 1993 to 2017

5.7.2 Outflows from Groundwater

Major outflows from the Subbasin are groundwater pumping (municipal, industrial, agricultural, and domestic), groundwater discharge into streams, and ET by riparian vegetation.

5.7.2.1 Pumping by Wells

Pumping from M&I wells has been measured and recorded for many years by EVMWD and WMWD. Those data are used in the groundwater model. This category of pumping in the Elsinore MA generally increased during 1990 to 2005 due to urban growth then decreased after 2007 as EVMWD sought to decrease pumping to the safe yield of the MA as identified in the 2005 GWMP (MWH 2005). Since 2010 EVMWD has participated in a conjunctive use project with MWDSC (MWDCUP). That project seeks to store water by in-lieu recharge up to 3,000 AFY during wet years, with the stored amount of up to 4,000 AFY recovered during droughts. In practice, that means EVWMD groundwater pumping can be below the sustainable yield in wet years and above the sustainable yield during dry years. Over the long run, however, pumping is managed to equal the sustainable yield. During 2010 to 2018, Conjunctive Use Program recharge occurred in five years at a maximum rate of 2,995 AFY. A second conjunctive use program known as SARCCUP operates in parallel with the MWDCUP utilizing an additional 1,500 AF of storage capacity. Together, these programs increase EVMWD pumping by up to 5,500 AFY in dry years and decrease it by the same amount during wet years.

The sole public supply well in the Warm Springs MA pumps a small amount of water for landscape irrigation at a cemetery. Several municipal wells are located along Temescal Wash in the Lee Lake MA. There are private pumpers in these MAs and the Elsinore MA, but the locations of active wells and the associated production volumes are unknown. Pumping from active private wells is assumed to be below two AFY.

The only agricultural pumping of significance in the basin has been to irrigate citrus groves in the Lee Lake MA. Most of those were replaced by residential development in the late 1990s, whereupon irrigation pumping decreased from 8 to 10 percent of basin wide pumping to 2 to 4 percent. Irrigation pumping is estimated by the rainfall-runoff-recharge model based on evaporative demand and crop characteristics.

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. Results from the groundwater model indicate that flow across the Temecula Valley Basin boundary is essentially zero due to a very flat water-level gradient and low subsurface permeability. Simulated flow from the Lee Lake MA into the Bedford-Coldwater Basin is small (20 to 30 AFY), due to limited cross-sectional area of the subsurface flow paths and the ability of groundwater to discharge into Temescal Wash, instead. The only significant flow between MAs within the Subbasin is from the Warm Springs MA into the Elsinore MA, which historically amounted to about 8 percent of total Warm Springs outflows and 3 percent of total Elsinore inflows (247 to 356 AFY).

5.7.2.3 Groundwater Discharge to Streams

Discharges from the Subbasin 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 occurs primarily along Temescal Wash in the Warm Springs and Lee Lake MAs. Stream channels in the Elsinore MA are far above the groundwater table in almost all locations except along the San Jacinto River upstream of the USGS stream gage. Stream-aquifer exchanges are a major part of the Warm Springs and Lee Lake MA groundwater budgets. Estimated flows were obtained primarily by calibration to water levels and gaged outflows from Lee Lake. In the Warm Springs MA, groundwater discharge to streams slightly exceeded stream percolation to groundwater, but both were in the range of 12 to 42 percent of total inflows or outflows in the historical and current analysis periods. In the Lee Lake MA, percolation from streams was substantially greater than groundwater discharge to steams, as a result of groundwater pumping that captured the percolated water.

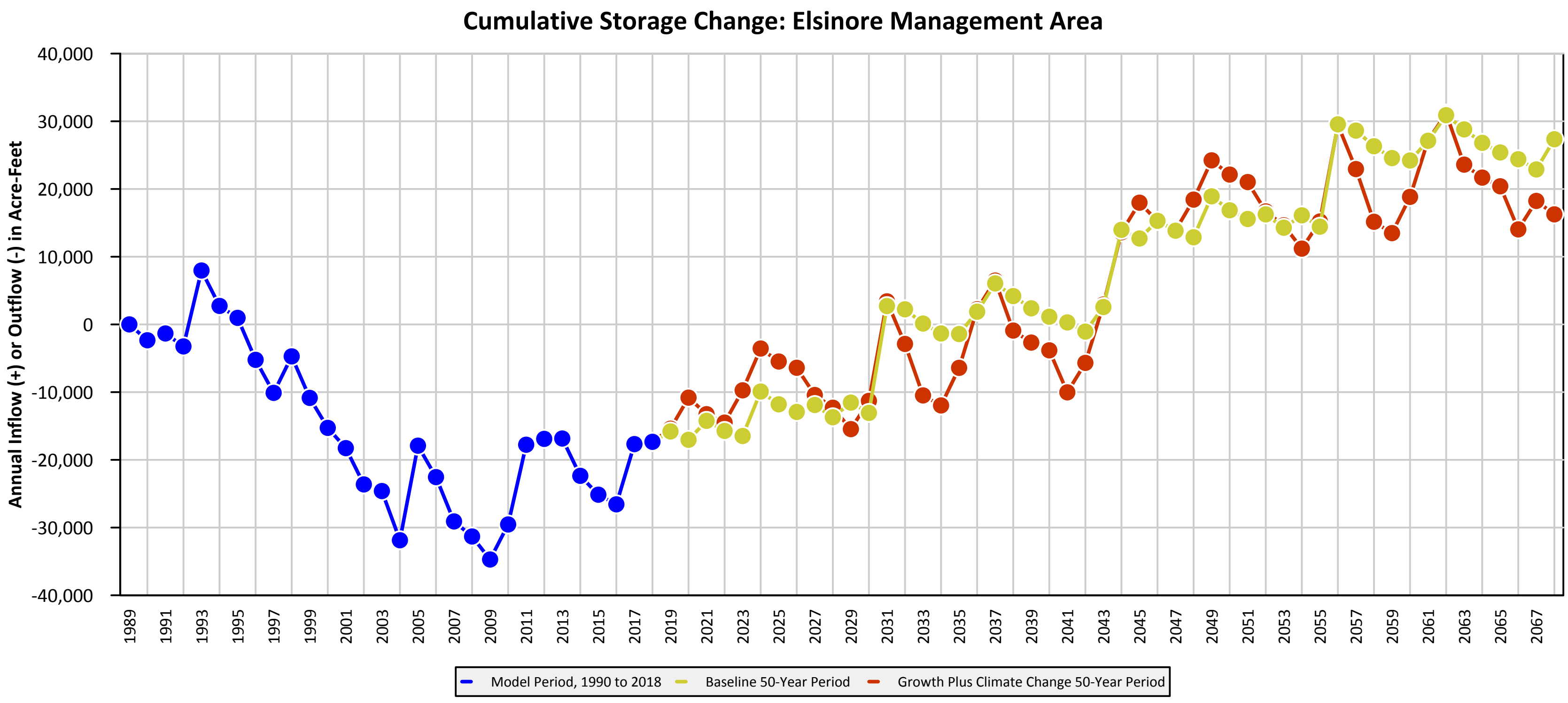
5.7.2.4 Riparian Evapotranspiration

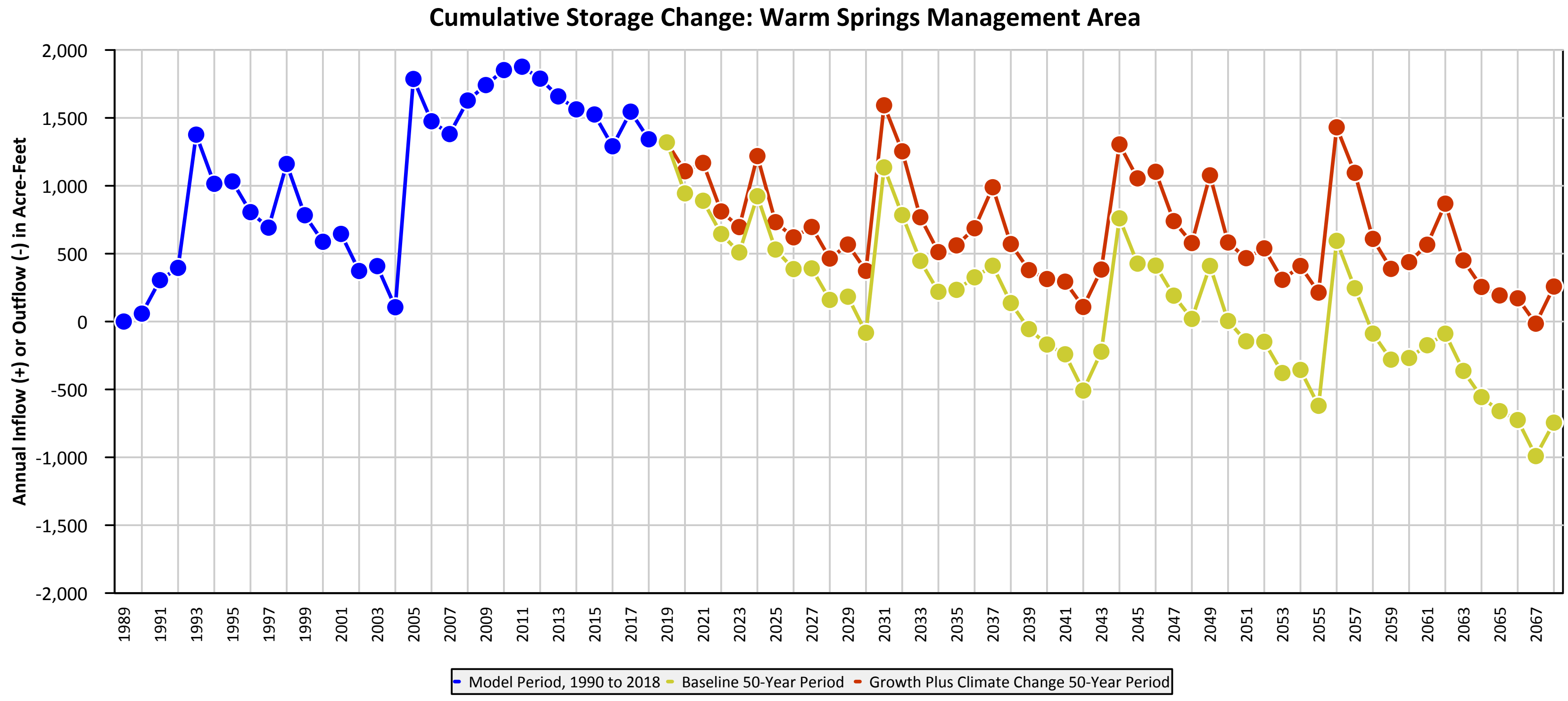
ET of groundwater by phreatophytic riparian vegetation is influenced by available soil moisture and by depth to the water table. Like other types of vegetation, phreatophytes use soil moisture supplied by rainfall when it is available. Any remaining ET demand is met by drawing water from the water table. 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 ft or more bgs. These calculations are applied at all model cells, but non-zero amounts only occur where the depth to water is commonly less than 20 ft. Aerial photographs indicate a correlation between those areas and the presence of dense, lush riparian vegetation.

Riparian ET was a significant component of groundwater outflow in all three MAs—as much as 67 percent in the Warm Springs MA. In the Elsinore MA, it occurred along the San Jacinto River and along small streams where they first enter the Subbasin. In the Warm Springs and Lee Lake MAs, a substantial fraction of total simulated riparian ET was along tributary streams where they first enter the Subbasin, with the remainder along Temescal Wash.

5.8 Change in Groundwater Storage

Figure 5.11 shows the cumulative change in storage from the model for the three MAs 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 during 1990 to 2018. As shown, groundwater storage in the Elsinore MA decreased dramatically during 1990 to 2007, consistent with observed declines in groundwater levels. Beginning in 2008, pumping was reduced to the safe yield that was estimated in the 2005 GWMP. Storage has fluctuated since then but has not exhibited an obvious upward or downward long-term trend. Both future scenarios exhibit an upward trend in storage, which means total inflows exceeded total outflows over the long term. If such a trend does turn out to occur, groundwater pumping could be slightly increased and use of imported water slightly decreased. The larger storage fluctuations visible in the growth plus climate change scenario are because conjunctive-use variations in municipal pumping were included in that simulation. They were not included in the baseline simulation; pumping was the same every year, and storage fluctuations resulted from variations in recharge.





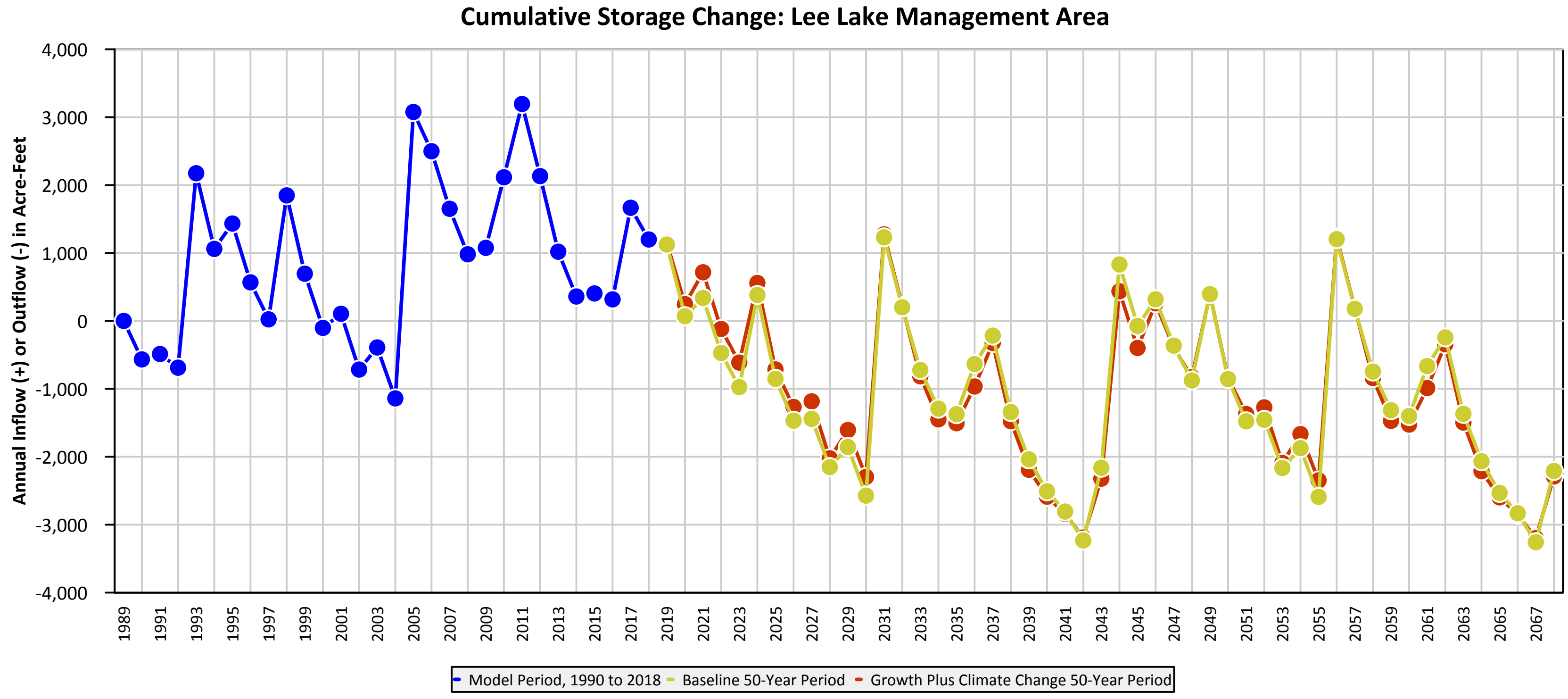


Figure 5.11 Cumulative Storage Changes

Simulated historical storage in the Warm Springs MA increased abruptly in wet years such as 1993 and 2005 and was maintained at a high level during 2009 through 2013 by large discharges of EMWD reclaimed water. The baseline scenario produced a slightly declining storage trend. Such a trend is not expected and might simply reflect minor inaccuracies in estimated some water budget items. The cumulative storage decline corresponds to an imbalance of only 2 percent between total inflows and total outflows. The in cumulative storage under the growth plus climate change scenario relative to the baseline scenario was expected. Although groundwater pumping was greater, it was more than offset by increased recharge resulting from urbanization (percolation of urban runoff, pipe leaks, irrigation return flow, and inflows derived from urbanization in the tributary watersheds).

In the Lee Lake MA, historical cumulative storage change followed a pattern similar to that in the Warm Springs MA, with large increases in wet years. Cumulative storage change for the two future scenarios were also similarly slightly negative, possibly reflecting a water budget error on the order of 2 percent. Unlike the Warm Springs MA, the two future scenarios had nearly identical cumulative storage change curves. Both MAs had similar amounts of increased pumping and similar effects of urbanization on recharge, so the difference between the growth plus climate change scenario and baseline scenario would be expected to be similar. The difference between the scenarios in the Warm Springs MA equaled only 2 percent of the average annual water budget, so an error of that magnitude in estimating water budget items would be sufficient to explain the difference in results between the two MAs.

5.9 Estimate of Sustainable Yield

The sustainable yield is defined as the volume of pumping that the Subbasin 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 estimate of sustainable yield presented in this section reflects the current status of those variables 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 changes in the relative amounts of recharge and pumping from normal or wet conditions to droughts and back again. In basins like the Elsinore Valley Subbasin, where groundwater and surface water supplies are used conjunctively, groundwater storage is expected to decline during droughts and recover afterwards. In a dry year when imported supplies are generally more limited and/or costly, the volume of groundwater pumped is generally higher. This increased pumping can be sustained for limited periods of time as long as the basin is subsequently replenished and there is sufficient groundwater storage capacity to accommodate the fluctuations. In wet years when rainfall recharge is relatively high, imported supplies are more available and groundwater pumping is generally reduced, recharge exceeds pumping and storage recovers.

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 average conditions during 1993 to 2017, which is representative of long-term average conditions in terms of precipitation and stream flow. Sustainable yield was estimated for each MA 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

MA	Sustainable Yield (AFY)		
	Historical Period (1993 to 2017)(1)	Baseline 50-Year Period(2)	Growth Plus Climate Change 50-Year Period(4)
Elsinore MA	6,878	6,301	6,617
Warm Springs MA	103	27	958(5)
Lee Lake MA	1,040	410(3)	1,108(6)
Total	**8,021**	**6,737**	**8,683**

Notes:

(1) Historical periods reflect 1993 to 2017 conditions and are documented in Section 5.3.

(2) The 50-year baseline simulation assumes that current pumping practices will continue in the future and use historical hydrology for 1993-2017 two times in succession. This scenario assumes increased pumping in dry years and decreased pumping in wet years due to conjunctive use program agreements. This scenario is documented in Section 5.5.3.1.

(3) In recent years, the Lee Lake MA has had reduced pumping due to a reduction in agricultural irrigation demands in the area.

(4) The 50-year growth plus climate change simulation assumes that increased demand in the future and use historical hydrology for 1993-2017 two times in succession. This scenario assumes increased pumping in dry years and decreased pumping in wet years due to conjunctive use program agreements. This scenario is documented in Section 5.5.3.2.

(5) The growth plus climate change simulation assumes increased pumping in the Warm Springs MA as documented in the Hydrogeologic Study of the Warm Springs Groundwater Basin report (Geoscience and Kennedy/Jenks Consultants 2017).

(6) The growth plus climate change simulation assumes increased pumping in the Lee Lake MA due to plans for using this MA as a municipal supply.

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 resulted in estimated sustainable yields shown in Table 5.5.

The estimates for the Warm Springs and Lee Lake MAs 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 Warm Springs MA growth plus climate change sustainable yield and the Lee Lake historical and growth plus climate change estimates. (Table 5.5). Pumping in Lee Lake was higher in the historical period than in the recent past, which was used as the basis for the baseline scenario, and pumping in both Warm Springs and Lee Lake were assumed to be higher in the growth plus climate change simulation (Table 5.4).

Results for the growth plus climate change scenario demonstrate that increased pumping can cause an increase in the calculated sustainable yield if that pumping can increase inflows or decrease outflows at head-dependent boundaries such as streams or MA boundaries. Pumping was greater than in the baseline scenario in the Warm Springs and Lee Lake MAs, and the estimated sustainable yields increased by amounts roughly equal to the increase in pumping.

These estimates of sustainable yield differ somewhat from estimates developed in previous studies that used different methodologies and had different objectives.

A GWMP prepared 15 years ago for the Elsinore MA estimated a sustainable yield of 5,500 AFY (MWH 2005). A subsequent yield reevaluation in 2014 obtained almost exactly the same estimate (Sibbett and Gastelum 2014). The difference between those estimates and the one presented here is the result of differences in methodology and itemization of the water budget, not the result of a change in the hydrogeologic conceptual model or major change in basin operation.

A hydrogeologic study of the Warm Springs MA applied three different methods of estimating yield, with results ranging from 910 to 2,410 AFY and averaging 1,575 AFY (GSSI and KJ 2017). The three methods were based primarily on estimation of recharge, whereas the method used here is equivalent to the practical-rate-of-withdrawal approach in which yield equals pumping plus storage change. Because of the hydraulic connection of groundwater with Temescal Wash. additional pumping will tend to increase yield up to a point. The results of the growth plus climate change scenario demonstrated that yield can be increased by if pumping is increased. Whether the Warm Springs MA could sustain the highest estimate from the previous study is unclear, but the upper limit of sustainable yield could be explored by means of additional model simulations.

A water budget for the Lee Lake MA was completed in 2014 estimated a sustainable yield of 590 to 1,000 AFY (Thomas Harder 2014). The range in values presented by Harder reflect variable recharge related to differences in precipitation and channel infiltration. As with the Warm Springs MA, increased pumping in Lee Lake would also affect the sustainable yield by inducing additional stream percolation. This is illustrated in the comparison of the Lee Lake sustainable yield estimates for the historical, baseline, and growth plus climate change periods in Table 5.5, which show higher yield estimates for periods of increased pumping (Table 5.4). EVMWD has plans to increase pumping in the Lee Lake MA to approximately 900 to 1,000 AFY; which was simulated in the growth plus climate change scenario. This demonstrates that increase in pumping increased sustainable yield commensurately.

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. Within the level of accuracy of current water budget estimates, the proposed amounts of pumping in all three MAs appear to be sustainable.

In the context of this GSP, the sustainable yield estimated from the water budget alone does not define sustainability. In accordance with SGMA, sustainability is contingent on the absence of undesirable results related to water levels, storage, subsidence, water quality, or depletion of interconnected surface water. Maintaining pumping below subbasin or MA-wide sustainable yield alone does not guarantee sustainability. Quantitative sustainability criteria are presented in Section 6 that define thresholds at which groundwater conditions become undesirable for each of those sustainability indicators. The sustainable yield values presented above are broad indicators that show no overdraft based on the water budget, but sustainability must be interpreted through evaluation of undesirable results. Annual groundwater production targets for operational purposes are discussed in Chapter 8, Projects and Management Actions.

Chapter 6

SUSTAINABLE MANAGEMENT CRITERIA

The 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 basin. SGMA identifies the following sustainability indicators that require definition of associated undesirable results:

- 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[1], a GSP must develop quantitative sustainability criteria 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.
- MT[2] – numeric value used to define undesirable results for each sustainability indicator.
- 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.

Due to the location of the Elsinore Valley Subbasin more than 20 miles inland from the Pacific Ocean, the sustainability indicator of seawater intrusion and the associated criteria are not applicable to this GSP.

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[1] 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 Elsinore Subbasin, seawater intrusion is not present and would be impossible.

[2] The abbreviations for MT and 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 Goals and Indicators

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 Elsinore Valley Subbasin, stated below, was developed through discussion at several public meetings of the project team, Technical Advisory Committee, and at the September 15, 2020 public workshop.

6.1.1 Description of Sustainability Goal

The goal of the EVGSA in preparing this GSP is to manage the Elsinore Valley Subbasin to provide sustainably and adequately for all beneficial uses within the Subbasin over wet and dry climatic cycles.

This goal is consistent with SGMA and is based on information from the Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget which are described in Chapters 2 through 5 of this GSP, that:

- Identify beneficial uses of Elsinore Valley Subbasin 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 the GSP, and 2) discussions with Elsinore Valley Subbasin stakeholders and local agency representatives, as well as Technical Advisory Committee (TAC) meetings and project workshops. This approach 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 MTs 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 results, 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 an important one in the Elsinore Valley Subbasin particularly for groundwater quality because of concerns that TDS and nitrate concentrations are close to Elsinore Basin Plan objectives. Arsenic is treated for at some municipal wells, and there are other COCs, such as perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). Sustainable management is all about use and management of groundwater without *causing* undesirable results but does not require reversing existing 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.

Another important aspect to defining sustainability criteria has been considering what is known and more importantly what is not known about undesirable results that may be detected or may potentially occur in the Elsinore Valley Subbasin. From a big picture perspective, the Elsinore Valley Subbasin is demonstrably well managed—historical groundwater level declines and overdraft have been reduced or stabilized, subsidence generally has not been perceived, groundwater storage has been managed such that recent drought impacts have been minimized, significant local groundwater quality degradation due to wastewater disposal is being reversed, and inter-connected surface water and GDEs are being maintained. While water resource monitoring has been useful and adaptive, data gaps and uncertainties still 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 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 summarizes the five sustainability criteria relevant to the Elsinore Valley Subbasin as guided by the Sustainability Goal. As documented in this section, the basin has been and is being managed sustainably relative to all criteria. 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—most notably importation of Colorado River and SWP water and its conjunctive use with groundwater. It also includes improvement and expansion of management actions and monitoring; these are addressed for each sustainability criterion's MO in a subsection, Discussion of Monitoring and Management Measures to be Implemented.

While the Elsinore Valley Subbasin has been managed sustainably, the following MT are defined for each of the three MAs of the Elsinore Valley Subbasin (Elsinore, Lee Lake, and Warm Springs as depicted on Figure 6.1).

Chronic Lowering of Groundwater Levels: The MT for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well. In the central portion of the Elsinore MA the threshold value in each Key Well is defined by operational considerations to maintain pumping water levels sufficiently above current pump intakes in municipal water supply wells to avoid the cost of lowering pump bowls, adding pump stages, and increasing pumping energy usage. In the peripheral portions of the Elsinore MAs and all of the Warm Springs and Lee Lake MAs MTs are defined by historical low groundwater levels rounded up to the nearest 5 ft. Undesirable results are indicated when four consecutive exceedances occur in each of three consecutive years, in three-quarters or more of the Key Wells in each MA.

Reduction of Groundwater Storage: The MT for reduction of storage for all MAs is fulfilled by the MT for groundwater levels as proxy. The MO for storage is fulfilled by the MT for groundwater levels, which maintains groundwater levels within the historical operating range.

Degraded Water Quality: The MT for degradation of water quality address nitrate and TDS for each MA as defined in the Basin Plan Amendment associated with the Elsinore Basin SNMP and Upper Temescal Valley SNMP submitted to the SARWQCB. The last calculation, through year 2018 was completed on July 8, 2020. The GSA will use the triennial calculations performed by the SAWPA Basin Monitoring Task Force rather than performing their own calculations.

- **Nitrate**: The MT for Nitrate is established at 5 mg/L as N in the Elsinore MA, consistent with the Maximum Benefit Objectives, while the MT for nitrate in the Warm Springs and Lee Lake MAs is established at 7.9 mg/L as N, consistent with the Upper Temescal Valley SNMP water quality objectives.
- **Total Dissolved Solids**: The MT for TDS is established at 530 mg/L in the Elsinore MA, consistent with the Elsinore Basin Plan water quality objectives, while the MT for TDS in the Warm Springs and Lee Lake MAs is established at 820 mg/L, consistent with the Upper Temescal Valley Salt and Nutrient Management Plan water quality objectives.

Undesirable results occur when the estimates of nitrate and/or TDS concentrations calculated by the SAWPA Basin Monitoring Task Force on a triennial basis do not meet exceed the MT. The MO is to maintain calculated basin-wide TDS and nitrate concentrations below the MTs.

Land Subsidence: Change in ground surface elevation of more than 1 ft in 50 years, with a minimum change of 6 inches to trigger action, using maximum displacement in service area as measured by InSAR satellite measurements and compared to the earliest InSAR measurement (May 2015).

Depletion of Interconnected Surface Water: The MT for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian trees is greater than 35 ft for a period exceeding 1 year.

The development of the undesirable results, MTs, and sustainability criteria for each of the undesirable results defined in SGMA relative to the Elsinore Valley Subbasin are described in detail below.

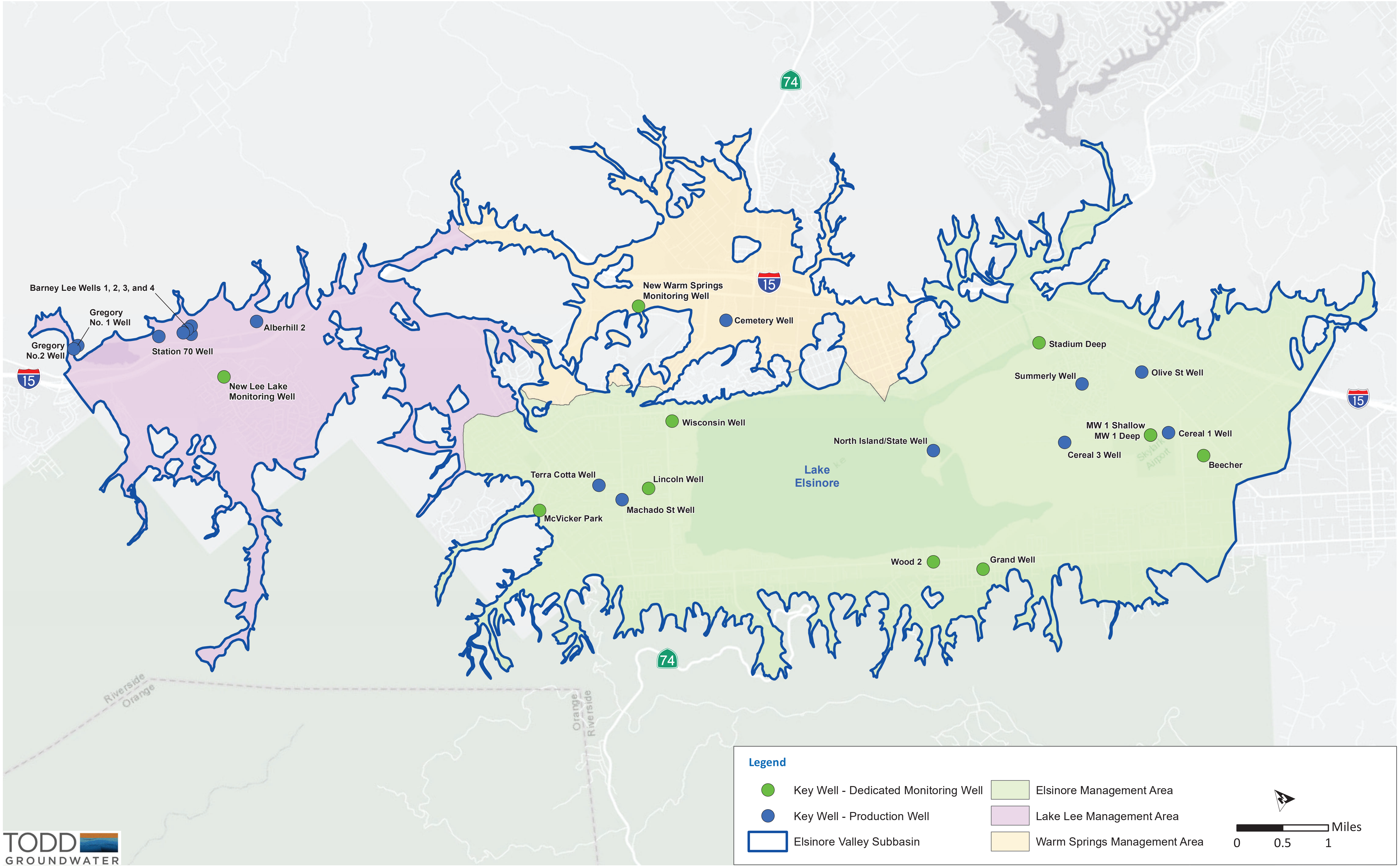

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Figure 6.1 Key Wells

6.2 Chronic Lowering of Groundwater Levels

Chronic lowering of groundwater levels can indicate significant and unreasonable depletion of water 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 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.

Groundwater elevation trends in Elsinore Valley Subbasin are documented in Groundwater Conditions Section 4.1; hydrographs of representative wells are presented for each MA. The Subbasin is not characterized by overdraft with widespread chronic groundwater level declines. Water levels in the Warm Springs and Lee Lake MAs have been very stable over time. Hydrographs in the Elsinore MA indicate that water levels have generally stabilized or risen since EVMWD limited pumping in this MA in accordance with findings of the 2005 GWMP (MWH 2005). While groundwater level declines may still occur with dry and critically-dry years, recent drought-related declines in this MA have not been as rapid or deep as in previous droughts. Some parts of the Subbasin experienced record lows during the most recent drought. However, the Subbasin 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 energy and related costs and a decrease in pump output (in gpm). With further declines, the pump may break suction, which means that the water level in the well has dropped below the level of the pump intake. This can be remedied by lowering the pump inside the well and adding pump stages, which can be costly. 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 the pump. The other potential adverse effect is accelerated corrosion or bacterial fouling 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 water level in the well has reached the current pump intake depth.

For purposes of setting an MT, undesirable results are defined as a well pump losing suction. The rationale is summarized as follows with more explanation in the following sections:

- Accurate information on the location, elevation, status, and construction of private supply wells is not readily available for detailed consideration of the range of adverse effects.
- During the recent drought, Elsinore Valley Subbasin was not marked by reports of significant water level decline impacts to shallow production wells.

- 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.
- MTs in most of the Subbasin are set based on historical groundwater level lows.

6.2.2 Potential Causes of Undesirable Results

For the Elsinore Valley Subbasin, the primary potential cause of groundwater level undesirable results would be reduction of surface and imported water supplies and associated groundwater recharge (in-lieu, direct, and return flows). Reduction of imported water deliveries could have direct adverse impacts on water users throughout the Subbasin by requiring increased groundwater pumping to meet demand or significant water conservation measures. This would in turn result in the potential for declining groundwater levels and overdraft impacts, primarily in the Elsinore MA. It should be noted that disruption of imported water will be mitigated through EVMWD's drought and water shortage plans, but the possibility for short term increased groundwater pumping still exists. Undesirable results also can occur because of increased demand for groundwater that exceeds available supply; this is most problematic in portions of Elsinore Valley that rely on private wells and do not have access to supplemental imported water supplies.

Given that the Elsinore Valley Subbasin 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).

6.2.3 Definition of Undesirable Results

As context, the Elsinore Valley GSP Sustainability Goal has the objective to manage the Subbasin to provide water sustainably and adequately for all beneficial 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 groundwater production wells in the Elsinore Valley Subbasin.

This definition also recognizes that chronic lowering of groundwater levels could affect groundwater flow to or from the hydraulically connected Bedford-Coldwater Subbasin, and thereby potentially affect their ability to maintain sustainability.

As documented in Groundwater Conditions Section 4.1, analysis of hydrographs reveals that Elsinore Valley Subbasin 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 because of the availability of imported supply and EVMWD's commitment to producing groundwater within sustainable limits. Moreover, the Subbasin 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 Elsinore Valley and that the basin is managed sustainably relative to groundwater levels. This finding is consistent with the water budget analyses for the MAs that indicate (within the range of uncertainty) balanced inflows and outflows into the future.

6.2.4 Potential Effects on Beneficial Uses and Users

Groundwater is a major source of water supply in the Subbasin and supplies wells for agricultural, municipal, industrial, and domestic 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. Beneficial uses in the Subbasin include use of interconnected surface water by aquatic organisms and shallow water tables by riparian vegetation, as described in Chapter 4.

6.2.5 Sustainable Management Criteria for Groundwater Levels

The general approach to defining sustainability criteria (MTs and MOs) 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 and operational considerations in Key Wells. This approach is founded on two concepts:

1. 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.
2. The central portion of the Elsinore MA where most of the productive municipal water supply wells are located is much deeper and generally hydraulically independent from the rest of the Subbasin. Water level declines in this area only affect municipal water supply wells operated by EVMWD, and undesirable results should not occur in this part of the Subbasin so long as operability for these wells can be maintained.

6.2.5.1 Selection of Key Wells

The approach includes selection of existing wells in the EVGSA monitoring program to represent nearby conditions. 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 have been identified by reviewing groundwater level hydrographs from all currently monitored wells and selecting wells that have a long, reliable, and recent records of groundwater level monitoring, that represent local or regional trends, and that together provide a broad geographic distribution for each MA and the Subbasin as a whole. The distribution of these wells also has been reviewed with respect to the density of wells across the Subbasin.

These wells are mostly production wells, which is not optimal for monitoring; on the other hand, they are generally representative of production wells in the basin. The Key Wells are shown on Figure 6.1.

Groundwater level data and hydrographs of each Key Well have been reviewed to identify the all-time lowest groundwater elevation at each Key Well. The historical minima in these wells do not correspond to a single point in time because water level trends vary locally in much of the Subbasin as discussed in Chapter 4 – Groundwater Conditions. The identified historical low water level at each Key Well (i.e., historical maximum depth to water) represents the first component of an MT and addresses the first foundational idea indicated above. Well construction and current pump setting depth information were also collected for Key Wells and nearby production wells, where available. This information provides guidelines on operability for these production wells.

6.2.5.2 Evaluation of Existing Wells with Construction Information

Figure 6.1 shows the locations of the selected Key Wells along with locations of other existing municipal supply wells in their vicinity.

As discussed in Sections 6.2.1 and 6.2.2, groundwater level declines involve a continuum of potential impacts that ranges from those effects not noticed by the well operators to those that are noticed and reasonably handled. For purposes of this GSP, unreasonable results occur when a well goes dry, in other words, the water level is below the current pump intake.

Little is known about the locations of existing private water supply wells in the Subbasin. EVMWD staff and other consulting efforts. The known private wells are located in the Warm Springs MA or the peripheral portions of the Elsinore MA. However, the construction and pump intake information for even the few known private wells is unavailable. It is assumed that historical low water levels have not resulted in undesirable results for these private wells based on a lack of reported problems, but additional information to support this assumption is not available at this time.

As described in Chapter 4, the central portion of the Elsinore MA is bounded by faults that run parallel to the long sides of Lake Elsinore. Faulting has caused this area to be deep and partially hydraulically independent from the rest of the Subbasin. This area also contains the most productive wells in the Subbasin, all of which are municipal water supply wells. Construction and pump intake depth information are known for most of the municipal water supply wells, which are all within the deep central portion of the Elsinore MA. This information was collected and evaluated in comparison to historical low water levels. The pump intakes in these wells are all well below historical low water levels. This evaluation indicates that water level declines greater than the historical lows would not result in undesirable results, as undesirable results are defined to occur when the water level is below the current pump intake. This allowed adjustment of MT level to 50 ft above the pump intake in each Key Well or nearby municipal supply wells in the central portion of the Elsinore MA.

6.2.6 Minimum Thresholds

According to GSP Regulations Section 354.28(c)(1) the MT 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, groundwater levels are not chronically declining in Elsinore Valley. While groundwater levels decline in dry and critically-dry years, they have recovered in normal, above normal, and wet years.

No Key Wells indicate groundwater levels below the respective MT and no undesirable results are known to have occurred. Nonetheless, MTs have been developed because the potential exists for chronic lowering of groundwater levels in the future.

Using recent and reliable information on the construction of existing supply wells, the MT levels shown in Table 6.1 are protective of municipal supply wells, based on available information. The MTs are based on historical low groundwater levels or operational considerations. 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 Bedford-Coldwater Subbasin.

Based on historical lows and operational considerations, 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, data gaps exist and thus the MTs include some uncertainty as summarized below:

- The geographic distribution of wells in the groundwater level monitoring program is uneven. While broad "blank" areas on Figure 6.1 generally are areas with few wells (production or monitoring), additional Key Wells would be beneficial.
- Current Key Wells are generally production wells that were not sited or designed for monitoring and may not be accurately representative of nearby supply wells as a matter of short historical record, distance, topographic and groundwater gradients between the Key Well and supply well, or respective screen settings.
- Information on vertical groundwater gradients is lacking and groundwater levels in shallow wells may not be represented adequately by relatively deep Key Wells.

These data gaps have been recognized and are being addressed in this GSP as follows:

- Mapping and prioritization of geographic gaps in the monitoring program with subsequent identification of existing wells that can be added to the program.
- Installation of new dedicated monitoring wells as part of the GSP (funded by a Sustainable Groundwater Management grant) with incorporation into the monitoring program; these are wells sited and designed to support the groundwater level monitoring program (among other objectives) and to become Key Wells, as indicated by their inclusion on Table 6.1.
- Identification and accurate location of existing active private supply wells and digitization of well information including construction, pump intake depths, and annual production.

The benefits of these efforts will accrue over the next few years and will support review and update of the MTs in the Five-Year GSP Update in 2027.

Table 6.1 Minimum Thresholds and Measurable Objectives for Groundwater Levels

Key Well	Historical Maximum Depth to Water (ft bgs)	Top of Screens (ft bgs)	Total Well Depth (ft bgs)	Current Pump Intake Depth (ft bgs)	Threshold, Depth to Water (ft bgs)	Threshold Notes	MO (ft bgs)
ELSINORE MANAGEMENT AREA							
McVicker Park	57	NA	NA	NA	60	Maximum depth to water rounded up to nearest 5 ft	57
Lincoln	324	360	960	NA	350	Maximum depth to water rounded up to nearest 5 ft	324
Terra Cotta	404	320	1,000	420	370	Maintain 50 ft above pump	404
Machado	277	570	980	400	350	Maintain 50 ft above pump	277
Wisconsin	302	NA	300	NA	350	Assuming 400 ft pump setting to maintain 50 ft above pump	302
Wood 2	38	192	600	NA	40	Maximum depth to water rounded up to nearest 5 ft	38
Grand	36	240	450	NA	40	Maximum depth to water rounded up to nearest 5 ft	36
North Island	499	600	1,800	NA	600	Based on pump intake in Cereal 4, maintain equivalent of 50 ft above pump in that well	499
Cereal 3	524	440	1,784	534	484	Maintain 50 ft above pump	524
Cereal 1	501	420	1,430	534	484	Maintain 50 ft above pump	501
Summerly	506	390	980	590	540	Maintain 50 ft above pump	506

Key Well	Historical Maximum Depth to Water (ft bgs)	Top of Screens (ft bgs)	Total Well Depth (ft bgs)	Current Pump Intake Depth (ft bgs)	Threshold, Depth to Water (ft bgs)	Threshold Notes	MO (ft bgs)
Beecher	394	NA	NA	NA	484	Based on pump intake in Cereal 1, maintain equivalent of 50 ft above pump in that well	394
Olive	411	308	720	440	390	Maintain 50 ft above pump	411
MW 1 Deep	479	700	1,005	NA	484	Based on pump intake in Cereal 1, maintain equivalent of 50 ft above pump in that well	479
MW 2 Deep	459	700	1,005	NA	484	Based on pump intake in Cereal 1, maintain equivalent of 50 ft above pump in that well	458.7
Stadium Deep	105	NA	NA	NA	110	Maximum depth to water rounded up to nearest 5 ft	105
LEE LAKE MANAGEMENT AREA							
Gregory 1	16	NA	NA	NA	20	Maximum depth to water rounded up to nearest 5 ft	16
Gregory 2	42	NA	NA	NA	45	Maximum depth to water rounded up to nearest 5 ft	42
Station 70	60	NA	NA	NA	60	Maximum depth to water rounded up to nearest 5 ft	60
Barney Lee 1	68	NA	NA	NA	70	Maximum depth to water rounded up to nearest 5 ft	68

Key Well	Historical Maximum Depth to Water (ft bgs)	Top of Screens (ft bgs)	Total Well Depth (ft bgs)	Current Pump Intake Depth (ft bgs)	Threshold, Depth to Water (ft bgs)	Threshold Notes	MO (ft bgs)
Barney Lee 2	80	NA	NA	NA	80	Maximum depth to water rounded up to nearest 5 ft	80
Barney Lee 3	76	19	135	NA	80	Maximum depth to water rounded up to nearest 5 ft	76
Barney Lee 4	58	NA	NA	NA	60	Maximum depth to water rounded up to nearest 5 ft	58
Alberhill 2	19	NA	NA	NA	20	Maximum depth to water rounded up to nearest 5 ft	19
New Lee Lake Monitoring Well(2)	NA	NA	NA	NA	NA	Well constructed as part of the GSP, information for establishing threshold not yet available	NA
WARM SPRINGS MANAGEMENT AREA							
Cemetery	22.96	NA	65	NA	25	Maximum depth to water rounded up to nearest 5 ft	23
New Warm Springs Monitoring Well(2)	NA	NA	NA	NA	NA	Well constructed as part of the GSP, information for establishing threshold not yet available	NA

Note:

(1) These wells are being installed as part of GSP preparation (funded by a Sustainable Groundwater Management grant) with incorporation into the monitoring program; they were sited and designed to support the groundwater level monitoring program and to become Key Wells. However, information to support development of thresholds is not yet available.

6.2.6.1 Installation of Two 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 EVGSA groundwater level monitoring program includes data collection at multiple time periods ranging from continuous to quarterly. Implementation of the GSP will include annual report preparation following the SGMA required schedule. The annual report will provide not only groundwater levels, but information on climate, imported water availability, groundwater storage, and groundwater extraction. Accordingly, groundwater level monitoring and annual reporting provides an early warning system that allows response by the EVGSA and local groundwater users. From this perspective, four consecutive quarterly exceedances in each of three 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 monitoring program. It should be noted that EVGSA responses do not have to wait for three 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 Elsinore Valley Subbasin has been organized into three MAs. As discussed in Chapter 5, this reflects the fact that the Subbasin includes a series of linked valleys and that MAs have distinct land use mixes, water supply sources, management, and groundwater level trends. Groundwater level MTs are established 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 others. At this time, the Key Wells are distributed across the MAs (disregarding the Warm Springs MA and portions of the Lee Lake MA), but relatively few, and even within MA boundaries, could be responding more to local problems than MA-wide sustainability issues. Accordingly, undesirable results are indicated to be occurring when three-quarters or more (greater than 75 percent) of the Key Wells have had the four consecutive exceedances in each of three consecutive years. In the case of Warm Springs where there is currently only one Key Well with a threshold, this equates to 100 percent of the wells.

To summarize for the Elsinore Valley Subbasin:

- The **MT** for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well. In the central portion of the Elsinore MA the threshold value in each Key Well is defined by operational considerations to maintain static water levels above current pump intakes in municipal water supply wells. In the peripheral portions of the Elsinore MA and all of the Warm Springs and Lee Lake MAs thresholds are defined by historical groundwater low levels rounded up to the nearest 5 ft.

Undesirable results are indicated when four consecutive quarterly exceedances occur in each of three consecutive years, in three-quarters or more of the Key Wells in each MA.

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 municipal well operation. Groundwater storage has changed, with drought-related declines followed by recovery. The major concern expressed in the Sustainability Goal is to have reliable storage for drought or storage; the MTs for groundwater levels will maintain groundwater levels and thus storage, too.
- **Seawater Intrusion.** There is no possibility of seawater intrusion in Elsinore Valley due to the inland location of the Subbasin and the lack of hydrogeologic connectivity with the ocean or other bodies of salt water. Accordingly, there is no seawater intrusion MT and no relationship with other MTs.
- **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 in much of the Subbasin, including Lee Lake and Warm Springs MA, and peripheral portions of Elsinore MA. In the central portion of the Elsinore MA, the operationally defined MT levels will prohibit significant pumping if water levels decline below historical lows. Accordingly, the MT 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 the operational ranges would minimize any effects on maintenance of water quality at or above MTs. The groundwater quality issues in Elsinore Valley Subbasin are associated primarily with salt and nutrient loading and not likely to be affected by groundwater levels or flow within this range.
- **Interconnected Surface Water.** The set of monitoring wells used to evaluate interconnected surface water overlaps with the set of Key Wells used for the groundwater levels MT. The groundwater elevation 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 Elsinore Valley Subbasin is adjacent to and upstream from the Bedford-Coldwater Subbasin (see Figure 2.2). Groundwater and surface water flow is from the Elsinore Subbasin towards the Bedford-Coldwater Subbasin, consistent with topography. If water levels in the Lee Lake MA were lowered, outflow to the Bedford-Coldwater Subbasin would decrease.

However, the groundwater level MTs in the Lee Lake MA are based on the historical range of groundwater levels, so they will support maintenance of water levels within the historical range in the Bedford-Coldwater Basin. This will in turn support maintenance of groundwater levels in the Bedford-Coldwater Subbasin by sustaining the current downstream gradient.

The Temecula Valley Groundwater Basin adjoins the southern end of the Subbasin at a regional groundwater divide. There is little to no flow across this boundary. The MTs for the Elsinore Valley Subbasin are not expected to affect this groundwater divide or the ability to sustainably manage the Very Low Priority Temecula Valley Groundwater Basin.

6.2.6.4 Effect of Minimum Threshold on Beneficial Uses and Users

Groundwater an important source of water supply in the Subbasin and supplies wells for municipal, industrial, and domestic beneficial uses and users. The MTs are based generally on operational considerations and 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 four consecutive quarterly exceedances in each of three 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

The establishment of MTs has been conceived and applied across all three MAs. MTs are based on operational considerations in the most productive part of the Subbasin and historical low levels (with some adjustments) in other areas. Operational considerations for the active municipal water supply wells have been used to establish MTs in the deep and somewhat geologically isolated central portion of the Elsinore MA. Water levels in this area of the Subbasin generally behave independently from other areas of the Elsinore MA and the rest of the Subbasin. Therefore, MTs in this area will prevent undesirable results in other MAs. Historical low levels have been used to establish MTs in the peripheral portions of the Elsinore MA and in the Warm Springs and Lee Lake MAs. These MTs represent maintenance of groundwater levels within a historical range during which the MAs have been managed without causing known undesirable results in other 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 EVGSA groundwater level monitoring program, 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 historical low groundwater levels in each Key Well represent the bottom of the operating range. 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 GDEs 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 drainage problems.

- The **MO** is to maintain groundwater levels above the historical maximum groundwater depths in each Key Well (as quantified above in Table 6.1), 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 for example, the lack of reliable and accessible information on private well construction and the uncertainties associated with using production wells for Key Wells. Monitoring improvement are discussed in Section 7.

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 recycled water sources to offset potable water demands, acquiring imported water for direct use and managed aquifer recharge, and other conjunctive use operations. EVMWD also has education and outreach programs to promote water use efficiency and to reduce water demand.

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 and a buffer for capturing runoff in wet years. 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 through drought or shortage. The storage criteria are closely linked to groundwater levels, but unlike the other sustainability criteria, the reduction of groundwater storage criteria is not defined at individual monitoring sites but is evaluated as a volume on an MA or basin-wide basis. 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.

Change in groundwater storage (either reduction or increase) can be evaluated with two main methodologies; one method uses groundwater level change data from wells with application of a storage coefficient and the other method involves an accounting of all the inflows and outflows and computation of change in storage according to the water budget equation (inflows – outflows = change in storage).

For the each of the three MAs of the Elsinore Valley Subbasin, the water budget has been calculated using the numerical groundwater model, as described in Water Budget Section 5. In brief, this has included analyses of the cumulative change in storage for each of the three 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, recovery, and changes in groundwater use and indicate that groundwater storage in the Subbasin has been sustainably managed relative to storage.

The water budget inflow and outflows have been balanced over the long-term in two of the MAs and future simulations predict the third MA to become balanced. Furthermore, as indicated in Section 6.2, none of the water supply wells have been reported as going dry in the Subbasin during the historical period of record.

6.3.1 Description of Undesirable Results

Given that Elsinore Valley 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. These undesirable results have not been observed in the Subbasin. 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 Subbasin, the basic cause of undesirable results would be an imbalance of the water budget, such that outflows to exceed inflows resulting in reduction of groundwater storage. This imbalance could be caused in turn by reduced surface water supplies and associated groundwater recharge (in-lieu, direct, and return flows). Such reduction could potentially include the following conditions: 1) increased pumping due to disruption of imported water purchased from the MWDSC, 2) reduced percolation from Temescal Wash, 3) reduced natural recharge due to prolonged drought or climate change, or 4) increased pumping due to reduced recycled/non potable discharge and use. It should be noted that disruption of imported water will be mitigated through EVMWD’s drought and water shortage plans, but the possibility for short term increased groundwater pumping still exists. Undesirable results also could occur because of changes in land use causing increased demand for groundwater or reduced recharge due to decreased impervious area. Such changes would be most problematic in portions of Elsinore Valley without access to other water supplies (i.e., Warm Springs) or those with a high percentage of undeveloped land.

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 150 to 1,000 ft deep, with a few almost 1,800 ft.

The depth of the basin ranges from 50 ft in some areas to more than 2,800 ft in others (see Figure 3.5). Groundwater wells used for water supply are generally located in the central deeper portion 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 domestic beneficial uses. Reduction of groundwater storage would reduce access to that supply with adverse effects on the community, economy, and environmental setting of Elsinore 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 revealing about how much storage has been used in each MA, effectively defining an *operating storage*. Similarly, the approach focuses on the beneficial uses of the Subbasin 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

Figure 5.8 shows the cumulative change in storage by MA for historical and current conditions (1990 through 2018) 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 for all three MAs in 2016, because the 2014 to 2017 drought period at the end of the simulation. Table 5.4 shows the average change in storage for each MA for the historical period (1997 through 2007), current period (2010 through 2017), and the simulated future conditions (repeated hydrology of 1993 through 2017 with future demand and supply assumptions). Observations about the historical operating storage for each of the MAs are as follows:

Elsinore MA. The cumulative storage, as simulated by the model, declined consistently in the historical period (1997 through 2007) due to increased water demand to support growth. Both groundwater pumping and imported water deliveries increased to meet demands, with an average loss of storage in the MA of 2,055 AFY. This was followed by a halt in growth due to the 2007/2008 recession, periods of increasing storage reflecting wet years, and/or imports and decreasing storage due to droughts. The current storage volume (2008 through 2020) change averaged an increase of 2,206 AFY recognizing both sustainable groundwater management and the significant drought from 2014 to 2016.

Warm Springs MA. The average annual change in groundwater storage remained stable throughout the historical period (1997 through 2007) and current periods (2008 through 2020), an increase of 80 AFY and a decrease of 24 AFY, respectively. As shown in Figure 5.8, even the significant drought of 2014 through 2016 had a limited impact on the cumulative storage. This small MA has had consistent pumping and the change in storage is mainly driven by natural processes including groundwater and surface water interaction.

Lee Lake MA. The pattern of cumulative storage change for Lee Lake is similar to the Elsinore MA, but of lower magnitude. Lee Lake MA is smaller in area than the Elsinore MA, but the cumulative storage is also dependent on groundwater pumping. The historical period (1997 to 2007) had a higher total groundwater pumping but more available recharge, resulting in an average change in storage of 87 AFY per year. Reductions of pumping in the current period (2010-2017) has stabilized groundwater storage showing a slight average storage increase of 74 AFY.

In Elsinore and Lee Lake MAs, the cumulative change in simulated groundwater storage shows short term drought and recovery cycles, with a long-term general decrease in groundwater storage due to increased groundwater production over the same time (1989-2009).

Given, the storage stability in the most current period (2008 to 2020) 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 two years.

6.3.6 Minimum Threshold

Undesirable results relative to groundwater storage, lack of available supply for beneficial uses, have not occurred in the Subbasin 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 Elsinore Valley production wells, additional storage outside of the historical limits may be needed to support future recharge and recovery programs. According to SGMA, the MT 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 demonstrate 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 changes in pumping, 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 prevent significant and unreasonable results relating to storage. In brief, groundwater level MTs have been defined to protect public and private water 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 Subbasin.
- MTs that are based on a combination of historical low groundwater elevations and 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.
- Groundwater level MTs include four consecutive quarterly exceedances in each of three years, providing early warning for storage changes, while also involving three-quarters 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 storage is directly related and constrained by water levels (including groundwater level proxies for depletion of interconnected surface water) and given all the above, the MTs for groundwater levels should be sufficiently protective of groundwater storage.

To summarize for the Elsinore Valley Subbasin:

- The **MT** for storage for all MAs is fulfilled by the MT for groundwater levels. The **MT** for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well. In the central portion of the Elsinore MA the threshold value in each Key Well is defined by operational considerations to maintain water levels above current pump intakes in municipal water production wells. In the peripheral portions of the Elsinore MA and all of the Warm Springs and Lee Lake MAs thresholds are defined by historical groundwater low levels rounded up to the nearest 5 ft. Undesirable results are indicated when four consecutive quarterly exceedances occur in each of three consecutive years, in three-quarters or more of the Key Wells in each MA.

The Sustainability Goal for the Elsinore Valley Subbasin 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 MTs for groundwater levels are protective of the beneficial use of the basin – municipal 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 Elsinore Valley Subbasin. Accordingly, there is no MT and no relationship with other MTs.
- **Subsidence.** Subsidence is linked to groundwater levels. Because the storage reduction MT would not cause water levels to drop below their MTs, it would not interfere with the subsidence MT.
- **Water Quality.** Maintenance of groundwater storage within historical and operational ranges would minimize any effects on water quality relative to water quality MTs. Groundwater quality issues in Elsinore Valley Subbasin 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 MTs 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 MTs for water levels in those areas. Thus, it is more likely that the interconnected surface water threshold would constrain storage utilization rather than vice versa.

6.3.6.2 Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Elsinore Valley Subbasin is adjacent to the Bedford-Coldwater Subbasin located downstream along Temescal Wash. Groundwater flow directions are from the Elsinore Valley Subbasin to the Bedford-Coldwater Subbasin. The groundwater level MTs for the Elsinore Valley Subbasin would support maintenance of groundwater levels and storage within the historical range in Lee Lake MA (located on the boundary of the Bedford-Coldwater Subbasin and this in turn will support maintenance of operational groundwater storage in the neighboring basin.

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 domestic groundwater users. The MTs for groundwater levels are based generally on historical lows and 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 MT is consistent with the water level MT, which means that available storage will be adequate to supply beneficial uses as long as water levels remain above their MTs.

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 MA would be associated with a change in water levels. That change could affect groundwater flow between that MA and an adjoining one. The boundary flow would only change if storage and water levels in the adjoining MA did not experience a similar change. Therefore, no incompatibility among MAs 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 storage, will be part of the EVGSA groundwater level monitoring program (see Chapter 7). Data and analytical results, including assessment of change in storage, are presented in the 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 historical low level that corresponds to the MT for storage, which would keep groundwater storage within the historical operating range. This is prudent and reasonable, especially given the realization that considerable additional storage underlies portions of the basin. 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 **MO** 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 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 Elsinore Valley Subbasin because of its inland location and lack of hydrogeologic connection to known bodies of saline water. 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 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 production wells. As described in Groundwater Conditions sections 4.7 and 4.8, elevated concentrations in drinking water of some constituents, such as nitrate, can adversely affect human health.

Discharge of groundwater with degraded water quality can harm ponds, wetlands, and associated ecosystems (e.g., eutrophication). Consideration of the causes and circumstances of water quality conditions is important in the Subbasin because TDS and nitrate concentrations have increased in the basin over the decades, and nonetheless has been used for beneficial purposes, primarily municipal and domestic purposes. Additionally, naturally occurring constituents such as arsenic are high in portions of the Elsinore Valley Subbasin. 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 are recognized as sources of groundwater quality deterioration. Such loading from septic systems, fertilizer use, and other sources, have 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 to centuries (USGS, 2010). This means that groundwater quality monitoring data can be misleading, as the current conditions seen may be based on decades-old land use conditions, and not account for constituents in the vadose zone. Thus, there is a possibility that the effects of current management activities may not be seen for decades.

The sustainability goal is to protect groundwater quality from getting worse but not to reverse existing undesirable water quality conditions as of 2015. The MT and MO related to water quality should 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.

6.5.1 Potential Causes of Undesirable Results

The groundwater in the Elsinore Valley Subbasin is generally controlled by the interaction between rainwater and the vadose zone and aquifers (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, most contaminants are effectively regulated as described in Groundwater Conditions Section 4.6 and regularly tracked as part of the EVMWD monitoring program.

As described in the Groundwater Conditions section, TDS and nitrate are COCs for the Subbasin. While there are elevated natural background TDS concentrations in groundwater, TDS also is an indicator of human impacts including imported water use, infiltration of urban runoff, agricultural return flows, and wastewater disposal via septic tanks and natural recharge after wastewater treatment effluent disposal. Natural nitrate levels in groundwater are generally very low (less than 2 mg/L), and elevated concentrations (above 3 mg/L) are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facility discharges (Mueller 1995).

Other constituents have been documented (see Groundwater Conditions Section 4.8) but occurrences of these are either under regulation by SARWQCB (e.g., MTBE) or are naturally occurring and limited potential for mobilization due to management actions (e.g., arsenic).

6.5.2 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 Elsinore 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 EVGSA is not responsible for local problems or water quality degradation caused by others. While the Subbasin 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 Federal agencies. The EVGSA does not have the mandate or authority to duplicate these programs. Nonetheless, EVMWD historically has cooperated with these agencies and checks regulator files regularly as part of its water quality monitoring program. In addition, this GSP avoids management actions that would result in the introduction or mobilization of groundwater contamination through managed aquifer recharge, pumping, or other activities.

6.5.3 Potential Effects on Beneficial Uses and Users

Groundwater is a major source of water supply in the Subbasin and supports a range of beneficial uses including: municipal, residential, and environmental. Beneficial uses of water and respective water quality objectives are defined by the SARWQCB in the Basin Plan. For TDS and nitrate, these are tabulated in the GSP Groundwater Conditions (Section 4.7 Key Constituents of Concern).

The primary concern of high TDS and nitrate is the impact to environmental conditions that are higher than the historic or native water quality condition in the Subbasin and could have an impact on water quality in streams and other surface water bodies. High nitrate levels (above 10 mg/L as N) would violate the MCL and would require treatment before use as a potable water source. High TDS levels affect the aesthetic use of the water, such as hardness, scale formation, or bitter tastes. Other constituents, such as arsenic and other contaminants of concern, have either current or potential MCLs, which would limit their use as a potable water supply either now or in the future.

6.5.4 Sustainable Management Criteria for Groundwater Quality

The definition of an Undesirable Result due to degraded water quality was based on historical, existing, and potential future water quality conditions in each MA. It was decided that water quality in this GSP will be evaluated for TDS and nitrate only, while arsenic and other constituents may be added in subsequent GSP updates if future monitoring indicates that management actions may impact water quality in one or more MAs.

6.5.4.1 Sustainable Management Criteria for TDS and Nitrate

A major consideration in this evaluation is the reality of historical salt and nitrate loading to shallow portions of the principal aquifers. In deep alluvial basins such as the Elsinore MA, there is typically a delay of decades for solute loading at the land surface to noticeably affect groundwater quality at the depths tapped by water supply wells. The amount of such legacy loading is not known nor is the rate at which it is moving down. Substantial scientific investigation and years of monitoring would be needed to get reliable estimates. Accordingly, the nitrate and TDS concentrations may change due to existing deposition of salts in the vadose zone, as well as changing practices, even without active management.

For the decision to set sustainable management criteria, SGMA poses two basic questions:

1. Were undesirable results occurring as of the SGMA baseline of January 2015?
2. Is there a potential for future undesirable results?

The Elsinore MA has antidegradation water quality standards of 480 mg/L for TDS and 1 mg/L for nitrate as N. The 1996-2015 ambient water quality report (DBS&A 2017) showed TDS concentrations of 490 mg/L and nitrate concentrations of 2.2 mg/L as N. Since there was no assimilative capacity in 2015, undesirable results were existing as of January 2015. However, there is a proposed Basin Plan amendment for the Elsinore MA, setting water quality goals as 530 mg/L for TDS and 5 mg/L for nitrogen as N in the Elsinore MA (EVMWD 2020). A continued potential for undesirable results during the next 20 years is undeniable as legacy loading from septic systems arrives at deeper layers of the aquifer. Accordingly, consistent with SGMA, criteria must be set for groundwater quality as there is the possibility of undesirable results.

GSP regulations require that the MT 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)). While there are a number of wells in the Elsinore MA, there are only seven wells in the Lee Lake MA, and two wells in the Warm Springs MA. It is difficult to manage water quality on just two wells. Therefore, for the water quality sustainability criteria, the Lee Lake and Warm Springs MAs will be managed together. The issues of concern in the Elsinore Valley Subbasin are focused on regional nitrate and salt loading and data are insufficient to define plumes or volumes of water, thus the position of an isocontour is not applicable.

6.5.4.2 Sustainable Management Criteria for Arsenic

Arsenic is another constituent within the Elsinore Valley Subbasin of concern. Arsenic occurs naturally in the Elsinore MA and it has been detected in some of the deep municipal wells.

The drinking water MCL for arsenic is 10 µg/L. While the average arsenic concentration in the Subbasin is below the MCL, there are some wells which register arsenic concentrations above the MCL and require treatment before delivery to municipal customers. EVMWD employs both centralized treatment and blending practices to mitigate arsenic concentrations that surpass the MCL.

The relationships between depth, water level, and arsenic concentrations are unknown. EVMWD conducted zone sampling in two wells in the Elsinore MA; one well showed increasing arsenic concentrations with depth, while the other well showed no correlation between arsenic concentration and depth. An MT or MO has not been set for arsenic in the Subbasin because there is insufficient information available to understand whether any management actions, such as changing groundwater levels, could have an impact of arsenic concentrations in groundwater. The SARWQCB currently regulates arsenic within the region but has not currently set standards for arsenic in the Subbasin. At this time, the GSA does not wish to conflict with the management of the SARWQCB by defining an MT or MO that may end up in conflict with their future standards. EVMWD will work closely with SARWQCB and DWR to determine how to manage this parameter in the future. Continued monitoring of arsenic concentrations are recommended. A study of which portions of the aquifer contain arsenic may give more insight into the impact of management actions on arsenic concentrations. Monitoring and studies may lead to an establishment of an MT or MO in future GSP updates.

6.5.4.3 Sustainable Management Criteria for Other Constituents of Concern

There are other COCs within the Elsinore Valley Subbasin. For example, California is now requiring municipal water providers to monitor for per- and polyfluoroalkyl substances (PFAS). At this time, the concentrations, extent, and impact of these constituents are unknown. Monitoring and studies may lead to an establishment of an MT or MO in the future.

6.5.5 Existing Monitoring Programs

EVMWD regularly collects water quality data from its wells for purpose of understanding the basin and to track local water quality conditions. The wells which are monitored are generally municipal production wells, which are monitored on a regular basis to track quality for municipal delivery purposes in accordance with health guidelines as monitored by the DDW as part of the California SWRCB. EVMWD also collects water quality data at some of the monitoring wells on a regular basis (approximately yearly) to collect water quality information in areas not covered by the municipal wells to represent regional conditions. The municipal wells generally are sampled monthly, while other wells are sampled approximately annually for general minerals, physical parameters, and selected COCs. Accordingly, these data sets can be used to detect a range of problems quickly, to track trends, allow geochemical investigation, and support focused management actions.

A regional groundwater monitoring program was established with sample results also submitted to the SARWQCB as part of the Basin Plan (SARWQCB 2019). The SAWPA collects and complies all the water quality data in the Santa Ana Basin into a database. Since the Elsinore Valley Subbasin is part of the Santa Ana Basin, all data collected by EVMWD is submitted to the SAWPA database. SAWPA's Basin Monitoring Task Force which tabulates TDS and nitrate-nitrogen concentrations in each management zone on a triennial basis for the preceding 20 years. The last triennial report was completed in July 2020 for the period 1999 through 2018 (Water Systems Consulting, Inc. [WSC] 2020).

Table 6.2 summarizes the number of wells sampled for nitrate and TDS during the current conditions period (2008 through 2020) as defined in this GSP. There are an acceptable number of sampled wells in the Elsinore MA, but there are relatively few in the Lee Lake MA, and only one sampled well in the Warm Springs MA. Limitations of this data set include the limited data and number of wells in the Lee Lake and Warm Springs MA, the uneven distribution of sampled wells across the Subbasin, lack of information on the vertical zone being sampled (well construction information), and absence of historical record for some wells. These limitations present significant uncertainties to the EVGSA and stakeholders who are required to establish quantitative, measurable criteria and then comply with them, with real-world consequences. Nonetheless, the available data provides a snapshot and overview of TDS and nitrate for the Subbasin.

Table 6.2 Number of Wells with Nitrate or TDS Data, 2016-2018

MA	Number of Wells with TDS Data	Number of Wells with Nitrate Data
Elsinore	16	16
Lee Lake	7	7
Warm Springs	1	1

6.5.6 Minimum Thresholds

MTs are presented for nitrate and TDS for each of the MAs using the best available information. To coordinate with existing monitoring and compliance programs, the water quality MTs have been based on the calculations already performed by SAWPA's Basin Monitoring Task Force.

With adaptive management in mind, the MTs for nitrate and TDS quantify current conditions (2015 through 2017) based on available monitoring data. However, recognizing the problem of legacy loading and the inherent limitations of water quality monitoring, the approach of the GSP is to proceed with measures to reduce loading of nitrate and salts once certain thresholds have been met based on the proposed Basin Plan amendment (EVMWD 2020).

6.5.6.1 Minimum Threshold for Nitrates

Table 6.3 summarizes current conditions for NO_3 expressed a N in mg/L. For the Elsinore MA, with the proposed Basin Plan amendment, the proposed maximum benefit objective for the Elsinore MA is 5 mg/L. Current conditions for the Elsinore MA is based on an average for each MA based on tabulation methods used to calculate Santa Ana Basin Plan compliance. The methodology for tabulating the numbers is fully defined in the report, *Recomputation of Ambient Water Quality in the Santa Ana Watershed for the Period 1999 to 2018* (WSC 2020). The baseline data for the Elsinore MA is data complied over the period of 1999 to 2018.

Since the Warm Springs MA has only a single well, the Lee Lake and Warm Springs MAs will be managed as a single unit for purposes of water quality. The Upper Temescal Valley Salt and Nutrient Management Plan (WEI 2017) and related Basin Plan Amendment has defined the maximum benefit objective for nitrate as 7.9 mg/L as N. Current conditions for the Lee Lake and Warm Springs MAs are based on an average for the two MAs and the downstream Bedford portion of the Bedford-Coldwater Subbasin. The baseline data for the Lee Lake and Warm Springs MAs is based on data complied over the period of 2015 to 2017.

Table 6.3 Summary of Current Conditions for Nitrate (expressed as Nitrogen)

MA	MT (mg/L)	Current Conditions (mg/L)
Elsinore	5	2.3
Lee Lake and Warm Springs	7.9	6.0

Note:
(1) Ambient water quality for the past 20 years (WSC 2020).

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 MT for NO_3 (as N) for each MA is defined as the proposed Basin Plan objective in the Elsinore MA as 5 mg/L and the Basin Plan objective in the Lee Lake and Warm Springs MAs as the Upper Temescal Valley antidegradation goal of 7.9 mg/L.

This MT is presented with full recognition of data gaps and uncertainties, and with commitment incorporated in this GSP to investigate nitrate and salt loading under current conditions (including vertical distribution in shallow zones) and to implement management actions for reduction of nitrate and salt loading without delay.

As documented in Table 6.3, the current conditions for nitrate concentrations are below the MT for all MAs. While wells in the Subbasin have been significantly affected by septic returns and legacy nitrate loading from fertilizer use, the nitrate concentrations are below the proposed maximum benefit objectives. Even though there are a number of wells affected by high nitrate concentrations, there has been historical and ongoing groundwater use without concerns from users. The conditions in the Elsinore Valley Subbasin are considered sustainable.

Given the above definition, the MTs for nitrate in each MA are expressed in Table 6.3. These MTs refer to the proposed numeric SARWQCB Basin Plan maximum benefit objective and quantify current conditions based on available data. The proposed Basin Plan amendment defines a plan to manage the nitrate concentrations in the Elsinore MA. These include a septic removal programs by connecting customers to municipal sewer services and the eventually installation of reverse osmosis prior to recharge of treated wastewater into the Elsinore MA.

6.5.6.2 Minimum Threshold for Total Dissolved Solids

Table 6.4 summarizes current conditions for TDS in reference to the Basin Plan Objective, which, based on the proposed basin plan amendment, will be 530 mg/L for the Elsinore MA. Current conditions for the Elsinore MA are based on an average value from tabulation methods used to calculate Santa Ana Basin Plan compliance. The methodology for tabulating the numbers is fully defined in the report, *Recomputation of Ambient Water Quality in the Santa Ana Watershed for the Period 1999 to 2018* (WSC 2020). The baseline data for the Elsinore MA is data complied over the period of 1999 to 2018.

Since the Warm Springs MA has only a single well, the Lee Lake and Warm Springs MAs will be managed as a single unit for purposes of water quality. The Upper Temescal Valley Salt and Nutrient Management Plan (WEI 2017) has defined the maximum benefit objective for TDS in these MAs as 820 mg/L. Current conditions for the Lee Lake and Warm Springs MAs is based on an average for the two MAs. The baseline data for the Lee Lake and Warm Springs MAs is based on data complied over the period of 2015 to 2017.

Table 6.4 Summary of Current Conditions for Total Dissolved Solids

MA	MT (mg/L)	Current Conditions (mg/L)
Elsinore	530	490
Lee Lake and Warm Springs	820	692

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 **MT** for TDS for each MA is defined as the proposed Basin Plan Maximum Benefit Objective for the Elsinore MA of 530 mg/L and the Basin Plan Antidegradation Objective for the Lee Lake and Warm Springs MAs of 820 mg/L.

The current conditions for TDS concentrations are below the MT for all MAs. Even though there are some individual wells affected by high TDS concentrations, there has been historical and ongoing groundwater use without concerns by users. The conditions in the Elsinore Valley Subbasin are considered sustainable.

Given the above definitions, the MTs for TDS in each MA are expressed in Table 6.4. These MTs refer to the numeric MCL and Basin Plan objective, honor the non-degradation policy, and quantify current conditions based on available data. As described in the following section, MOs, the approach is to implement management actions that will maintain or reduce TDS concentrations in the future.

6.5.6.3 Relationship of Minimum Threshold to Other Sustainability Indicators

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 and contamination plumes may change direction or velocity by changing groundwater levels or flow patterns.

6.5.6.4 Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Elsinore Valley Subbasin is adjacent to the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin to the north, and adjacent to the Temecula Valley Basin to the south.

Groundwater flow is from the Lee Lake MA to the Bedford-Coldwater Subbasin with some drainage into Temescal Wash. While the flow rate is low, it is possible that management actions in the Elsinore Valley Subbasin could impact water quality in the Bedford-Coldwater Subbasin. It should be noted that the Bedford portion of the Bedford-Coldwater Subbasin downstream of the Lee Lake MA is also within the Upper Temescal Valley GMZ, so the TDS and nitrate MTs described above are the regulatory levels for that area as well. Hence, the MTs defined in this GSP should allow for consistent management of water quality in the Bedford-Coldwater Subbasin. Additionally, overall improvement of groundwater quality in the Elsinore Valley Subbasin through management actions (e.g., recharge of treated wastewater after reverse osmosis) will be beneficial to both subbasins.

As the Temecula Valley Basin and the Elsinore MA drain in opposite directions, it is unlikely that groundwater quality in the Elsinore Valley Subbasin will impact the Temecula Valley Basin.

6.5.6.5 Effect of Minimum Threshold on Beneficial Uses and Users

The MTs are based on the proposed water quality objectives in the MAs relative to nitrate and TDS concentrations. The MTs recognizes that groundwater has been and is being used reasonably for the range of beneficial uses. Hence, the MTs are not anticipated to have an adverse impact on current beneficial uses and users. 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 BMPs approach.

6.5.6.6 Relationship of Minimum Threshold to Regulatory Standards

The MTs have been established with direct reference to regulatory standards, most notably the Basin Plan Objectives set by the SARWQCB. Processing of the water quality data is defined by the SARWQCB process for the Santa Ana Basin to minimize expenses.

6.5.6.7 How Management Areas Can Operate without Causing Undesirable Results

The establishment of MTs has been consistently conceived and applied across all three MAs. For all MAs, the goal is to protect groundwater quality and all MTs are based on basin plan objectives. It is not known if the current status represents equilibrium conditions between the successive MAs from upstream to downstream and change may occur between them. The MAs were established to aid in implementation and operation of management actions and projects, which will include actions to improve groundwater quality in all MAs.

6.5.6.8 How the Minimum Threshold will be Monitored

The GSP will use the SAWPA Basin Plan Monitoring Task Force triennial process to tabulate and calculate the ambient water quality parameters. The monitoring program will be improved and expanded to include a broader and more even distribution of sampled wells across the Subbasin. The GSP monitoring program is presented Chapter 7 of this GSP.

6.5.7 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 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.

6.5.7.1 Description of Measurable Objectives

MOs 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 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 **MO for NO_3** is defined as maintaining or reducing the average ambient concentration of nitrate to the MT, which is 5 mg/L for the Elsinore MA and 7.9 mg/L for the Lee Lake and Warm Springs MAs.
- The **MO for TDS** is defined as maintaining or reducing the average ambient concentration of TDS to the MT, which is 530 mg/L for the Elsinore MA and 820 mg/L for the Lee Lake and Warm Springs MAs.

MOs 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.

6.5.7.2 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. However, SGMA does not require water quality concentrations prior to 2015 to be addressed. All management actions will be deferred to the Regional Board, the State regulatory agency in charge of groundwater quality management. Monitoring and management actions already undertaken are summarized in Chapter 2 and would be continued, most notably including the following:

- Upper Temescal Valley SNMP, as meeting the requirements set this in Plan will reduce salt and nutrient loading.
- Compliance with the proposed Basin Plan Amendment for the Elsinore MA, which define management actions to minimize salt and nutrient loading in the long-term, including the potential for a desalter prior to groundwater recharge.

Additional monitoring measures are discussed in Chapter 7, and additional management measures are discussed in Chapter 8.

6.6 Land Subsidence

Subsidence has not been a known issue in the Elsinore Valley Subbasin, and undesirable results have not been reported. Nonetheless, the potential has been recognized that subsidence could occur as a result of groundwater pumping and significant groundwater level declines, typically in areas underlain by thick layers of fine-grained alluvial and lacustrine sediments.

As described in Section 4.3, available information on vertical land displacement (subsidence) includes InSAR, a Global Positioning System (GPS) data system using satellites. InSAR data provides mapping of ground surface elevations across the basin, presented at regular (typically monthly) intervals.

The InSAR data (as of November 2020) include two datasets, TRE Altamira InSAR Dataset and NASA JPL InSAR Dataset. The NASA JPL provides data from May 2015 to April 2017, while the TRE Altamira provides annual and total vertical displacement data beginning in June 2015 and in monthly intervals thereafter until September 2019. While these are short periods of record, both datasets indicate local areas of subsidence in all three MA, with less than +/-1-inch range. In general, the Elsinore and Lee Lake MAs show minor declines (in fractions of an inch) and the Warm Springs MA shows minor increases (in fractions of an inch).

Given the short records of these datasets, small vertical displacements, and patchy distribution of areas, 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. Subsidence information from the DWR InSAR data will be reviewed as it becomes available.

In brief, potential subsidence remains a potential risk and the Sustainability Goal includes an objective to prevent subsidence; this recognizes that inelastic subsidence is irreversible. However, it can be prevented by maintaining groundwater levels above historical lows. Insofar as data are available, subsidence prevention is supported by the MT for groundwater levels, which is equal to or above historical minimum levels.

6.6.1 Description of Undesirable Results

Land subsidence is the differential lowering of the ground surface, which can damage structures, roadways, and hinder surface water drainage. 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 Subbasin. 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 MTs.

6.6.2 Potential Causes of Undesirable Results

As described in Section 4.3, subsidence may be caused by regional tectonism or by declines in groundwater elevations due to pumping. Regarding the former, the InSAR data shows a general rising trend in the Warm Springs MA 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), a flattening trend with no recovery during times of rising groundwater levels and reduced pumping (e.g., wet years), and can show rebound trend.

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 Elsinore MA, due to the larger amount of pumping in this area, but there is no indication that permanent inelastic subsidence has occurred.

6.6.3 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 Subbasin of subsidence problems in the Central Valley that cause the above listed effects. Future declines in water level can lead to subsidence, which can contribute to drainage or flooding problems and are 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. Therefore, continued tracking of subsidence and efforts to prevent subsidence are warranted.

6.6.4 Minimum Threshold

According to the GSP regulations Section 354.28(c)(5) the MT 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 **MT** is defined as an average rate of decline of 0.1 ft in any five-year period, equal to a 1-ft decline over 50 years. However, the MT is not triggered unless there is a change of greater than 6 inches since 2015, the base year for the GSP.

The 1-ft 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 ft, video surveys of 88 undamaged wells and 80 damaged wells showed that casing damage was uncommon in wells where subsidence was less than 1 ft (Borchers and Carpenter 2014).
- Ground floor elevations are recommended or required to be at least 1 ft above the Base Flood Elevation in some jurisdictions (see for example, City of Lake Elsinore Municipal Code, Section 15.64.200). More than 1 ft of subsidence may cause some buildings to become flooded.
- The minimum freeboard along roadside ditches is often required to be 1 ft 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 this Subbasin, any subsidence has been slow and not noticed and if occurring in the future, is likely to be gradually cumulative as would be its undesirable results. Accordingly, the 0.1 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 Subbasin. 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 1-2 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 MT criterion.

6.6.4.1 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 MTs in much of the Subbasin, including Lee Lake and Warm Springs MA, and peripheral portions of Elsinore MA. In the central portion of the Elsinore MA, the operationally defined MT levels will prohibit significant pumping if water levels decline below historical lows. Accordingly, the MT for groundwater levels is consistent with and supportive of the objective to prevent subsidence undesirable results. The water level MTs, do not interfere with managing the other sustainability indicators to remain above their respective MTs, as described in Section 6.2.

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.

6.6.4.2 Effect of Minimum Threshold on Sustainability in Adjacent Areas

Subsidence problems are not likely to have an impact on sustainability in adjacent areas. As the amount of flow between the Subbasin and surrounding basins are relatively minimal, a small change in subsidence is unlikely to affect neighboring areas.

6.6.4.3 Effect of Minimum Threshold on Beneficial Uses and Users

Subsidence problems have not been reported in Subbasin, 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.

6.6.4.4 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.

6.6.4.5 How Management Areas Can Operate without Causing Undesirable Results

The MTs are consistently conceived and applied across all three MAs. Tracking and analysis of InSAR mapping over the next five years (until five-year GSP update) may be revealing about the potential for subsidence in the Subbasin. 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.

6.6.4.6 How the Minimum Threshold will be Monitored

The MT will be monitored using the InSAR aerial 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 ft apart. The data sets typically have considerable “noise”, meaning that adjacent points often have very different readings at the scale of 1-2 inches. Some of this apparently random variation might be due to changes in grading due to development, plant growth, and some might be due to inherent measurement error associated with atmospheric conditions. To obtain a more meaningful signal, the raster data sets will be smoothed using several passes of a bilinear interpolation algorithm. The smoothed surface for spring 2015 will be subtracted from the smoothed surface for the most recent semi-annual InSAR data set to obtain pixel-scale estimates of cumulative subsidence. There could still be considerable spatial variability at the pixel scale that is not indicative of subsidence. Accordingly, a grid of 0.5 by 0.5-mile cells will be overlain on the pixel data, and the average pixel value will be calculated for each cell. This will effectively 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 MT criterion.

6.6.5 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.

6.6.5.1 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.

6.6.5.2 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.

6.7 Depletions of Interconnected Surface Water

This section builds and extends the discussion in Chapter 4 of the 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 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 active diverters of surface water from Temescal Wash. Lee Lake dam and reservoir 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. In recent years it has been operated for recreational fishing under the name "Corona Lake". EVMWD retains water rights for diversion from Temescal Wash at two locations upstream of Lee Lake but has not diverted in recent years. Although not exactly a diversion, EVMWD obtained a permit to reduce its historical discharges of treated effluent from the Regional WRF to Temescal Wash, instead discharging most of that water to Lake Elsinore. Up to 3.87 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 [Application 30502]). However, the WRF is required to continue discharging 0.5 mgd (0.77 cfs) into Temescal Was at all times to support habitat. 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. With respect to surface water users farther downstream, 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.

6.7.2.2 Isolated Springs and Wetlands

Small off-channel wetlands are included in the NCCAG on-line vegetation geodatabase developed by The Nature Conservancy (TNC) for DWR in support of SGMA (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 16.4 acres in the Elsinore Valley Subbasin are located along several of the tributary streams (see Figure 4.20). Almost all those polygons are far up in canyons upstream of the main Subbasin, where groundwater discharge from bedrock in the tributary watershed supports a persistent shallow water table and/or base flow. Groundwater pumping in the main Subbasin areas would not affect water levels or habitats at those locations. Other polygons are along ephemeral stream channels that cross the main part of the Subbasin to Lake Elsinore or Temescal Wash. Inspection of recent summer aerial photography (Google Earth 2020) at those locations did not reveal green or lush vegetation that is typical in locations with perennial access to water. The descriptions all indicated "seasonally flooded." Groundwater discharge tends to be persistent and create distinctively lush vegetation during the dry season. Therefore, the mapped polygons are probably rain-fed wetlands that support some mesic vegetation in spring and are not groundwater dependent.

Wetlands around the shoreline of Lake Elsinore are associated with the lake and affected primarily by management of lake levels. Regional groundwater considered in this GSP is hydraulically uncoupled from the lake and occurs at depths tens to hundreds of ft below the lake bottom.

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. 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 Subbasin 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 (RCRCD 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 evaluates the presence and habitat needs of 146 species. The only ones mapped in the vicinity of the Subbasin 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 Subbasin. However, edges of a few mapped habitat border the Temescal Wash corridor (see Figure 4.20).

The California Natural Diversity Database (CNDDB) includes records of eight sightings of Least Bell's vireo along the reach of Temescal Wash in the Subbasin. Many more sightings were in upland areas not overlying a groundwater basin. Least Bell's vireo is a bird species listed as endangered under the California Endangered Species Act. It is a key focus of vegetation management in the Prado Wetlands at the downstream end of Temescal Wash but use of the Wash itself was apparently not great enough to include it in the species' critical habitat area. For the purpose of this GSP, management of groundwater levels that avoids unreasonable impacts on riparian and wetland vegetation is considered protective of Least Bell's vireo.

6.7.2.4 Riparian Vegetation

Riparian vegetation that uses groundwater is the beneficial use subcategory of interconnected surface water most likely to be impacted by groundwater pumping along Temescal Wash.

The metric for assessing undesirable effects on riparian vegetation is significant mortality or canopy die-back in riparian trees. Inspection of the sequence of Google Earth aerial images for 1994 through 2020 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 between I-15 and Temescal Canyon Road near Hostettler Road in the Lee Lake MA is illustrated by images from 1994, 2014, 2016, and 2018 in Figure 6.2. In the Subbasin, dense stands of riparian trees were present continuously since 1994, and this was one of several locations in the Subbasin exhibiting mortality during the drought. In the Bedford-Coldwater Subbasin and Temescal Valley Basin, vegetation was relatively sparse in 1994, increased in coverage and density more or less steadily during 1994 through 2013 before suffering the large die-back during the 2014 to 2016 period.

Figure 6.2 Aerial Images of Riparian Vegetation, 1994-2018

Pre-1994 aerial photographs reveal a more complex history of riparian vegetation along Temescal Wash. For example, Figure 6.3 compares photographs from 1967, 1994, and 2018 for a 1-mile reach of Temescal Wash just upstream of Lake Street. Dense riparian vegetation was almost entirely absent in 1967, abundant in 1994 and somewhat reduced due to drought-related die-back in 2018. The 1967 photo followed 20 years of below-average precipitation (see Figure 5.1). Groundwater pumping in the Warm Springs and Lee Lake MAs upstream of this reach was probably less than current groundwater pumping because there was there was no historical agriculture in that region. The conditions in 1967 suggest that the extent and vigor of riparian vegetation may wax and wane with shifts in climatic conditions between droughts and wet periods.

Tree mortality and canopy die-back can be reliably detected in aerial photographs. Spectral analysis of light reflected from the vegetation provides additional information that can reveal lower levels of moisture stress. Two commonly used metrics of vegetation health and vigor are the NDVI and 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 (Nature Conservancy 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.

Groundwater Pumping and Shallow Groundwater Levels 1990 through 2018

Pumping from wells in the Warm Springs and Lee Lake MAs in the Subbasin and the Bedford MA in the Bedford-Coldwater Subbasin along Temescal Wash was about three times greater during 1990 through 1993 than during the 2013 to 2016 drought, as shown in Figure 6.4. 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 Subbasins. 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 6.5. Many wells with water-level data are production wells with significant, frequent pumping drawdown. Estimation of static water levels in those wells can be difficult in years when the well was operated frequently.

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 sixth year of another drought, which can be seen as the declining trend in the cumulative departure of rainfall during 1984 through 1990 (see Figure 5.1). This suggests that low groundwater levels during 1984 through 1990 might also have caused substantial die-back, after which vegetation slowly recovered.

Surface Flow 1990 through 2018

Surface flow in Temescal Wash correlates with vegetation die-back in the Lee Lake MA when all sources of flow during the full 1990 through 2018 period are considered. Natural flow in Temescal Wash is mostly ephemeral and sporadic, as indicated by flows at various stream gages in the region (see Figure 4.18). Large natural flow events occur only in response to storm events in winter. Spills from Lake Elsinore occurred in 1993 and 1995. 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 described below:

- **EWMD**. By far the largest discharges have been from EMWD near the upper end of Temescal Wash. EMWD's service area is located outside the Elsinore Valley Subbasin and beyond the jurisdiction of this and neighboring GSPs. With the exception of a relatively small discharge in 1998, there were no EMWD discharges prior to 2004. The peak discharge years were 2005 through 2008, when annual discharge volumes ranged from 9,100 to 16,700 AFY. Discharges declined thereafter as EMWD increased its ability to store and use recycled water. There were no discharges in 2014 through 2016 and 2018. Since 2009, discharges have been almost entirely during December through April. When EMWD discharges do occur, they 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.
- **EVMWD Regional WRF**. The Regional WRF is also located near the upstream end of Temescal Wash. The WRF discharged its entire flow to Temescal Wash from 1986 until 2007 when discharge to Lake Elsinore commenced. 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 reach downstream of the discharge location in the Warm Springs MA remained relatively healthy throughout the drought. However, the small discharge rate since 2007 is not large enough to sustain riparian vegetation as far downstream as the Lee Lake MA.

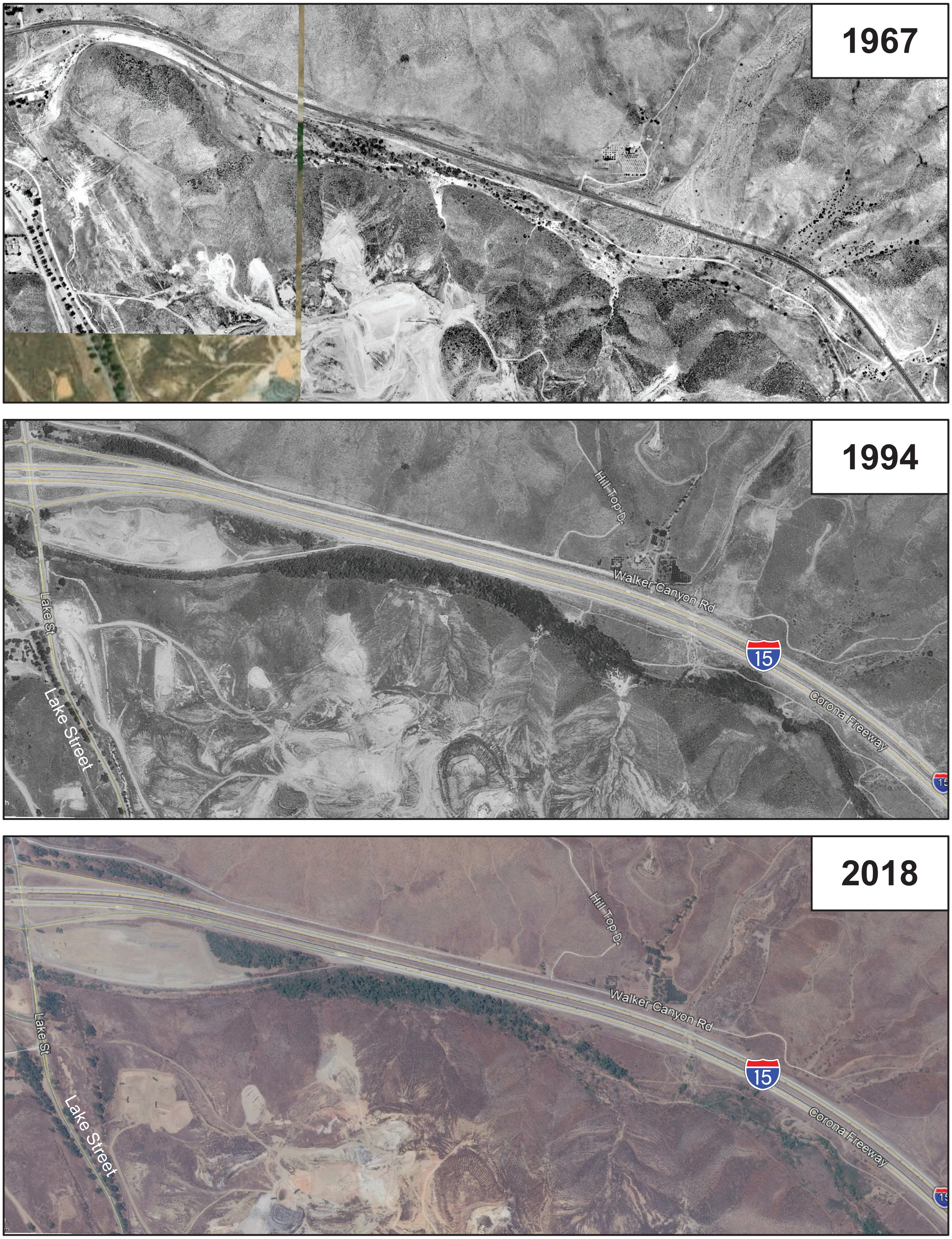
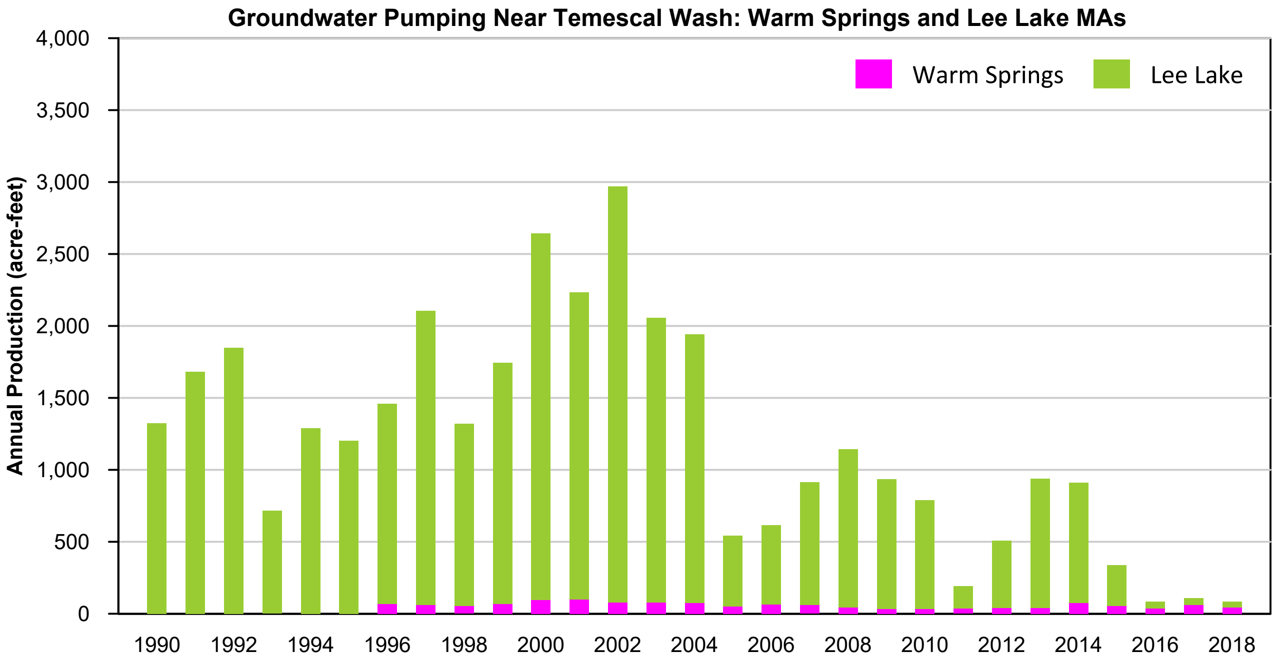


Figure 6.3 Aerial Photograph of Part of Temescal Wash in 1967



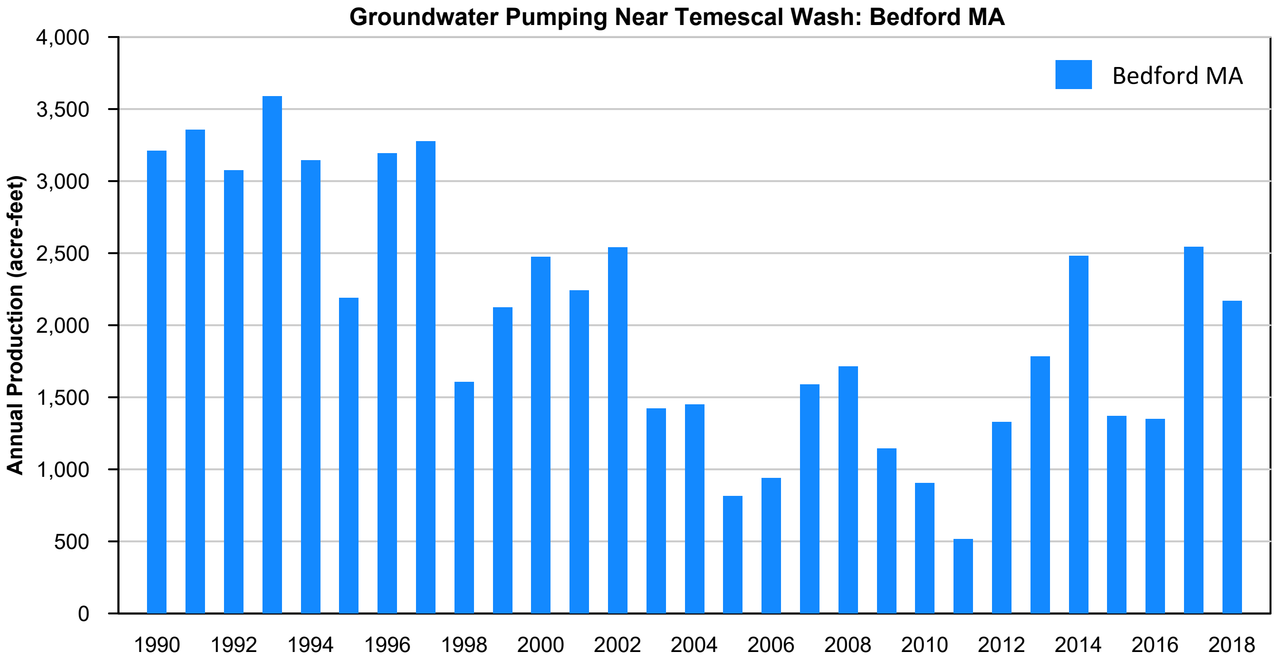


Figure 6.4 Annual Groundwater Pumping Near Temescal Wash, 1990-2018

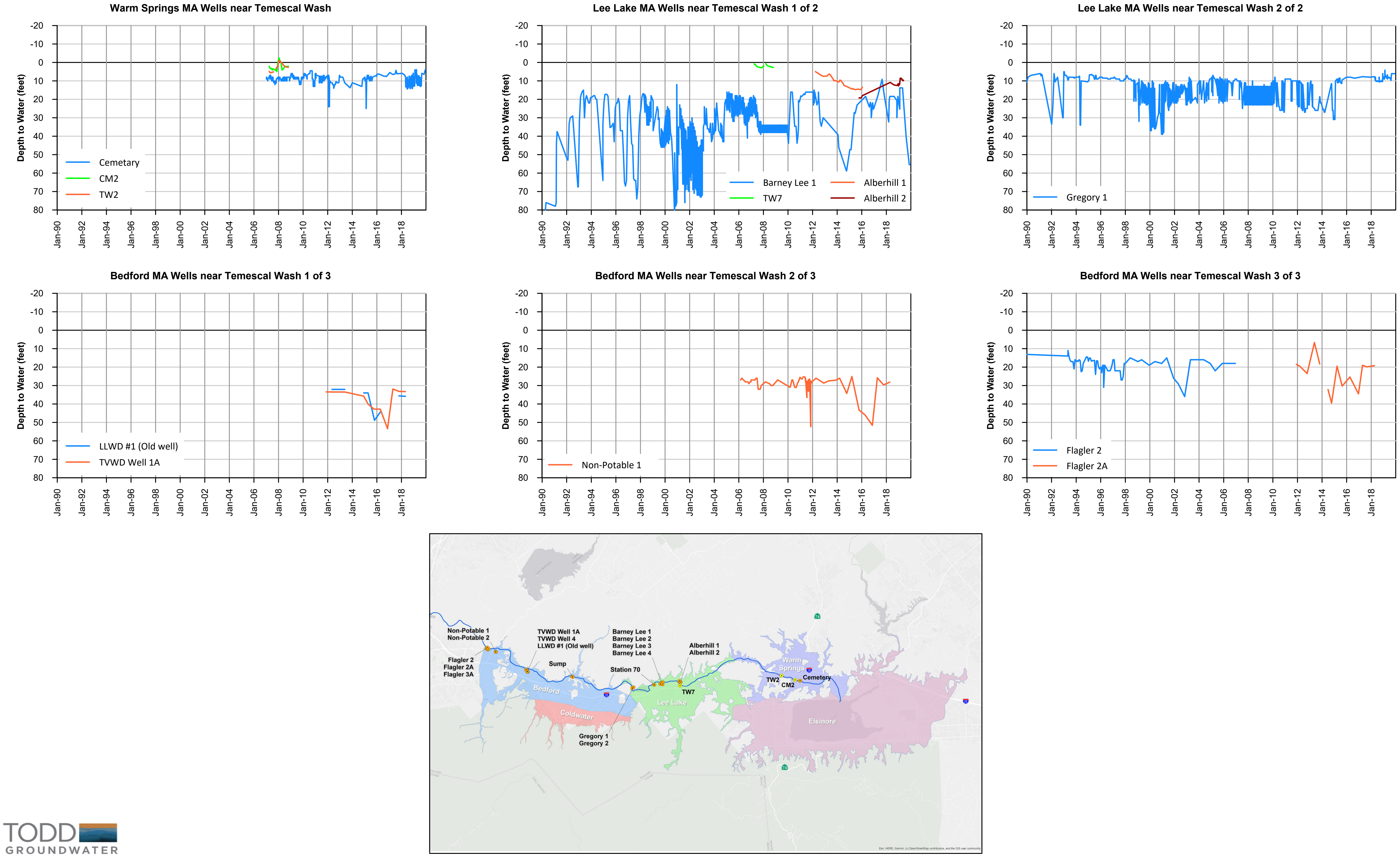


Figure 6.5 Water Levels in Wells Near Temescal Wash

- **Temescal Valley Water District (TVWD) Lee Lake WRF**. The Lee Lake WRF is located about halfway down the Bedford-Coldwater Subbasin 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 Subbasin. Those discharges would not influence vegetation patterns observed upstream.

The combined discharges from EMWD and EVMWD's Regional WRF during 2014 through 2016 were substantially lower than in any prior year since 1990, and that decrease coincided 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. That coincided with a period of normal climatic conditions when the Regional WRF discharged its entire flow to Temescal Wash. Some of the riparian vegetation could have become established as a result of the discharges, which were fairly continuous during that period and ranged from 1,100 to 4,200 AFY (averaging 2,600 AFY, equivalent to a continuous flow of 3.6 cfs). If that water were all available to riparian vegetation on a timely basis, it could have supported up to 580 acres of vegetation along the channel downstream of the WRF. After 2007, the Regional WRF discharge dropped to a continuous flow of only 0.77 cfs (558 AFY) in almost all years. Thus, both of the recycled water discharges dropped to negligible levels during 2013 to 2016, which could have caused much of the observed vegetation mortality. during 2014 through 2016.

6.7.2.5 Riparian Vegetation Summary

The relationships between precipitation, recycled water discharges, groundwater pumping, groundwater levels, and vegetation density are not clear-cut. Comparing these factors in each MA for four time periods (1967, 1990, 1992-2012 and 2013 through 2017) reveals some common patterns. Vegetation die-back during 2013 through 2017 occurred where groundwater levels were low. In Warm Springs MA, water levels remained high during 2013 through 2017 in spite of the decrease in recycled water discharges, perhaps because pumping remained low and there was sufficient recharge from the remaining recycled water discharge. That discharge was too small to maintain high groundwater levels in the Lee Lake MA. In Lee Lake and Bedford MAs, groundwater pumping did not increase during the drought, but water levels declined. This suggests that the decrease in upstream recycled water discharges played a major role in lowering groundwater levels (although natural stream flow was certainly also below average during the drought). The fact that vegetation die-back and mortality generally increased with distance downstream of the recycled water discharges also points to that source of water as a major influence.

Vegetation conditions in 1967 might also point to the importance of recycled water discharges, which were nonexistent at that time. There was very little dense riparian vegetation anywhere along Temescal Wash, and groundwater pumping ranged from very low in Warm Springs MA and probably low in Lee Lake MA to high in Bedford MA. Unfortunately, groundwater level information is not available for 1967.

6.7.3 Definition of Undesirable Results

The Sustainability Goal includes an objective to support beneficial uses in the Subbasin. 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 Subbasin and there does not appear to be a correlation between groundwater levels and streamflow. Subbasin 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 MT 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 MTs and MOs (23 California Code of Regulations [CCR] §354.28(d) and 23 CCR §354.30(d)).

It would be difficult to define an MT in terms of flow depletion in this Subbasin because phreatophytic riparian vegetation appears to be mostly correlated with areas where depth to water is consistently shallow. Groundwater levels reflect the net effect of stream percolation and groundwater pumping. Much of the stream flow that established the abundant vegetation during the 1990s derived from recycled water discharges. In practice, the supply of recycled water is more of a limitation than the fraction of it that percolates. Declining groundwater levels can result from increased pumping, decreased recycled water discharges, or a combination of both. By the same token, either of those variables could be adjusted to manage water levels. It is reasonable to define the MT in terms of water levels instead of flow because levels correlate directly with riparian vegetation conditions and because it leaves open opportunities to conjunctively manage discharges and pumping to sustain riparian vegetation.

6.7.6 Minimum Threshold

Given the above, the MT 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. The lack of such shallow monitoring wells is a data gap and a source of uncertainty. Hence, the MT 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 Elsinore Valley Subbasin:

- The **MT** for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian vegetation of greater than 35 ft for a period exceeding one year.

This threshold is much shallower than the water-level MTs for wells along the Wash, which equal historical minimum water levels. At six of the nine water level MT wells near the Wash, the maximum historical depth to water was 42 to 80 ft (Table 6.1). Given the above uncertainty in the relationships between surface flows, groundwater pumping, groundwater levels and the health of riparian vegetation, the MT for interconnected surface water presented here must be considered tentative and subject to revision in future GSP updates.

Undesirable results are considered to commence if water levels along more than half of the reach of Temescal Wash within the Subbasin exceed the MT. By this definition, undesirable results did not occur in the Elsinore Valley Subbasin, because vegetation die-back only occurred along about 0.8 mile of Temescal Wash, or about 9 percent of the total length of the Wash in the Subbasin. In contrast, undesirable results did occur in the Bedford-Coldwater Subbasin, where die-back occurred along about 3.9 miles of channel, or about 57 percent of the total length of Temescal Wash in that subbasin.

6.7.6.1 Relationship of Minimum Threshold to Other Sustainability Indicators

- **Groundwater Levels.** All the wells used to evaluate the MT are also representative wells used for compliance with the MT for groundwater levels. The groundwater level MT involves four consecutive quarterly water-level measurements rather than a period of one year. However, in the area of the Temescal Wash both thresholds are based on historical water levels. For most of the wells included in both sets of criteria, the interconnected surface water threshold water levels are considerably higher than the groundwater-level thresholds (by 10 to 45 ft). 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 MT for interconnected surface water would similarly be more restrictive than the MT for groundwater storage near GDE reaches, because the latter is functionally the same as the MT for water levels.
- **Seawater Intrusion.** Seawater intrusion would not occur in the Subbasin due to its inland location. No MT 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 MTs for interconnected surface water are within the historical range and thus unlikely to cause subsidence.
- **Water Quality.** Water quality issues in the Subbasin 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 MT for interconnected surface water is consistent with the MT for water quality.

6.7.6.2 Effect of Minimum Threshold on Sustainability of Adjacent Areas

The areas of interconnected surface water in the Subbasin are those that are upstream of and adjoining the Bedford-Coldwater Subbasin. Groundwater and surface water flow is from the Subbasin towards the Bedford-Coldwater Subbasin, consistent with topography. If water levels in the Lee Lake MA were lowered, surface and/or subsurface outflow to the Bedford -Coldwater Subbasin would decrease. The water levels used to define the MT 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 Bedford-Coldwater. By protecting vegetation along the Temescal Wash—which is a shared waterway between the subbasins—the MT will protect those resources for the benefit of both subbasins.

The Temecula Valley Groundwater Basin adjoins the southern end of the Subbasin, but it is upstream from the Temescal Wash and the interconnected surface water locations that have been identified in the Subbasin. The interconnected surface water MT will have no effect on the Temecula Valley Groundwater Basin due to this distance and gradient.

6.7.6.3 Effect of Minimum Threshold on Beneficial Uses

Surface diversions are no longer a source of supply in the Subbasin; all water uses are currently 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 MT water level for interconnected surface water is higher than the MT for chronic lowering of groundwater levels, the interconnected surface water threshold improves groundwater availability.

The MT 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 MT 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

Nine 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.

- Cemetery.
- New Warm Springs Monitoring Well.
- Alberhill 2.
- Barney Lee 1.
- Barney Lee 2.
- Barney Lee 3.
- Barney Lee 4.
- Gregory 1.
- Gregory 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. 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. Chapter 8 of this GSP includes a management action to install shallow monitoring wells at several riparian locations in the Subbasin if feasible based on the findings of the feasibility study. Over time, MT groundwater elevations for the new shallow wells can be defined based on the monitored data and the relationship to deep water levels.

6.7.7 Measurable Objective

The MO for interconnected surface water is an amount of depletion that is less than the amount specified as the MT. 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.

Groundwater conditions with respect to interconnected surface water and most GDE parameters are already 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, 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 2007-2008 (MWH 2008). Shallow (7-ft-deep) piezometers were installed in the channel at several locations along a 4-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 they are 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 that will be implemented for first 5-year implementation period:

- Install shallow piezometers at several locations along Temescal Wash that have dense riparian vegetation, including at least one that suffered die-back during 2014 through 2016, one that did not, and one near a production well. Permission to access land along Temescal Wash will need to be acquired prior to installation. Monitor water levels on the same schedule as for the existing monitored wells.
- Survey the elevation difference between the wellhead of monitored wells along Temescal Wash and the bottom of the creek channel at the nearest point on Temescal Wash.
- Obtain older aerial photographs to evaluate riparian vegetation conditions pre-1990, and as close to the pre-development period as possible. Use those to evaluate vegetation trends under additional combinations of groundwater pumping, water levels and wastewater discharges.

Management actions that could be implemented to prevent or respond to vegetation die-back include:

- During droughts, discontinue pumping from the non-potable wells into the recycled water system (applies to B-C only).
- Shift pumping away from municipal wells near Temescal Wash and increase pumping at wells farther away.
- Plan to locate any future wells in the Warm Springs and Lee Lake MAs at least 3,000 ft from Temescal Wash.

Chapter 7

MONITORING NETWORK

This chapter describes both the existing groundwater monitoring within the GSP Area and the representative monitoring required by the SGMA. In areas where existing monitoring does not meet the SGMA requirements, this chapter identifies data gaps and proposed measures to address these data gaps during the SGMA implementation period, so the representative monitoring improves over time. Future GSP updates will reflect new information for improvements to representative monitoring. This chapter includes the required information in compliance with §354.32 through §354.40 of the GSP Regulations.

7.1 Existing Monitoring Networks and Programs

Within the GSP Area, there are multiple existing local, regional, state, and federal programs that monitor groundwater levels, water quality, surface water flow, weather and precipitation, and land subsidence. These programs were summarized in Section 2.5 Water Resources Monitoring Programs. Additional details of key programs including specific monitoring sites, wells, parameters, frequency, regulatory agency, and other information are described briefly in the following sections for context. These details from existing programs are considered for the development of the GSP monitoring network.

7.1.1 Existing Groundwater Level Monitoring

Groundwater elevations are monitored primarily by EVMWD and regional agencies as described in Section 2.5.4 and Section 4.1. Historically monitored wells are shown on Figure 4.1.

Table 7.1 presents a summary of existing groundwater level monitoring in the GSP Area. EVMWD is a DWR-accepted monitoring entity for the CASGEM program in the Elsinore Valley Subbasin (EVMWD, 2014). Established in 2009, DWR uses the CASGEM program to track seasonal and long-term groundwater elevation trends in groundwater basins statewide in collaboration with local monitoring entities. Water levels have been compiled on the CASGEM website from 181 different wells in the Elsinore Valley Subbasin, with records dating back to the early 1950s. However, 106 of these wells were part of a USGS study that only collected monitoring data one time in Spring 1968. EVMWD has monitored water levels in 39 wells over the last 20 years, as discussed in Sections 2.5 and 4.1. There are 60 wells in and around the Subbasin within the DWR CASGEM database (inclusive of EVMWD wells) with more than 3 groundwater level measurements in the last 10 years.

Table 7.1 Existing Groundwater Level Monitoring Summary

Agency	Monitoring Frequency	Period of Record	No. of Wells	Types of Wells
EVMWD(1)	Varies (up to three times per year)	Varies (~mid-1980s-2020)	39	Monitoring and Production
DWR CASGEM(2)	Two times per year	10 years (2010-2020)	60	Monitoring and Production

Notes:

(1) EVMWD is a DWR-accepted monitoring entity for the Elsinore Valley GMZ and has submitted a CASGEM monitoring plan to DWR. Monitoring activities include groundwater level measurements twice per year, upload of data to CASGEM website, seasonal aggregation of data (summertime: June – August; wintertime: December – April).

(2) There are 60 wells in the Subbasin with more than 3 water level measurements in the last 10 years, which includes wells monitored by EVMWD as listed in the first row. CASGEM requires that wells be monitored at least twice per year, representing wet and dry seasonal conditions.

7.1.2 Existing Water Quality Monitoring

Groundwater and surface water quality monitoring and reporting programs are conducted by EVMWD as well as various public agencies and programs; program details are summarized in Table 7.2. These programs are discussed in more detail in Sections 2.5.3, 2.5.5, 2.6, and 4.4. In general, there is an extensive network of basin wide and regional water quality monitoring and reporting programs in the GSP Area. Wells monitored for water quality are shown on Figure 4.10.

Table 7.2 Existing Water Quality Monitoring Network

Monitoring Program	Participating Entities	Program Type	Parameters	Frequency
EVMWD Compliance with State and Federal drinking water regulations	EVMWD and SARWQCB	Groundwater – Production and Monitoring Wells	Drinking Water Regulations (i.e., general minerals, physical parameters, and COCs: arsenic, nitrate, TDS)[1]	Monthly and Annually
Upper Temescal Valley SNMP	EVMWD and SARWQCB	Groundwater – Production and Monitoring Wells	TDS and nitrate (objectives for the Warm Springs and Lee Lake MAs: TDS 820 mg/L; nitrate 7.9 mg/L)(2)	Monthly (includes Triennial Reporting)
Upper Temescal Valley SNMP	SARWQCB, EVMWD, and EMWD	Surface Water	TDS, nitrate, major anions/cations	Surface – bi-weekly
GeoTracker/ GAMA	Multiple local and regional agencies	Groundwater - Wells	State Water Board GAMA Program	Varies

Monitoring Program	Participating Entities	Program Type	Parameters	Frequency
Other Drinking Water Systems in GSP Area	See Note(4)	Groundwater Wells Elsinore MA: 10 wells; Lee Lake MA: 5 wells; Warm Springs MA: 1 well	DDW DWSAP Program(3)	Varies
Water Quality Control Plan for the Santa Ana River Basin	SARWQCB(7), SAWPA, and others	Framework for surface and groundwater quality management in Santa Ana Region	TDS and nitrate objectives for the Elsinore MA (TDS 480 mg/L; nitrate 1 mg/L)	Varies
Basin Plan Amendment for the Elsinore Basin(5)	EVMWD and SARWQCB(7)	Groundwater and Surface Water	TDS and Nitrate objectives, with corresponding monitoring	
SAWPA Basin Monitoring Task Force/Program(6)	SAWPA(7) and others	Groundwater and Surface Water	Santa Ana Watershed – rely on EVMWD data	Ambient groundwater conditions calculated every 3 years
TMDL Monitoring	SARWQCB and LESJWA	Surface Water (3 stations in Lake Elsinore; 4 stations in Canyon Lake)	Temperature, nitrogen species, specific conductance, phosphorus species, TOC, chlorophyll-a, sulfides, DO, and others	October - May (monthly) June-September (bi-weekly)
Canyon Lake Raw Water Supply	EVMWD and SWRCB-DDW	Surface Water	Raw and treated surface water quality	Monthly

Notes:

(1) Data are provided to DDW and available through the SWRCB.

(2) Data available in the state-wide WDL and GeoTracker/GAMA program.

(3) Parameters are reported to SWRCB-DDW in compliance with DWSAP program to ensure wells are not subject to local contamination.

(4) Elsinore Area: Lake Elsinore Village, Neighbors Mutual Water Company (inactive), Elsinore WD (no longer exists and now part of EVMWD); Lee Lake Area: Glen Eden Sun Club, Grace Korean Church, Manteca Industrial Park; Warm Springs Area: Elsinore Hills RV Park.

(5) The EVMWD proposal to amend the Basin Plan to incorporate a Maximum-Benefit Based SNMP for the Elsinore GMZ was submitted to the SARWQCB in January 2020.

(6) WSC, Inc., Recomputation of Ambient Water Quality in the Santa Ana River Watershed for the Period 1999 to 2018. Prepared for the Santa Ana Watershed Project Authority Basin Monitoring Program Task Force. July 8, 2020.

(7) Relies primarily on data provided by EVMWD.

7.1.3 Existing Surface Water Inflow Monitoring

The surface water flow monitoring in the Elsinore Subbasin and surrounding area is described in Sections 2.5.2 and 4.11.1. Seven USGS streamflow gaging stations are within or near the GSP Area that characterize stream flow in the San Jacinto River, Temescal Wash, and smaller tributaries entering the Subbasin from the east and west, as summarized in Table 7.3. The first three locations listed (11070500, 11071760, 11071900) are shown on Figure 4.17; the next two locations (11070365, 11070465) are located to the north and northeast of Canyon Lake and shown on Figure 2.9; and the last two locations (11042700, 11042800) are located to the SE of the GSP Area.

Table 7.3 Streamflow Gauges for Monitoring Surface Flows in the Vicinity of the GSP Area

Monitoring Entity	Station ID	Station Name	Location(1,2)	Period of Record
USGS	11070500	San Jacinto R Nr (Elsinore, CA)	Located on the San Jacinto River downstream of Canyon Lake Dam and upstream of the confluence with Lake Elsinore	1916 - Present
USGS	11071760	Coldwater Canyon C Nr (Corona, CA)	Located on Coldwater Canyon Creek just west of the GSP Area	1919 - Present
USGS	11071900	Temescal C A Corona Lk Nr (Corona, CA)	At the spillway of Lee Lake	2013 - Present
USGS	11070365	San Jacinto R Nr (Sun City, CA)	Located along the San Jacinto River upstream of Canyon Lake and north of the GSP Area	2000 - Present
USGS	11070465	Salt Creek at Murrieta Road Nr (Sun City, CA)	Located to the east of Canyon Lake and northeast of the GSP Area	2000 - Present
USGS	11042700	Murrieta Cr Nr (Murrieta, CA)	Located on Murrieta Creek ~5 miles to the SE of the GSP Area	1998 - Present
USGS	11042800	Warm Springs C Nr (Murrieta, CA)	Located on Murrieta Creek ~8 miles to the SE of the GSP Area	1988 - Present

Notes:
(1) See Figures 2.9 and 4.17 for the locations of the first five streamflow gauges.
(2) All listed gages are monitored continuously.

7.1.4 Existing Lake Level Monitoring

Lake level monitoring is conducted by EVMWD at both Canyon Lake and Lake Elsinore. Daily elevation data is collected using automated supervisory control and data acquisition (SCADA) technology and stored electronically at EVMWD headquarters. Existing lake level data is available from 1990 to the present.

7.1.5 Existing Weather and Precipitation Monitoring

Existing weather and precipitation monitoring stations are discussed in Section 2.5.1 and summarized in Table 7.4. Climate data locations are shown on Figure 2.9. For the GSP Area, precipitation data for the past 100 years are available from the CDEC and through the RCFCWD. The precipitation gauge is located on the north side of Lake Elsinore, Station ELS, operated by the CAL FIRE. EVMWD is operating a precipitation weather station that is part of the NOAA/Mesowest system. Eventually this station will replace the CAL FIRE station. In addition, there are two close SWRCB CIMIS stations; however, neither are located in the GSP Area.

Table 7.4 Network of Stations for Monitoring Climate/Precipitation in the Vicinity of the GSP Area

Category	Monitoring Entity	Station Name	Location(1)	Period of Record
GSP Area	CAL FIRE	Station ELS	North side of Lake Elsinore	1897 -1912; 1915 - Present
GSP Area	EVMWD (NOAA/Mesowest)	ID – SDEOR Name – Elsinore EOR	~1 mile North of Lake Elsinore	2012 - Present
Close to GSP Area	DWR (CIMIS)	Perris – Menifee #240	~10 miles NW of Lake Elsinore	2013 - Present
Close to GSP Area	DWR (CIMIS)	Temecula #62	~13 miles SE of Lake Elsinore	1986 – Present
Close to GSP Area	NOAA	El Cariso California, CA US	~2 miles east of Lake Elsinore	1995 - Present
GSP Area	NOAA	Lake Elsinore 2.8 SSW, CA US	SW side of Lake Elsinore	2018 - Present
GSP Area	NOAA	Elsinore, CA US	NE side of Lake Elsinore	2010
GSP Area	NOAA	Lake Elsinore 3.5 WSW, CA US	NW Side of Lake Elsinore	2009 - 2010

Note:
(1) Monitoring locations are depicted on Figure 2.9.

7.1.6 Existing Land Subsidence Monitoring

As described in Section 2.5.11, land subsidence monitoring has not been directly monitored in the GSP area using specialized equipment (i.e., extensometers) or using repeated measurement of benchmarks at the ground surface. Groundwater levels have been managed to stay above historical low levels to minimize the potential for ground settlement. However, as described in Section 4.3, InSAR data provides spatial coverage using radar images from satellites. InSAR data provides mapping of the ground surface elevations across the basin, presented at regular (monthly) intervals. These data are provided by DWR via its SGMA Data Viewer, thereby documenting vertical displacement of the land surface across the entire state of California. The InSAR data includes two datasets: TRE Altamira InSAR Dataset and NASA JPL InSAR Dataset, as summarized in Table 7.5.

Table 7.5 Network of InSAR Subsidence Monitoring for use in the GSP Area

Dataset	Reporting Entity	Period of Record	Frequency
TRE Altamira InSAR Dataset	DWR	June 2015 – 2019	Annually
NASA JPL InSAR Dataset	DWR	May 2015 – April 2017	Annually

7.2 Monitoring Network Objectives

The overall objective of the monitoring network for the GSP Area is to track and monitor parameters that demonstrate progress toward meeting the sustainability goals. According to §354.34 (b), the monitoring network, when implemented, shall accomplish the following objectives:

1. Demonstrate progress toward achieving MOs described in the Plan.
2. Monitor impacts to the beneficial uses or users of groundwater.
3. Monitor changes in groundwater conditions relative to MOs and MTs.
4. Quantify annual changes in water budget components.
5. Monitoring changes for the pertinent sustainability indicators (defined in Chapter 6).

The MTs and MOs for the GSP area are associated with the following sustainability indicators:

- Groundwater levels.
- Groundwater storage.
- Groundwater quality.
- Land subsidence.
- Interconnected surface water.

Although listed in SGMA, seawater instruction is not considered in this Plan because it does not apply to the GSP Area (see description of Basin Setting in Chapter 2).

7.2.1 Monitoring Objectives

Per SGMA, 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.

The monitoring network will maintain data quality to meet the MOs of this GSP. In accordance with DWR 2016 BMP document for monitoring (Groundwater Monitoring Protocols, Standards, and Site BMP) (DWR, 2016a), the process will be iterative and evaluated every five years for effectiveness. To this end, the monitoring networks implemented by this GSP are adequate to obtain acceptable data necessary to monitor the Sustainability Indicator levels against MOs and MTs. As needed and where necessary, revisions will be made every five years.

7.2.2 Temporal Monitoring

The monitoring network will allow for collection of sufficient data to demonstrate seasonal, short-term (1 to 5 years) and long-term (5 to 10 years) trends in groundwater and related surface conditions. In addition, it will provide information on groundwater conditions necessary to evaluate the GSP's effectiveness in achieving the sustainability goal. The frequency for data collection is described in Section 7.5 (Monitoring Network Implementation).

7.2.3 Representative Monitoring

As discussed in §354.36 (Representative Monitoring), sites may be designated as the "*point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined.*"

Representative monitoring will include the use of groundwater elevations as proxy measurements for other sustainability indicators, such as groundwater storage and interconnected surface water.

Both the USGS and DWR have utilized groundwater elevation changes to estimate changes in storage. Similarly, there is a demonstrated correlation between groundwater elevation and discharge of groundwater in areas of interconnected surface water.

The Subbasin has three hydrologic areas/MAs (Figure 7.1), as described in previous chapters:

- **Elsinore** MA is the main area located in the southern portion of the basin.
- **Lee Lake** MA is located at the northern downstream portion of the Subbasin.
- **Warm Springs** MA is in the northeastern portion of the basin.

The Elsinore MA is the largest and most productive. The Lee Lake MA has limited hydrologic connection to the Elsinore MA. The Warm Springs MA is connected to both the Elsinore and Lee Lake MAs through the Temescal Wash. Representative monitoring for each MA is presented by sustainability criteria, as appropriate.

An MA is an area within the subbasin or GSA for which a GSP has identified MTs, MOs, monitoring, or projects and management actions based on unique local conditions. The MAs will maintain groundwater management practices and implement additional requirements set forth in this GSP.

7.3 Monitoring Rationale

The monitoring networks are capable of tracking progress toward achieving the MOs of this GSP, including temporal and representative monitoring of the three MAs: Lee Lake, Warm Springs, and Elsinore (Figure 7.1). As discussed in Chapter 4 (Current and Historical Groundwater Conditions) and summarized in Chapter 6 (Sustainable Management Criteria), overall trends include:

- **Groundwater Elevations** – The Subbasin is not characterized by overdraft with widespread chronic groundwater level declines. Water levels in the Warm Springs and Lee Lake MA's have been stable over time; water levels in the Elsinore MA have generally stabilized or risen since EVMWD limited pumping in accordance with the 2005 GWMP.
- **Groundwater Storage** – A water budget analysis using the numerical model shows inflows and outflows have been balanced over the long term in the Warm Springs and Lee Lake MAs. Hydrographs indicate water levels have generally stabilized or risen in the Elsinore MA since EVMWD limited pumping in accordance with its 2005 GWMP. However, there had been a decline in storage in the Elsinore MA in the past decades. Groundwater model simulations are used to project how the proposed management actions will contribute to making this MA more balanced in the future.
- **Water Quality** – Salt and nitrate loading are recognized as sources of groundwater quality deterioration. Groundwater quality changes with depth, lagging the salt and nutrient loading at the surface. In addition, naturally-occurring arsenic is naturally present at various locations and depths of the Elsinore MA.
- **Land Subsidence** – Subsidence has not been a known issue in the Elsinore Valley Subbasin, and undesirable results have not been reported. InSAR data indicate local areas of subsidence in all three MAs (< +/-1 inch range). The Elsinore and Lee Lake MAs show minor declines (fractions of an inch) and the Warm Springs MA show minor increases (fractions of an inch).
- **Interconnected Surface Water** – Interconnected surface water in the Plan area has not been documented per se (see Section 4.11), yet GDEs are present in certain areas within Temescal Wash. However, there are several data gaps that contribute to a lack of a clear relationship between groundwater pumping, groundwater levels, and GDEs.

Groundwater level monitoring is the key parameter that will be used to inform progress for measuring and tracking sustainable management, including undesirable results, MTs, and MOs. Other sustainability indicators will also be monitored using existing monitoring systems/programs, which will be evaluated concurrently with groundwater levels.

7.4 Monitoring Network Relationship to Sustainability Indicators

This section presents the representative monitoring network and program, along with its relationship to the sustainability indicators. To document changes in groundwater conditions related to the sustainability indicators, monitoring will be conducted using the representative monitoring network presented herein.

7.4.1 Chronic Lowering of Groundwater Levels

To monitor conditions related to chronic lowering of groundwater levels, the representative monitoring network is structured to accomplish the following:

- Track short-term, seasonal, and long-term trends in groundwater elevation.
- Demonstrate seasonal high and low groundwater elevations (i.e., in the spring and fall) for the aquifer system.
- Record groundwater elevations in representative wells (including key wells in which MTs and MOs have been identified to track progress toward the sustainability goals for the Elsinore Subbasin).

Criteria considered in selecting the representative monitoring network included:

- Record of historical data.
- Current data.
- Well accessibility.
- Well construction information.
- Total well depth.
- Uniform geographical distribution.

The representative groundwater monitoring well network for each MA is shown on Figure 7.1 and summarized in Table 7.6. The network consists of 27 key wells (designated in Chapter 6 as Key Wells). Key wells include two new monitoring wells drilled in the Lee Lake and Warm Springs MAs as part of this GSP effort. Selection of key wells is described in Section 6.2.5.1 and was based on review of hydrographs from all currently monitored wells followed by selection of wells that have long, reliable, and recent records of groundwater level monitoring, that represent local or regional trends, and that together provide a broad geographic distribution for each MA and the Subbasin as a whole. In addition, the distribution of these key wells was reviewed with respect to the density of wells across the Subbasin. MTs and MOs have been selected for these key wells, as described in Chapter 6. Conditions measured in the key wells will be used to document progress toward the sustainability indicator.

EVMWD is the monitoring entity for wells in the representative monitoring network listed in Table 7.6. This table shows well types and construction information, where available. As shown, many of the wells in the representative monitoring network are production wells.

Table 7.6 Groundwater Level Monitoring Network

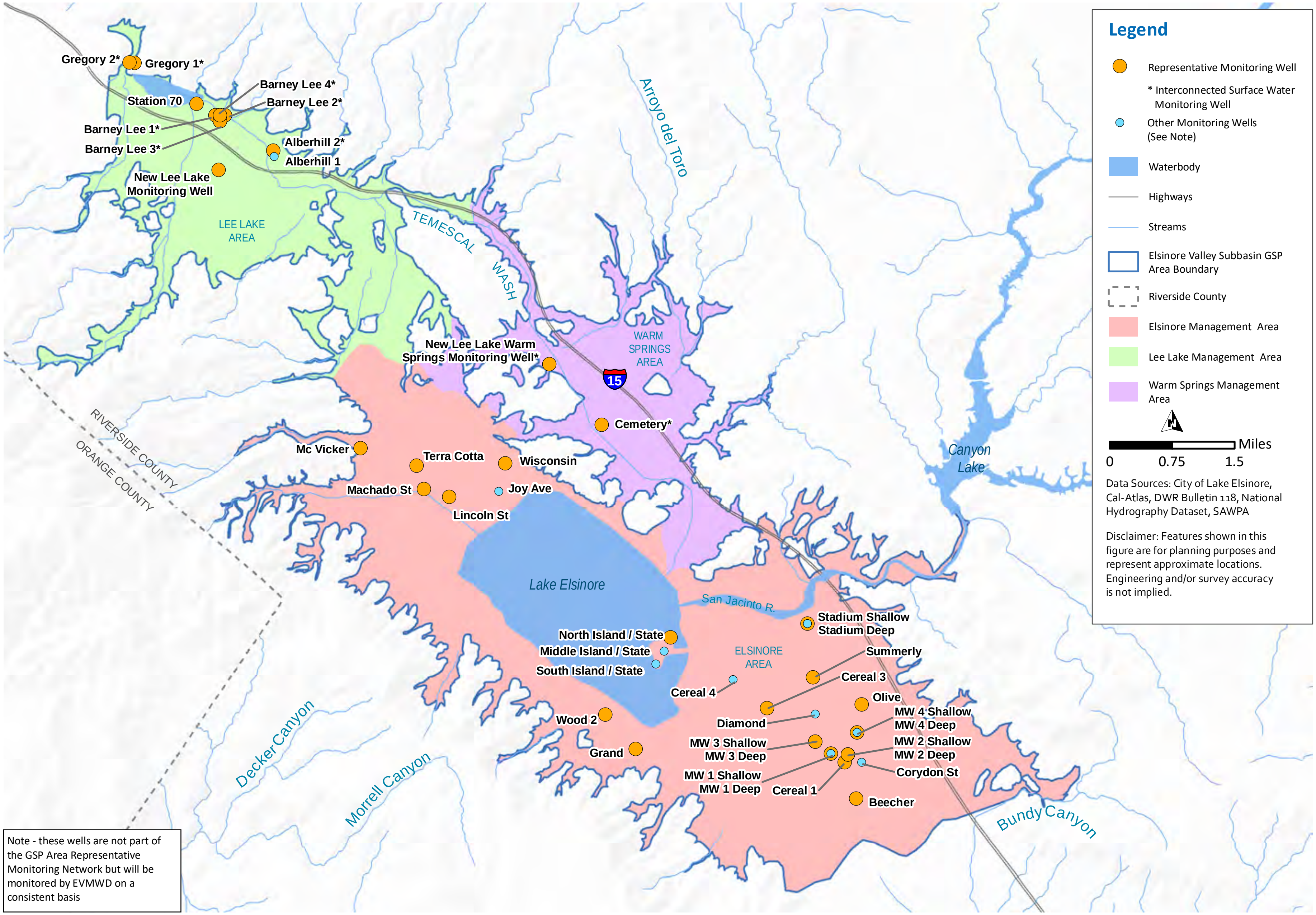
Well Name	Monitoring Network/ Key Well	Top of Screens (ft bgs)	Bottom of Screens (ft bgs)	Total Well Depth (ft bgs)	If Production Well, Year Last Pumped	Most Recent Sounding Method
Elsinore MA						
Beecher	X	NA	NA	NA		Wire
Cereal 1	X	420	1,410	1,430	2019	Air
Cereal 3	X	440	1,784	1,784	2019	Air
Grand	X	240	450	450	2010	Wire
Lincoln	X	360	940	960		Air
Machado	X	570	960	980	2019	Wire
McVicker Park	X	NA	NA	NA		Wire
MW 1 Deep	X	700	1,000	1,005		Wire
MW 2 Deep	X	700	1000	1,005		Wire
North Island	X	600	1,800	1,800	2019	SCADA
Olive	X	308	698	720	2002	Air
Stadium Deep	X	NA	NA	NA	2014	Wire
Summerly	X	390	970	980	2019	Air
Terra Cotta	X	320	980	1,000	2019	Wire
Wisconsin	X	NA	NA	300		Wire
Wood 2	X	192	600	600	1999	Wire
Cereal 4		NA	NA	NA		SCADA
Corydon		340	1,260	1,280	2019	Air
Diamond		430	950	990	2019	Wire
Joy St.		640	1,660	1,680	2019	Wire
Middle Island		NA	NA	NA		Wire
MW1 Shallow		230	430	435		Wire
MW2 Shallow		280	480	485		Wire
MW3 Deep		700	1,000	1,005		Wire
MW3 Shallow		300	500	505		Wire
MW4 Deep		700	1,000	1,005		Wire
MW4 Shallow		195	382	382		Wire
South Island		600	1,800	1,800	2017	Air
Stadium Shallow		NA	NA	NA		Wire

Well Name	Monitoring Network/ Key Well	Top of Screens (ft bgs)	Bottom of Screens (ft bgs)	Total Well Depth (ft bgs)	If Production Well, Year Last Pumped	Most Recent Sounding Method
Lee Lake MA						
Gregory 1	X	NA	NA	NA	2015	Wire
Alberhill 2	X	NA	NA	NA		
Barney Lee 1	X	NA	NA	NA	2017	Air
Barney Lee 2	X	NA	NA	NA	2017	Wire
Barney Lee 3	X	19	115	135	2017	Wire
Barney Lee 4	X	NA	NA	NA	2018	Wire
Gregory 2	X	NA	NA	NA	2014	Wire
New Lee Lake Monitoring Well(1)	X	NA	NA	NA		
Station 70	X	NA	NA	NA		Wire
Alberhill 1		NA	NA	NA		
Warm Springs MA						
Cemetery	X	NA	NA	65	2019	Wire
New Warm Springs Monitoring Well(1)	X	NA	NA	NA		

Notes:

(1) These wells are being installed as part of GSP preparation (funded by a Sustainable Groundwater Management grant) with incorporation into therepresentative monitoring program; they were sited and designed to support the groundwater level monitoring program and to become Key Wells.

(2) NA - Not Available.



Data Sources: City of Lake Elsinore, 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.

Note - these wells are not part of the GSP Area Representative Monitoring Network but will be monitored by EVMWD on a consistent basis

Figure 7.1 Monitoring Well Network

carollo

Last Revised: December 23, 2020 pw://IO-PW-INT.Carollo.local:Carollo/Documents/Client/CA/EVMWD/11585A00/GIS/Monitoring Well Network.mxd

This network is complemented by 14 additional wells that EVMWD already monitors, but these wells are not included in the representative monitoring network/program (based on location or history as previously described in Chapter 6/Section 6.2.5). Nevertheless, EVMWD will continue to monitor groundwater elevations in these additional wells on a routine basis, and data will be reviewed in preparing potentiometric surface maps for the annual reports.

Details and rationale regarding the spatial and temporal coverage of the representative monitoring well network is provided in the following section.

7.4.1.1 Spatial Coverage

Based on DWR's BMP guide for monitoring networks, Monitoring Networks and Identification of Data Gaps, (2016b), the well density goal is 4 to 10 wells per 100 square miles. The area of each MA is as follows:

- Elsinore MA: 24.4 square miles.
- Warm Springs MA: 5.2 square miles.
- Lee Lake MA: 7.2 square miles.

Accordingly, the minimum monitoring network requirement is one to three monitoring wells per area. Using this guidance, the selected representative monitoring well network provides more than sufficient coverage for monitoring as shown below:

- Elsinore MA: 16 Monitoring Wells (66 wells/100 square miles). The number of monitoring wells is sufficient for the size of the MA.
- Warm Springs MA: 2 Monitoring Wells (38 wells/100 square miles). While there are only two monitoring wells in Warm Spring MA, these two wells monitor the most active portion of this MA where changes from pumping in other MAs or recharge are likely to occur first. Therefore, these locations act as a sentry to the rest of the MA where the only current pumping is for private domestic use and are sufficient for the size of the MA.
- Lee Lake MA: 9 Monitoring Wells (125 wells/100 square miles). The number of monitoring wells is sufficient for the size of the MA.

As described in Section 3.6.1, a single principal aquifer is defined in the Elsinore Valley Subbasin. Therefore, the representative monitoring network is for the single principal aquifer.

7.4.1.2 Temporal Coverage

Groundwater elevation data will be collected from the representative monitoring well network to provide groundwater elevation conditions in the spring and fall of each year. This frequency is sufficient to demonstrate seasonal, short-term, and long-term trends in groundwater conditions and related surface conditions and yield representative information about groundwater conditions. Further discussion of the monitoring schedule and network implementation is provided in Section 7.5.

7.4.2 Reduction in Groundwater Storage

Change in groundwater storage is correlated with the change in groundwater levels based on groundwater model calibration. Therefore, the monitoring program is designed to use groundwater levels as a proxy for the change in groundwater storage. The designated representative monitoring well network is capable of documenting changes in this sustainability indicator. Annual groundwater storage changes will be estimated by evaluating the volumetric difference between changes in groundwater surfaces created based on groundwater level data collected in spring of each year.

Because groundwater levels will be used as a proxy for groundwater storage changes, details on rationale, spatial coverage, and temporal coverage are provided in Section 7.4.1 and not repeated herein.

7.4.3 Degraded Water Quality

Sustainable management under SGMA is founded on the use and management of groundwater without causing undesirable results but does not require reversing pre-existing 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 data of January 1, 2015. The sustainability goal is to protect groundwater quality from getting worse, but not to reverse undesirable water quality conditions.

Per the regulations (§354.34 (4)), to monitor conditions related to degraded water quality, the representative monitoring network shall collect sufficient spatial and temporal data from each principal aquifer to determine groundwater quality trends for water quality indicators to address known water quality issues.

Nitrate, TDS, and arsenic are COCs for the Subbasin, as described in in Section 4.7, and there is a single principal aquifer in the basin. Other constituents have been documented (Section 4.8), but occurrences of these are either under regulation by the SARWQCB or are naturally occurring and have limited potential for mobilization due to management actions. Accordingly, the MTs for degradation of groundwater quality address nitrate, and TDS for each MA, as summarized in Table 7.7. While the average arsenic concentration in the Subbasin is below the MCL, there are some wells that register arsenic concentrations above the MCL, in portions of the Elsinore MA. An MT has not been set for arsenic in the Subbasin because it is naturally occurring and there is insufficient information available to understand whether any management actions, such as changing groundwater levels, could have an impact of arsenic levels in groundwater. Wells in the Subbasin with elevated arsenic concentrations (Cereal 3 and 4, Summerly, and Diamond) are treated at a centralized treatment facility. In addition, the Cereal 1 and Corydon Street wells utilize blending to mitigate slightly elevated arsenic concentrations. Continued monitoring of arsenic concentrations is recommended and the GSA will coordinate and support the SARWQCB in all actions implemented to regulate arsenic. A study of which portions of the aquifer contain arsenic may give more insight into the impact of management actions on arsenic concentrations. Ongoing results of monitoring, coupled with an aquifer-specific study, may be used to determine the need for establishing an MT in future GSP updates.

Table 7.7 Summary of Constituents of Concern

MA	Nitrate (as N) MCL = 10 mg/L		TDS SMCL = 500 mg		Arsenic MCL = 10 ug/L	
	MT (mg/L)	Current Conditions (mg/L)	MT (mg/L)	Current Conditions (mg/L)	MT (µg/L)	Current Conditions (µg/L)
Elsinore	5	2.3	530	490	Not Defined	7.5
Lee Lake and Warm Springs	7.9	6.0	820	692	Not Defined	2.1

Table 7.8 summarizes the number of wells sampled for the COCs during the current conditions period as defined in this GSP and is adapted from Table 6.2 from Chapter 6. There are a large number of wells in the Elsinore MA (16 wells), but relatively few in the Lee Lake MA (8 wells), and only two in the Warm Springs MA. The two new monitoring wells constructed as part of this GSP (one in Lee Lake MA and one in Warm Springs MA) could serve to fill data gaps in groundwater quality.

Table 7.8 Summary of Existing Well Network for Water Quality Monitoring

MA	Number of Wells
Elsinore	16
Lee Lake	8
Warm Springs	2

Given the current groundwater quality monitoring being conducted (Section 7.1.2), in combination with existing regional monitoring, synthesis, and reporting, the existing groundwater quality monitoring network by MA is deemed sufficient to monitor conditions related to degraded water quality. No additional sites are currently recommended to expand the existing network, but future hydrologic studies (described in Section 7.7.3) may identify the need for additional wells.

Existing and ongoing collection of groundwater quality samples from the existing network will be used to track long-term trends in groundwater quality that may impact beneficial uses and users of groundwater in the Subbasin. Water quality data will be collected during the SGMA implementation period of 2022 to 2042. Existing monitoring includes EVMWD municipal production wells that will be sampled monthly; other wells will be sampled annually on a routine and consistent basis for general minerals, physical parameters, and selected COCs.

In summary, EVMWD groundwater quality monitoring activities will continue to support existing planning and management efforts in the region. The variety of regulatory programs in place will be supported by EVMWD's existing monitoring network, and data will help improve the understanding of the basin. A portion of EVMWD's existing wells are selected as Key Wells for the GSP monitoring network (see Table 7.6) to detect a range of problems quickly, to track trends, and support focused management actions.

7.4.4 Land Subsidence

Per the regulations (§354.34 (5)), the land subsidence monitoring network will be able to identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.

The representative monitoring network will utilize existing monitoring conducted by TRE Altamira. Existing InSAR data collection, which uses remote sensing technology, can collect sufficient data to demonstrate short-term (1 to 5 years) and long-term (5 to 10 years) trends in subsidence and yield representative information about land surface elevation changes during Plan implementation. DWR will continue to update the land surface elevation datasets, which in turn, will be accessed via the SGMA data viewer and compared to the earliest InSAR measurements (May 2015) to monitor changes.

MAs for the purposes of evaluating subsidence in the GSP Area will not be used. Rather, subsidence will be evaluated during the first five years of implementation across the entire area to determine the necessity for MAs specific to subsidence monitoring.

Cumulative subsidence will be monitored using the InSAR satellite-based geodetic data that DWR provides on the SGMA Data Portal website. This data is available as a raster file from the TRE Altamira InSAR dataset. Data processing and monitoring of the MTs is described in Section 6.6 and includes download of InSAR data to compare the vertical displacement between the 2015 baseline to current conditions, analyzing for signs of cumulative inelastic subsidence.

7.4.5 Depletion of Interconnected Surface Water

According to §354.34 (6), the network for this sustainability criteria should be able to 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. Interconnected surface water is documented in Section 4.11 and it is known that GDEs are present within Temescal Wash. Therefore, although the sustainability indicator per SGMA is "depletion of interconnected surface water" this GSP targets specific impacts to GDEs.

Figure 4.17 shows gaining and loosing stream segments on Temescal Wash, and Figure 4.20 shows the areas of dense riparian trees. However, in the Sustainability Criteria chapter the interconnected surface water MT is not only based on these segments but includes all of Temescal Wash in the Subbasin. From Chapter 6, "*The **MT** for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian trees is greater than 35 feet for a period exceeding one year.*" and "*Undesirable results are considered to commence if water levels along more than half of the reach of Temescal Wash within the Subbasin exceed the minimum threshold.*"

To this end, the representative monitoring network addresses the whole reach of the Temescal Wash in the Subbasin. The representative monitoring network consists of a subset of key wells for groundwater elevation monitoring. Specifically, nine wells will be monitored for groundwater levels are near stream reaches where GDE's have been identified (see Section 6.7). These wells are listed below and designated on Figure 7.1 with an asterisk (*). From east to west, this set of wells includes the following:

- Cemetery.
- New Warm Springs Monitoring Well.
- Alberhill 2.
- Barney Lee 1.
- Barney Lee 2.
- Barney Lee 3.
- Barney Lee 4.
- Gregory 1.
- Gregory 2.

As described in Section 6.7, the wells listed above are all mostly production 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. There is a three to four mile stretch through Walker Canyon with no wells and a significant amount of riparian vegetation, therefore, additional monitoring wells considered in the future. This data gap, and the potential for installing shallow monitoring wells near Temescal Creek, is addressed in Section 7.7.

7.5 Monitoring Network Implementation

Implementation of the monitoring activities by sustainability indicator is presented in this section.

7.5.1 Groundwater Level Monitoring Schedule

To obtain greater certainty associated with hydraulic gradients and to follow DWR guidance (DWR 2016ab), groundwater level measurements will consist of seasonal high and seasonal low groundwater conditions. Data will be collected in a consecutive two-week window, selected by EVMWD, in the spring (between April 1 and May 30) and in the fall (between October 1 and November 30) of any given calendar year.

7.5.2 Groundwater Storage Monitoring Schedule

Groundwater storage is directly related to, and calculated from, groundwater elevation data. Accordingly, the schedule for collection of monitoring groundwater storage is the same as that for monitoring groundwater elevations.

7.5.3 Water Quality Monitoring Schedule

EVMWD conducts annual and monthly groundwater quality monitoring in the dedicated well network. Specifically, EVMWD will utilize the existing network, whereby municipal production wells will be sampled monthly; other wells will be sampled annually on a routine and consistent basis for general minerals, physical parameters, and selected COCs during the SGMA implementation period of 2022 to 2042. This monitoring will continue, with an emphasis on consistent sampling and data management to document groundwater quality trends. These data will be reported to DWR in the 5-year GSP update report. EVMWD will use the data to plot trends to show how COCs may be changing over time during the SGMA implementation period, and these time series plots will be provided to DWR in the annual reports.

Annual reviews of the groundwater quality trends will be used to assess whether sampling frequency needs to be modified. In turn, this data will continue to be used by other agencies as previously described. Monitoring and management actions already in place will continue, most notably:

- Upper Temescal Valley SNMP, for meeting the requirements to reduce salt and nutrient loading in the Lee Lake and Warm Springs MAs.
- Compliance with the Basin Plan Amendment for Elsinore MA, which defines management actions to minimize salt and nutrient loading in the long-term.

7.5.4 Land Subsidence Monitoring Schedule

It is assumed that the collection of satellite imagery and InSAR data along with InSAR subsidence monitoring will continue for the foreseeable future, whereby InSAR data will be available from the DWR website. The monitoring schedule will involve annual download of InSAR data with analysis for signs of cumulative inelastic subsidence and comparison to the earliest/baseline InSAR measurements (May 2015) to monitor changes. Findings will be included in the 5-year GSP update report to DWR.

7.5.5 Depletion of Interconnected Surface Water Monitoring Schedule

Monitoring implementation for the interconnected surface water subset of key wells to evaluate this sustainability criteria is described in Section 7.5.1.

7.6 Data Collection Protocols

Data collection protocols are described by DWR in its Monitoring Protocols, Standards, and Sites BMP (DWR, 2016a) for collecting groundwater level measurements and groundwater quality samples, as well as downloading transducers.

7.6.1 Groundwater Level Monitoring Protocols

EVMWD uses a combination of techniques to measure groundwater elevations, whereby the most recent measurement method utilized for wells in the representative monitoring network is shown on Table 7.6:

- **Wire** – measurement with a manual electronic probe.
- **Air** – measurement using an air line (see GWPD13.pdf (usgs.gov) for a description of this method).
- **SCADA** – automated measurement using pressure transducers and transmission of data electronically.

As referenced in §352.4 of the GSP Regulations, *"monitoring protocols shall be developed according to best management practices. Monitoring protocols shall be reviewed at least every five years as part of the periodic evaluation of the Plan and modified, as necessary."*

EVMWD also follows its monitoring plan and protocols for collecting groundwater elevation data and reporting to DWR as required by the CASGEM program. EVMWD plans to increase automation and transition many of its wells to SCADA (see Section 7.5).

A bulleted description of DWR protocols that EVMWD will follow for groundwater level monitoring using both manual measurements and pressure transducers is provided next.

7.6.1.1 Manual Measurements

Per DWR's (2016a) Monitoring Protocol BMP, the following protocols apply:

- All groundwater levels will be collected in as short of time as possible (i.e., preferably within a 1 to 2-week period).
- Depth to water will be measured at an established Reference Point (RP) on the well casing, which will be identified with a permanent marker, paint spot, or notch. If no mark is apparent, then the measurement should be made from the north side of the top of the well casing.
- The sampler will remove the appropriate cap, lid, or plug and listen for a pressure release. If a release is notices, then measurement will be delayed for a short period of time to allow the water level to equilibrate.
- Measurements of depth to water and land surface will be measured and reported in ft to an accuracy of at least 0.1 ft relative to NAVD88, or another national standard, and the method of measurement noted (i.e., electronic sounder, steel tape, transducer, acoustic sounder, or airline).
- The water level probe should be cleaned after measuring each well.
- EVMWD will create a Well Identification Sheet, which will be used to track monitoring at each location. Data to record will include well number, date, RP elevation and description, location description, and well type and use. Other well details (i.e., construction information) will be maintained in a database.
- The sampler will replace any well caps/plugs and local any buildings or covers.
- All data will be entered into a GSP Area DMS as soon as possible. Care will be taken to avoid data entry mistakes. Entries will be checked by a second person for accuracy.

7.6.1.2 Pressure Transducers

Groundwater levels may be monitoring using pressure transducers installed in monitoring wells and recorded by data loggers, along with calculated groundwater elevations (DWR, 2016a). When relying on this technique, manual measurements of groundwater levels will be taken during installation to synchronize the transducer system, and periodically, to ensure monitoring equipment does not allow a "drift" in actual values. Protocols to follow when installing a pressure transducer include:

- Use an electronic sounder or chalked steel tape to measure the depth to water from the RP. Then, calculate the groundwater elevation by subtracting the depth to water from the RP elevation. These values will be used as references to synchronize the transducer system in the well.
- Record the well ID, transducer serial number, transducer range, transducer accuracy, and other pertinent information in a log.
- Record whether the pressure transducer uses a vented or non-vented cable for barometric compensation.
- Various factors will be considered in the selection of the transducer system (i.e., battery life, data storage capacity, range of water level fluctuations, natural drift). The transducer will be able to record water level with an accuracy of at least 0.1 ft.
- Follow manufacturer specifications for installation, calibration, and so forth to ensure optimal use of equipment.

- Transducer data will be checked periodically against hand-measured water levels to monitor electronic drift or cable movement. This check will not occur during routine site visits, but at least annually.
- Data will be downloaded regularly to ensure data are not lost. Data will be entered into a DMS following QA/QC protocols. After confirming the data have been downloaded and stored, data will be deleted from the data logger to allow for adequate memory for future measurements.

7.6.2 Water Quality Monitoring Protocols

EVMWD's Water Quality Department has Standard Operating Procedures for water quality monitoring. These procedures are summarized next. An analytical summary sheet showing analysis, method number, bottle type, and preservatives is provided in Appendix J.

Description:	Procedure for sampling and analysis of EVMWD sources to meet the requirements of general water quality monitoring.
Pre-Requisite Skills:	All samplers receive training according to method-specific standard operating procedures for pH,conductivity, chorine residual, turbidity, color, and total coliform sampling and analysis. Samplers also receive training regarding sample point locations.
Resources Required:	• Field meter equipped with probes for pH and conductivity measurement. • Turbidimeter with clean analysis vials. • Pocket colorimeter II with clean analysis vials and DPD reagent for total and free chlorine. • DR900 colorimeter with clean analysis vials. • Plastic carrying tote with clean towels, lint-free wipes, spare batteries, a 500 milliliter (mL) plastic beaker, deionized rinse water and a spray bottle of isopropyl alcohol. • Chains of custody, field data records, and sample labels. • Clean cooler with three to four ice packs. • Sample containers with required preservatives.
Safety Procedures and Caution:	When sampling in or near traffic, reflective vests are provided to ensure visibility. Sampling personnel must wear approved eye protection when working with chemicals during analysis. When sampling in high temperatures, water and heat illness prevention personal protective equipment (PPE) are provided. The following special practices must be followed during the COVID-19 pandemic: • Staff must always maintain a 6-ft personal space between one another. • Staff must wash hands thoroughly with soap and water before and after all meals and rest times. • Surfaces in EVMWD vehicles must be sanitized with 70 percent isopropyl alcohol before and after any staff use. • Commonly touched surfaces, such as padlocks and gates, must be sanitized with 70 percent isopropyl alcohol before touching.

Sequential Steps to Perform Tasks:

Assess the condition of the sampling location:

- Ensure exterior of sample ports are clean and free of debris that can contribute to contamination, such as plant overgrowth or animal activity.
- Inspect the area around the sample port and remove any material attached to the sampling goosenecks, such as spider webs or plant material.
- If insect activity is apparent, sterilize the sampling gooseneck and surrounding area with isopropyl alcohol.
- Ensure the gooseneck is not damaged or leaking and does not have signs of excessive corrosion or mineral deposits.
- Compliance samples are to be collected from the raw sample location unless a treated sample is required.
- When collecting coliform samples at sources, disinfect sample port before sample collection.

Thoroughly flush sample location to ensure representative sample:

- Sources must have been running for at least 15 minutes prior to sampling. If the source is running to the system, this requirement is met. Turbidity must be <5.0 nephelometric turbidity units (NTU).
- Run sample tap at full flow for 3-5 minutes.
- Reduce sample flow to a stream approximately 1/8 to 1/4 of an inch in diameter and allow to flow for an additional minute.
- Collect approximately 250 mL of water in a plastic beaker for field analysis, fill a 12-ounce (oz) glass jar with water for entrained air observations, and collect a sample for chlorine residual analysis directly in a sample vial.

Field analysis:

- Begin analysis for chlorine residual by adding DPD regent to sample vial and starting a timer for 3 minutes.
- Analyze for pH, conductivity, temperature, turbidity, and color using the sample collected in the plastic beaker and record the data on the field data record or chain of custody.
- If entrained air is observed while collecting the sample, start a timer after collecting the glass jar of sample and record the time required for the air to dissipate.
- After the 3-minute timer ends, read chlorine residual and record on the field data record or chain of custody.
- Data that does not agree with historical trends should be double checked for accuracy.
- Any verification or reanalysis of the sample due to questioned data should be noted on the field data record or chain of custody.

Coliform sample collection:

- Ensure hands are clean before sampling.
- Remove plastic seal from outside of sterile sample bottle.
- Remove the lid from the bottle, being careful not to touch the inside of the lid, and hold the lid open side down a short distance from the sample container.
- Fill the sample bottle in one continuous motion. Do not pour sample from the container after collection.
- Sample volume must be above the 100 mL mark and below the shoulder of the sample bottle.
- Immediately recap the bottle, tighten the lid, and shake the sample to dissolve the thiosulfate powder.
- Notate sample collection time, label the sample, and place the sample in the cooler for transportation.
- Turn off flow from the sampling point and secure location.

Inorganics, General Minerals, and General Physicals sample collection:

- While filling sample bottles, ensure that any preservative used is not rinsed, splashed, or in any way removed from the container while filling.
- Samples are to be stored on ice until delivered to the lab.

Organics sampling:

- While filling sample bottles, ensure that any preservative used is not rinsed, splashed or in any way removed from the container while filling.
- Sample vials are to be filled until a reverse meniscus forms. If needed, the vial cap can be used for adding small volumes of water.
- Screw the vial cap on carefully without disrupting the meniscus and ensure that no air bubbles exist in the sample vial.
- Samples are to be stored on ice until delivered to the lab.

7.7 Potential Network Improvements

The monitoring network described in this chapter is sufficient to document groundwater conditions and can be used to track progress toward the sustainability goals for the GSP Area. Nevertheless, there are potential areas of improvement as described next. The benefits of these potential improvements will accrue over the next few years and support review and update of MTs in the five-year GSP Update (2027) as described in Chapter 6.

7.7.1 Groundwater Levels

Data gaps and potential network improvements related to groundwater level monitoring can be divided into several categories:

- Spatial Coverage.
- Well Type.
- Well Construction.
- Shallow Monitoring Wells for GDEs.
- Automation and Technology.
- Consistency and Data Management.

7.7.1.1 Spatial Coverage

Spatial data gaps exist in the GSP Area relative to wells. The geographic distribution of wells is uneven, and particularly less dense in the Warm Springs and Lee Lake MAs. The Elsinore MA area has good spatial coverage. Two new monitoring wells were installed as part of this GSP effort to address this uncertainty, one in the Lee Lake MA and one in the Warm Springs MA. These locations are shown on Figure 7.1. These new monitoring wells were constructed in May 2021 accordance with the Technical Specifications prepared in June 2020 (Carollo/Todd Engineering, 2020). Furthermore, these wells will be constructed in compliance with State of California Water Well Standards, Bulletin N. 74-81 (December 1981) and 74-90 (June 1991).

Due to the small and varied nature of the MAs, although there is good spatial coverage in the Elsinore MA, there are still many unknowns regarding the hydrogeology of the Subbasin. Because of these unknowns, additional exploratory drilling and monitoring wells are recommended if funding is available to further understand the hydrogeology of the basin, especially in locations further away from existing wells.

7.7.1.2 Well Type

Many of the wells in the representative monitoring network are production wells that were not sited or designed for monitoring. Active production wells are not optimal for monitoring as they do not represent steady-state water levels. However, inactive production wells are appropriate and suitable for use as monitoring wells. The installation of two new dedicated monitoring wells helps to fill this data gap.

7.7.1.3 Well Construction

As shown on Table 7.6, construction information on some wells in the network is not known. In addition, information on vertical groundwater gradients is lacking, and groundwater levels for some area may not be represented adequately by relatively deep key wells (i.e., in areas with GDEs). This data gap could be improved with the digitization of well information (i.e., video log), including construction data.

7.7.1.4 Shallow Monitoring Wells for GDEs

Data gaps for monitoring GDEs are described in Section 6.7.8 and summarized herein. Shallow monitoring wells are needed in riparian areas to provide accurate groundwater table information and elucidate the relationship between deep water levels and vegetation conditions. A monitoring improvement for this GSP would be to install shallow monitoring wells at several riparian locations in the Subbasin, as budget permits. Over time, MT groundwater elevations for the new shallow wells can be defined based on the monitored data and the relationship to deep water levels.

7.7.1.5 Automation and Technology

EVMWD utilizes three methods to monitor groundwater elevations, namely 1) wire, 2) air, and 3) SCADA. Each method produces differing levels of inherent accuracy. Air measurements tend to be the least accurate of the methods used. Over time, as budget permits, EVMWD will increase its automation in monitoring by adding transducers and SCADA technology to more and more wells.

7.7.1.6 Consistency and Data Management

Implementation of the GSP brings the opportunity to perform the collection of groundwater level data on a more consistent basis and to optimize management of the data in a dedicated and comprehensive DMS. In turn, these optimization efforts will result in better and more consistent data that will not only be used for reporting to DWR annually but will also help EVWMD and other regional agencies with groundwater management efforts in the region.

7.7.2 Groundwater Quality

Regarding groundwater quality, the most significant network improvement is adding the element of consistency and data management. Implementation of this GSP affords the opportunity to conduct routine and consistent sampling, data collection protocols, and integration of groundwater quality data into the DMS for the GSP.

7.7.3 Future Studies

The following future studies are suggested if funds are available:

- **Synoptic Study on GDEs in Temescal Wash** - Future hydrologic studies may be conducted in the individual MAs, with an emphasis on the Lee Lake and Warm Springs MAs. Specifically, a series of synoptic studies is recommended along with continuous flow monitoring on Temescal Wash to monitor GDEs and the potential for interconnected surface water and groundwater. The study will be designed to focus on periods following large storm events to ensure there is adequate flow in the Wash. It is anticipated that these studies could result in the identification of new wells needed for monitoring.
- **Arsenic Leaching Study** – An arsenic leaching study is recommended. This study would consist of zone sampling at different wells and elevations in an effort to correlate arsenic concentrations in groundwater with depth.

Chapter 8

PROJECTS AND MANAGEMENT ACTIONS

8.1 Introduction or Overview

This chapter includes descriptions of projects and management actions to achieve basin sustainability goals and mitigate changing conditions in the Subbasin. Projects discussed are divided into three groups. Group 1 projects are considered existing or established commitments by the District, Group 2 projects have been developed and thoroughly evaluated by the District and have typically have concrete implementation dates, and 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. Table 8.1 below summarizes the projects that fall under each of these three groups and will be discussed in greater detail throughout this chapter.

Table 8.1 Projects and Management Actions

Description	Agency	Category	Status	Anticipated Timeframe
Group 1 – Baseline Project and Management Actions				
Groundwater Well Replacements	EVMWD	Project	Ongoing	Ongoing
Manage Pumping in Elsinore MA with In-Lieu Recharge due to Conjunctive Use Agreements	EVMWD, MWDSC, WMWD	Management Action	Ongoing	Implemented
Group 2 – Projects and Management Actions Evaluated Against the Sustainable Management Criteria				
Begin Groundwater Pumping in Lee Lake MA for Municipal Use	EVMWD	Project	In design	2019 to 2023: Design and Construction. 2024 onwards: Implementation and Operation.
Rotate Pumping Locations and Flows	EVMWD	Management Action	Not started	Can be implemented as needed dependent on groundwater levels.

Description	Agency	Category	Status	Anticipated Timeframe
Recycled Water IPR	EVMWD	Project	Planning Phase	Dependent on wastewater flow increases.
Septic Tank Conversions	EVMWD	Project	Not started	Dependent on funding sources.
Group 3 – Identified Projects and Management Actions That May Be Considered in the Future				
Imported Water Recharge and Recovery	EVMWD, MWDSC	Project	Inactive	No current anticipated timeline.
Stormwater Capture and Recharge	EVMWD	Project	Not started.	No current anticipated timeline.
Begin Groundwater Pumping in Warm Springs MA for Municipal Use	EVMWD	Project	Not started.	No current anticipated timeline.

8.2 Baseline Projects and Management Actions (Group 1)

Group 1 projects and management actions are considered existing or established commitments by the District or affiliated agencies. Group 1 projects are either already in operation or are currently being implemented with anticipated near-term operation.

8.2.1 Groundwater Well Replacements

Groundwater wells have a useful life and occasionally require maintenance, pump retrofit and replacement. Existing municipal wells occasionally collapse, fail, clog, or otherwise reach their end of their useful life. EVMWD plans on performing maintenance, retrofit, and replacement of existing municipal wells on an as-needed basis.

Last used for production in 2006, the Palomar Well, a municipal production well, collapsed. EVMWD has plans to install a replacement well within the existing well enclosure in addition to new wellhead treatment. Total project cost is anticipated to be $5.1 million (EVMWD 2019).

8.2.2 Manage Groundwater Pumping in Elsinore Management Area with In-lieu Recharge Due to Conjunctive Use Agreements

In-lieu recharge is the utilization of water sources, such as surface water or recycled water, to offset or allow for sustainable groundwater pumping. EVMWD has been practicing in-lieu recharge since 2016 by extracting higher quantities of groundwater in dry years and purchasing imported water in-lieu of extracting groundwater during wet years, to allow the basin to replenish. In-lieu recharge is a common component of conjunctive use agreements, which set forth projects the promote the coordinated use of surface and groundwater sources.

The 2005 GWMP identified conjunctive use as an important component of management of the Elsinore Valley Subbasin (MWH 2005). Dual-purpose wells were constructed by modifying existing production wells to dual-purpose extraction and injection wells, however, these wells are now used only for extraction. Groundwater injection practices began in 2007 and continued through year 2013. Since year 2013, EVMWD pumps more than the safe yield in dry years and less than the safe yield in wet years. The 2005 GWMP calculated the safe yield for the Elsinore MA as 5,500 AFY; EVMWD has used this value as a planning number for average pumping over the past 15 years.

EVMWD currently has two CUPs with other agencies which lead to variable groundwater pumping from the Elsinore MA due to in lieu recharge. The two CUPs are with MWDSC and SARCCUP. On an annual basis, MWDSC may deliver up to 3,000 AF of water for storage in the Elsinore Valley Groundwater Subbasin, and MWDSC may extract up to 4,000 AF of stored water as part of the Groundwater Storage Program (MWDSC 2011). During years when stored MWDSC deliveries are extracted, EVMWD's supply from imported water sources is reduced by an equal amount. The decrease in annual pumping has contributed to a stabilization of groundwater levels in the central-south portion of the Elsinore Valley Subbasin (MWDSC 2011).

In 2015, the SARCCUP received funding under the Proposition 84 2015 Integrated Regional Water Management (IRWM) grant. A component of the SARCCUP includes improving the water supply resiliency of Santa Ana River Watershed region through diversified conjunctive use. In the Elsinore Subbasin, this program will expand the conjunctive use program by 4,500 AF, or an additional extraction capability of 1,500 AFY. It is intended to store 4,500 AF in the Subbasin in wet years and extract as needed during drought conditions (DWR 2016 and 2020).

8.2.2.1 Future Pumping Recommendations

In Chapter 5, the water budget calculations show the sustainable yield of the Subbasin under historic, current, and future hydrologic conditions. For the Elsinore MA, the sustainable yield ranges from 6,301 AFY to 6,878 AFY, depending on the hydrologic simulation, with the lowest value of 6,301 AFY in the Baseline scenario. The Baseline scenario represents current conditions and practices continuing over a 50-year period and represents the most likely conditions in the next several years. Therefore, it is recommended that the 6,301 AFY sustainable yield value in the Baseline scenario be used for planning purposes.

Other than EVMWD, there are other pumpers in the Elsinore MA, such as the LEUSD and private well owners (who have a groundwater well at their residence). It is recommended that a pumping allocation of 300 AFY be reserved for these other well users. Historical data shows that there have been approximately 300 wells drilled in the Elsinore MA, but the status of many of these wells are unknown (MWH 2011). As the private well pumpers are not required to submit their pumping to DWR, it is unknown the actual use of these wells. The 300 AFY is an estimate of the amount of water that these users pump but this value should be reviewed and adjusted in the future as more information becomes available. In order to obtain additional information, it would be helpful to perform a survey of actively used private wells prior to or as a part of the 5-year GSP update. This will serve to inform if additional monitoring is necessary to meet the needs of private well users and DACs within the Subbasin.

Additionally, as shown in Figure 5.11, current levels in the Elsinore MA are low compared to historical levels. In order to allow for recovery to historical levels and prepare for other emergencies, it is recommended that EVMWD maintain a 5 percent allocation of the sustainable yield. For the Elsinore MA, this is equal to 315 AF.

Therefore, it is recommended that EVMWD plan for an average pumping rate of 5,686 AFY (rounded to 5,700 AFY) for planning purposes. During dry years, EVMWD would pump more than this recommended pumping rate of 5,700 AFY and less than this pumping rate in wet years in accordance with MWDSC Groundwater Storage Program and SARCCUP agreements. This recommended pumping rate will be reevaluated during the required 5-year GSP updates.

8.3 Projects and Management Actions Evaluated Against the Sustainable Management Criteria (Group 2)

Group 2 projects and management actions have been thoroughly studied, evaluated, and developed by the District and associated partner agencies and typically have concrete implementation dates. These projects will be implemented to meet Subbasin sustainability goals, in conjunction with Group 1 projects. An overview map of the location of each of these projects is available on Figure 8.1.

8.3.1 Begin Groundwater Pumping in Lee Lake Management Area for Municipal Use

8.3.1.1 Project Description

The Lee Lake MA previously had wells serving agricultural uses but has never been utilized for potable water purposes. The project will add two extraction wells in the subbasin with a combined average flow rate of 1,000 to 1,200 gpm for municipal use. The project will include disinfection, treatment for PFAS, and transmission piping to connect to the local municipal system (DWR 2016 and 2020). Figure 8.2 shows the proposed location of the new wells.

Based on the groundwater modeling performed as part of this GSP, the sustainable yield in the Lee Lake MA is approximately 1,100 AFY in the Future Growth plus Climate Change scenario as discussed in Chapter 5. As it is believed that the sustainable yield of the Lee Lake MA will vary based on pumping, it is recommended that EVMWD plan for pumping up to 1,000 AFY on an annual basis from the Lee Lake MA. Due to the hydrogeology of the Lee Lake MA, it is recommended that the pumping occur on an annual basis rather than some kind of conjunctive use.

8.3.1.2 Measurable Objective

EVMWD monitors groundwater elevations throughout the basin. Water levels have historically remained steady in the Lee Lake and Warm Springs MAs and have stabilized in recent years (since 2007) in the Elsinore MA. Pumping in the Lee Lake subbasin for municipal use will offset pumping in other areas of the Subbasin which see more fluctuation in water levels. EVMWD will monitor Lee Lake MA to ensure groundwater levels are maintained despite the new pumping.

8.3.1.3 Circumstances for Implementation

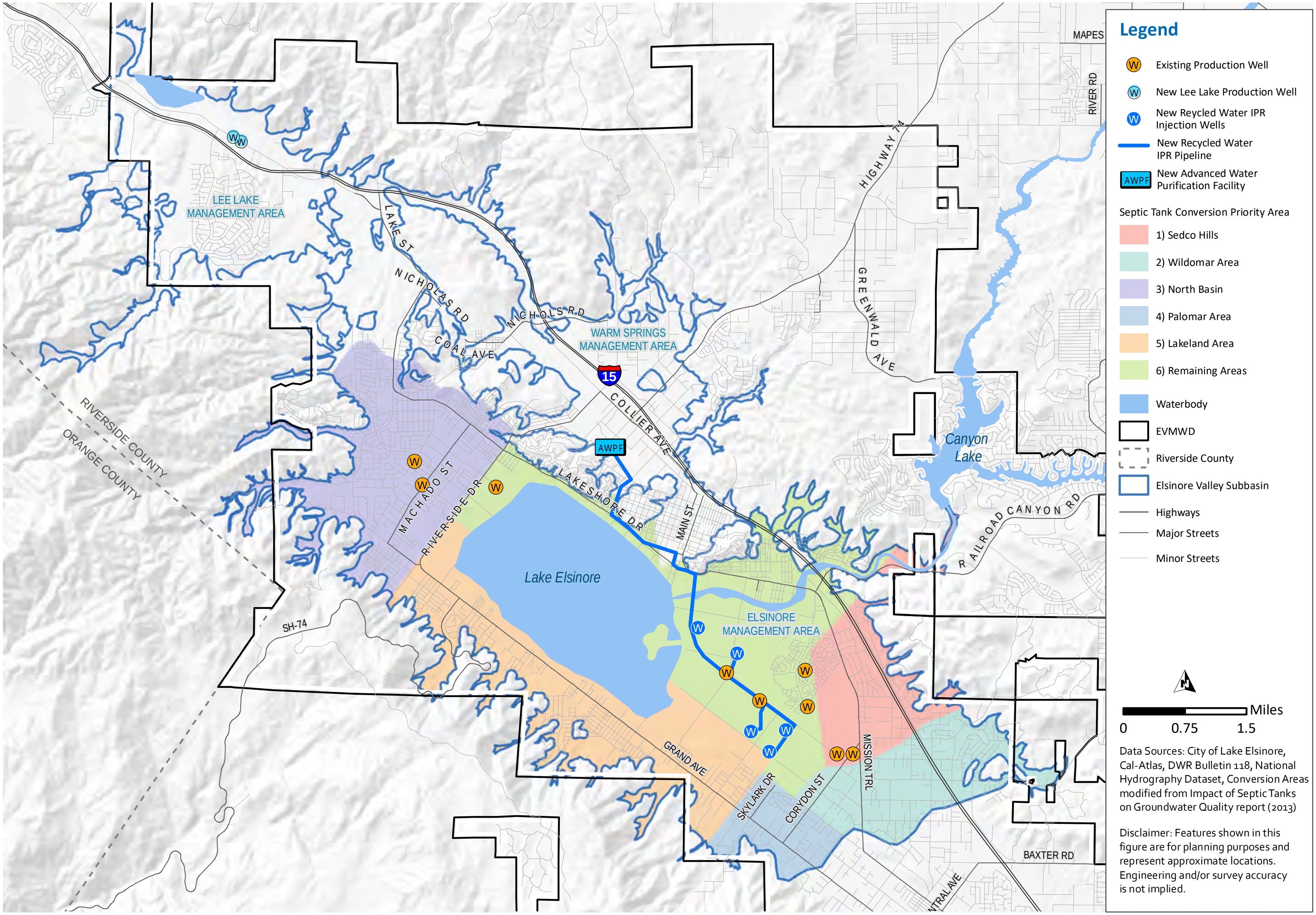
EVMWD has already started to implement this project. The District will need install two new extraction wells in the Lee Lake subbasin as well as piping to connect to the existing distribution system.

8.3.1.4 Public Noticing

The public will be notified per California Environmental Quality Act (CEQA) requirements, see Chapter 9 for detailed info on the CEQA process.

8.3.1.5 Overdraft Mitigation and Management Actions

EVMWD will manage their pumping from the Lee Lake MA to maintain groundwater sustainability by reviewing water levels during future 5-year GSP updates and making adjustments to the recommended pumping volume accordingly.



Data Sources: City of Lake Elsinore, Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset, Conversion Areas modified from Impact of Septic Tanks on Groundwater Quality report (2013)

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Figure 8.1 Group 2 Projects

carollo TODD GROUNDWATER

Last Revised: July 06, 2021 pw://IO-PW-INT.Carollo.local:Carollo/Documents/Client/CA/EVMWD/11585A00/GIS/Fig8.1_Group2Projects.mxd

Figure 8.2 Begin Groundwater Pumping In Lee Lake Management Area for Municipal Use

8.3.1.6 Timetable for Implementation

The Lee Lake wells are anticipated to be drilled in summer of 2021. Design for the Lee Lake wellhead and treatment facilities was initiated in early 2019 and is occurring in parallel to the well drilling. Final design is anticipated to be complete in summer of 2022 with bid advertisement anticipated in August of 2022. Construction is anticipated to commence in late 2022 and finishing in 2023. The project is expected to be operational in early 2024.

8.3.1.7 Expected Benefits

This project is expected to stabilize groundwater levels throughout the basin by adding flexibility for municipal pump locations. The added wells will increase yield to the region, as the Lee Lake MA is currently underutilized. In addition, an existing imported water pipe is located on Temescal Canyon Road, immediately adjacent to the future well site, so the treated water extracted from the wells will be easily piped to the distribution system.

8.3.1.8 How the Project will be Accomplished

Two wells will be drilled in the Lee Lake MA. The project will include pumping, disinfection, PFAS treatment facilities, and a small amount of piping. An existing 36-inch diameter transmission pipe is located on Temescal Canyon Road, immediately adjacent to the future well site, so the treated water extracted from the wells will be easily piped to the distribution system.

8.3.1.9 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.

8.3.1.10 Estimated Costs and Funding Plan

The District estimates an $8.6 million in capital expenses for the installation of two new extraction wells in the Lee Lake area and anticipated $250,000 per year for operations and maintenance (O&M) expenses.

This project is funded in part by SARCCUP IRWM grant. The grant allocates $55 million in funding to the SARCCUP, of that $3.0 million has been specifically designated for the implementation of the Lee Lake municipal wells (WMWD 2019). The remaining $5.6 million is funded by EVMWD sources.

8.3.1.11 Management of Groundwater Extractions and Recharge

Monitoring wells and DMS are used to record and compare groundwater elevations in the Basin to evaluate pumping impacts and ongoing sustainability. Municipal groundwater extraction is monitored by metering municipal production wells operated by EVMWD.

See Chapter 7 for additional information on the existing and proposed monitoring network.

8.3.1.12 Relationship to Additional GSP Elements

The addition of two new municipal wells in the Lee Lake MA is not related to any additional GSP projects and/or management actions discussed in this chapter.

8.3.2 Rotate Pumping Locations and Flows

8.3.2.1 Management Action Description

EVMWD operates a series of nine municipal wells in the Elsinore MA. Of these, three are located on the north side of Lake Elsinore (North Basin) and the remaining six are located on the south side of the Lake (Back Basin). The locations of these wells are shown in Figure 8.3. The District is equipped to rotate pumping locations as needed should water levels drop disproportionally in one area of the basin versus the other. This will help to keep groundwater basin levels consistent throughout.

8.3.2.2 Measurable Objective

EVMWD monitors groundwater elevations throughout the basin at representative monitoring wells (Key Wells). Chapter 6 includes additional discussion on groundwater level management. Historic monitoring of the Key Wells indicates that groundwater levels in the Elsinore MA are being maintained and there is not a significant difference in water levels in the North Basin and Back Basin at this time. Key Wells will continue to be utilized to monitor groundwater levels throughout the Subbasin and ensure the Elsinore MA is being sustainably managed.

8.3.2.3 Circumstances for Implementation

Project implementation will be contingent on groundwater levels throughout the Elsinore MA. The District does not need to implement any additional infrastructure for this project and can initiate pumping rotation when deemed necessary. Pumping rotation would be dependent on water levels in the North and Back Basins and would focus more pumping on the area where groundwater levels are dropping less than the other.

8.3.2.4 Public Noticing

Public noticing is not anticipated to be required for this project.

8.3.2.5 Overdraft Mitigation and Management Actions

EVMWD will manage their pumping from the Elsinore MA to maintain sustainable groundwater levels.

8.3.2.6 Timetable for Implementation

This project will occur as needed, dependent on groundwater levels in the Elsinore MA.

8.3.2.7 Expected Benefits

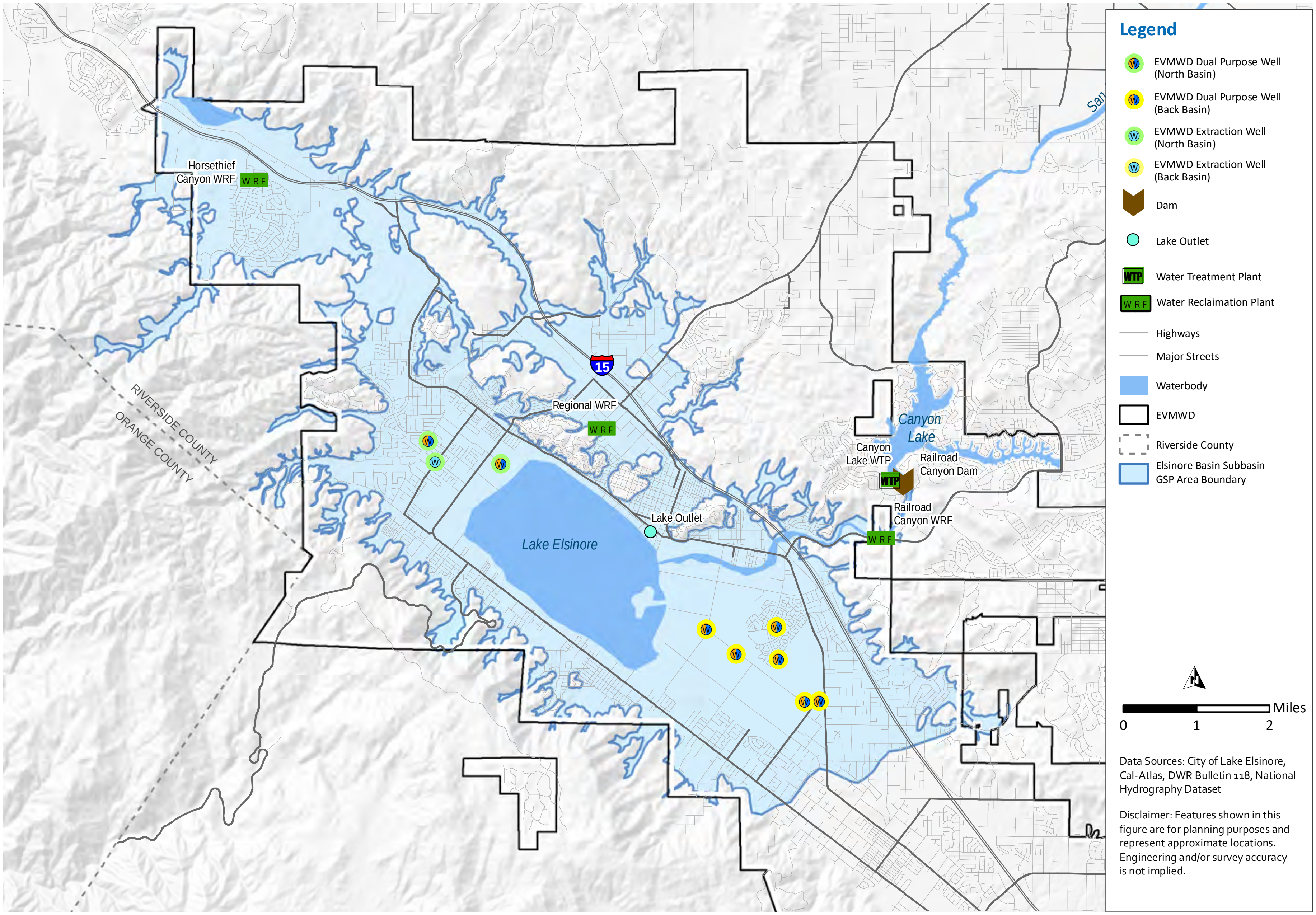
This project is expected to stabilize groundwater levels throughout the Elsinore MA.

8.3.2.8 How the Project will be Accomplished

No infrastructure is needed to implement this project. This is a management action that will be driven by the stability of groundwater levels in the Elsinore MA.

8.3.2.9 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.



Data Sources: City of Lake Elsinore, 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.

Figure 8.3 Rotate Pumping Locations and Flows

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8.3.2.10 Estimated Costs and Funding Plan

The District does not require additional infrastructure for this project. Thus, there are no capital or additional O&M expenses anticipated.

8.3.2.11 Management of Groundwater Extractions and Recharge

Monitoring wells and DMS are used to record and compare groundwater elevations in the Subbasin to evaluate pumping impacts and ongoing sustainability. Municipal groundwater extraction is monitored by metering municipal production wells operated by EVMWD.

See Chapter 7 for additional information on the existing and proposed monitoring network.

8.3.2.12 Relationship to Additional GSP Elements

Rotating pumping throughout the North and Back Basins of the Elsinore MA is not related to any additional GSP elements discussed in this chapter.

8.3.3 Recycled Water IPR Project

8.3.3.1 Project Description

Population growth and development in the Lake Elsinore region is anticipated to increase wastewater flow to the Regional WRF. Current Regional WRF capacity is 8 mgd and an ongoing expansion project will increase capacity to 12 mgd. Historically, 9.5 mgd of a combination of disinfected tertiary water and groundwater is required to maintain water levels in Lake Elsinore and support riparian habitat at Temescal Wash. Based on a 2017 study, it is estimated that by 2040, wastewater flows may increase to 18,000 AFY (16 mgd), leaving approximately 7,500 AFY (6.7 mgd) of water available for an IPR project in the region.

The proposed project will utilize Regional WRF source water and be constructed in two phases. Source water will be treated at an AWTF, constructed at the Regional WRF site, injected into a series of five injection wells throughout the groundwater basin, and extracted at existing wells. Key components of the project are described below (Kennedy/Jenks Consultants 2017):

- AWTF - The treatment train included microfiltration, three-stage reverse osmosis, advanced oxidation, and product water stabilization. The planned capacity of the treatment facility is 6 mgd (Phase 1 at 3 mgd and Phase 2 at 3 mgd). Brine disposal from the AWTF will be conveyed to the Inland Empire Brine Line (IEBL) for disposal. EVMWD owns a 0.8 mgd disposal capacity in the IEBL.
- Injection Wells - Five injection wells (with three wells for Phase 1 and two additional wells for Phase 2) are included in the recommended alternative. The injection wells are all located on the southeast side of Lake Elsinore, and specific locations are shown Figure 8.4.

Planning estimates prepared in 2017 estimate that Phases 1 and 2 are anticipated to be operational in 2030 and 2035, respectively. At the end of Phase 2, approximately 6,750 AFY of recycled water will be injected into the Subbasin (Kennedy/Jenks Consultants 2017). Figure 8.4 shows the planned injection well locations and piping from the AWTF required for the project.

8.3.3.2 Measurable Objective

An IPR project of this scale has the potential to raise groundwater levels in the basin, reduce the threat of land subsidence, and improve groundwater quality, supporting three of the sustainable management criteria outlined in Chapter 6. This project will also provide a new water supply for the region, diversifying the District's supply portfolio, increasing independence from imported water.

Table 8.2 presents the groundwater budget in the Subbasin accounting for population growth, climate change, and implementation of the IPR project and a septic conversion project (discussed further in Section 8.3.4). IPR project implementation will nearly double the sustainable yield of the Elsinore MA. This project will have no impacts to the Warm Springs and Lee Lake MAs, because IPR water will be specifically injected into the Elsinore MA. The groundwater budget accounting for IPR project implementation is also shown in graphical format in Figure 8.5.

Figure 8.6 shows modeling results for storage change in the Elsinore MA incorporating climate change assumptions, the IPR project, and a septic system project (discussed further in Section 8.3.4). The storage balance was set at zero for 1989 levels and subsequent actions are plotted as to how they will add or subtract the available groundwater in the Subbasin over time. As shown in the figure, implementing the IPR project has little to no impact on storage in the MA compared to the baseline scenario. This is due to the fact that the increased supply of water produced will allow the District to pump more water from the Subbasin while maintaining the same level of storage. Regardless, the District will still end up with a net positive storage change at the end of the modeling period. Note that since the injection of IPR water is expected to occur in the Back Basin portion of the Elsinore MA, the additional water pumping will need to also occur in the Back Basin portion of the Elsinore MA.

8.3.3.3 Circumstances for Implementation

Wastewater flow increases and subsequent Regional WRF upgrades are the main triggers to implementing this project. Flows will need to increase beyond the 9.5 mgd required to maintain Lake Elsinore water levels and support Temescal Wash before an IPR project will be implemented. The District is committed to implementing this project based on their agreement with the SARWQCB in the proposed Basin Plan amendment (EVMWD 2017), but the current timeline is unknown.

8.3.3.4 Public Noticing

Public outreach and noticing have not yet been completed for this project. As implementation dates become clearer, the District intends to solicit public input through community outreach and educational workshops.

8.3.3.5 Overdraft Mitigation and Management Actions

This project provides overdraft mitigation and water quality improvement (to reduce TDS and nitrate) in the Elsinore MA. By providing additional water to the MA, there is increased yield available for municipal use.

8.3.3.6 Timetable for Implementation

The project will be implemented in two phases. Dates developed by the 2017 study anticipates Phase 1 to be operational in 2030 and Phase 2 in 2035. Required research studies and piloting will be conducted from 2023 through 2024, with design for Phase 1 starting in 2025 (Kennedy/Jenks Consultants 2017). As previously noted, these dates are subject to change dependent on the increase in wastewater flows in the region.

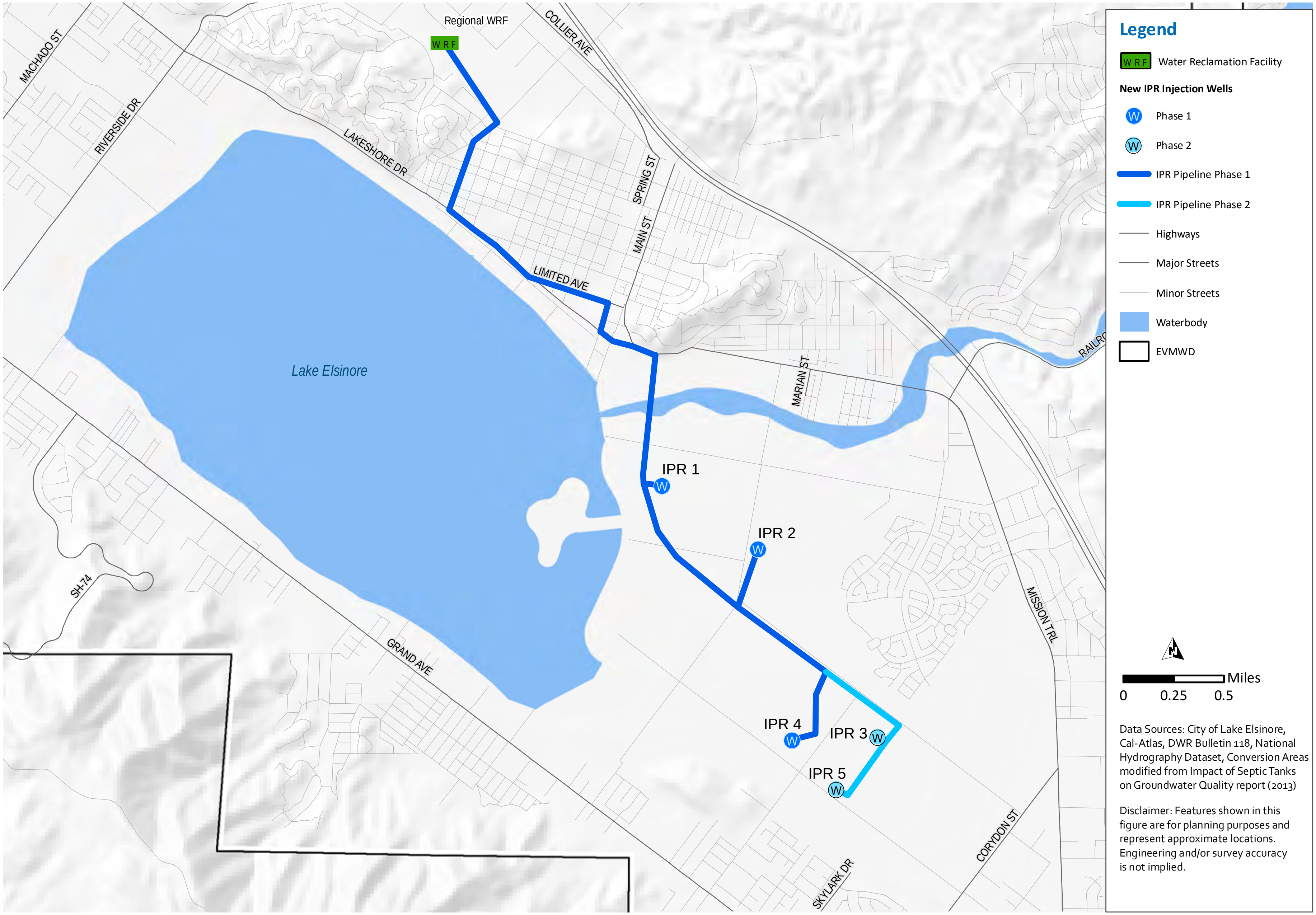
Table 8.2 Groundwater Budgets for Future Growth Plus Climate Change and Projects

Water Balance Items	Elsinore MA				Warm Springs MA				Lee Lake MA			
	Growth + Climate Change 2019-2068(1)	IPR 2019-2068(1)	Septic Conversion 2019-2068(1)	Recommended GSP Projects 2019-2068(1)	Growth + Climate Change 2019-2068(1)	IPR 2019-2068(1)	Septic Conversion 2019-2068(1)	Recommended GSP Projects 2019-2068(1)	Growth + Climate Change 2019-2068(1)	IPR 2019-2068(1)	Septic Conversion 2019-2068(1)	Recommended GSP Projects 2019-2068(1)
Groundwater Inflow												
Subsurface inflow from external basin	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	1,699	1,891	1,947	1,926	1,208	1,159	1,213	732	828	829	829	832
Bedrock inflow	1,298	1,298	1,299	1,299	751	751	751	751	732	732	732	732
Dispersed recharge: non-irrigated land	1,059	1,059	1,059	1,059	246	246	246	246	368	368	368	368
Dispersed recharge: irrigated land	2,160	2,160	2,160	2,160	553	553	553	553	653	653	653	653
Pipe leaks	1,583	1,583	1,583	1,583	461	461	461	461	581	581	581	581
Reclaimed water percolation or injection	0	5,834	0	5,834	0	0	0	0	489	489	489	489
Septic system percolation	918	918	1	1	179	179	172	172	9	9	9	9
Leakage from lake	98	98	98	98	0	0	0	0	0	0	0	0
Conjunctive use project injection(2)	0	0	0	0	0	0	0	0	0	0	0	0
Inflow from other management areas	498	491	510	382	0	0	0	0	15	15	15	15
Total inflow	9,313	15,332	8,656	14,341	3,398	3,349	3,396	2,915	3,677	3,677	3,677	3,680
Groundwater Outflow												
Subsurface outflow to external basin	-4	-4	-2	-6	0	0	0	0	-61	-61	-61	-61
Wells - M&I and domestic	-5,724	-11,548	-5,720	-11,066	-958	-958	-958	-48	-1,057	-1,059	-1,060	-1,059
Wells - agricultural	0	0	0	0	0	0	0	0	-53	-53	-53	-53
Groundwater discharge to streams	-137	-144	-128	-131	-261	-261	-260	-347	-599	-599	-599	-600
Riparian evapotranspiration	-2,551	-2,628	-2,236	-2,257	-1,893	-1,863	-1,890	-2,238	-1,908	-1,907	-1,907	-1,908
Outflow to bedrock	-4	-4	-2	-6	0	0	0	0	0	0	0	0
Outflow to other management areas	0	0	0	0	-285	-268	-287	-274	0	0	0	0
Total outflow	-8,420	-14,328	-8,090	-13,467	-3,397	-3,350	-3,396	-2,907	-3,678	-3,679	-3,679	-3,682
Net Change in Storage												
Inflows minus outflows	893	1,004	567	874	0	0	0	8	-2	-2	-3	-2
Sustainable yield	6,617	12,552	6,287	11,941	958	958	958	56	1,108	1,110	1,111	1,111

Notes:

(1) The 50-year future simulations use historical hydrology for 1993-2017 two times in succession.

(2) Growth + Climate Change simulation includes recharge by in-lieu variations in M&I pumping.



Data Sources: City of Lake Elsinore, Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset, Conversion Areas modified from Impact of Septic Tanks on Groundwater Quality report (2013)

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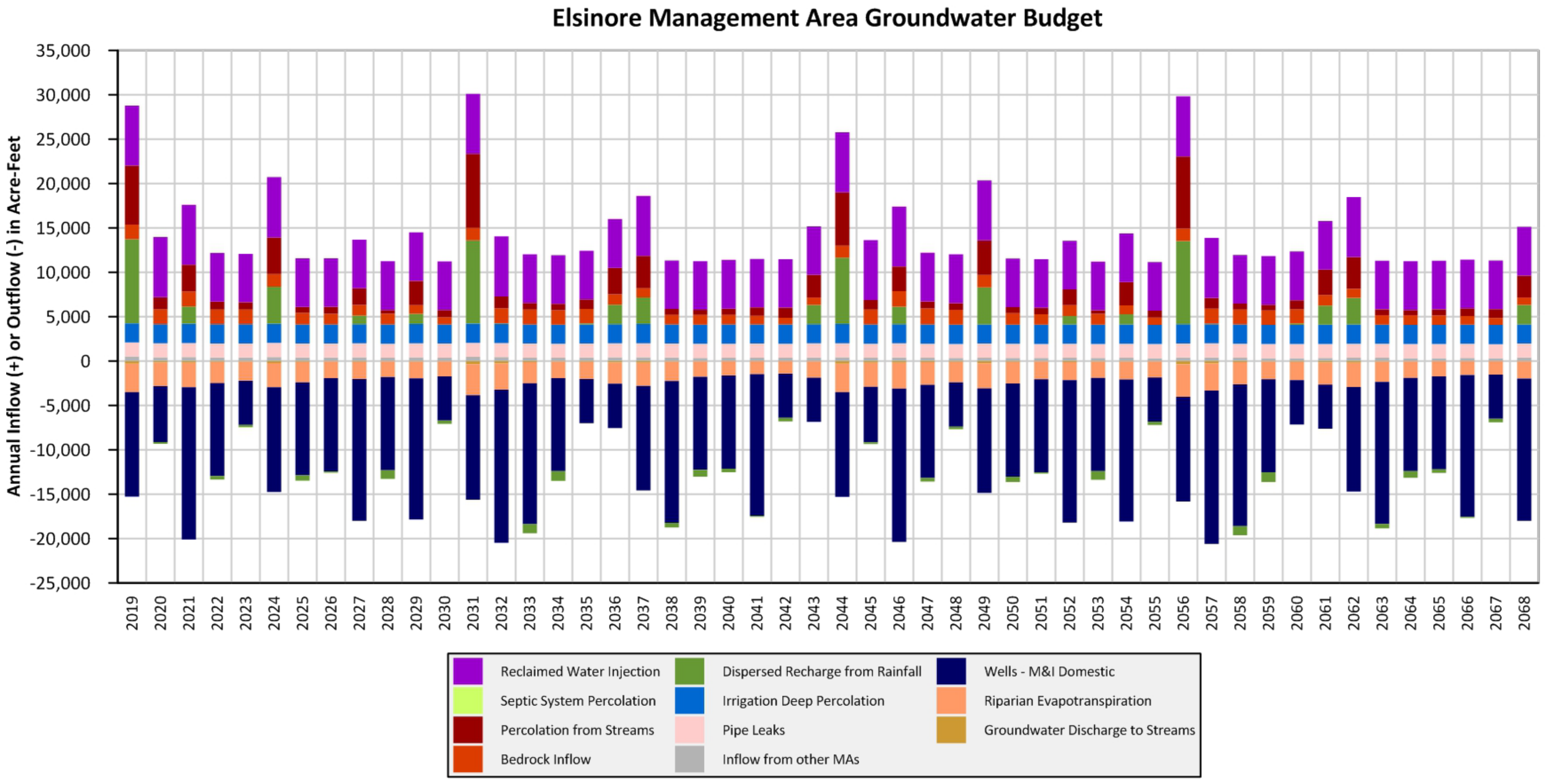
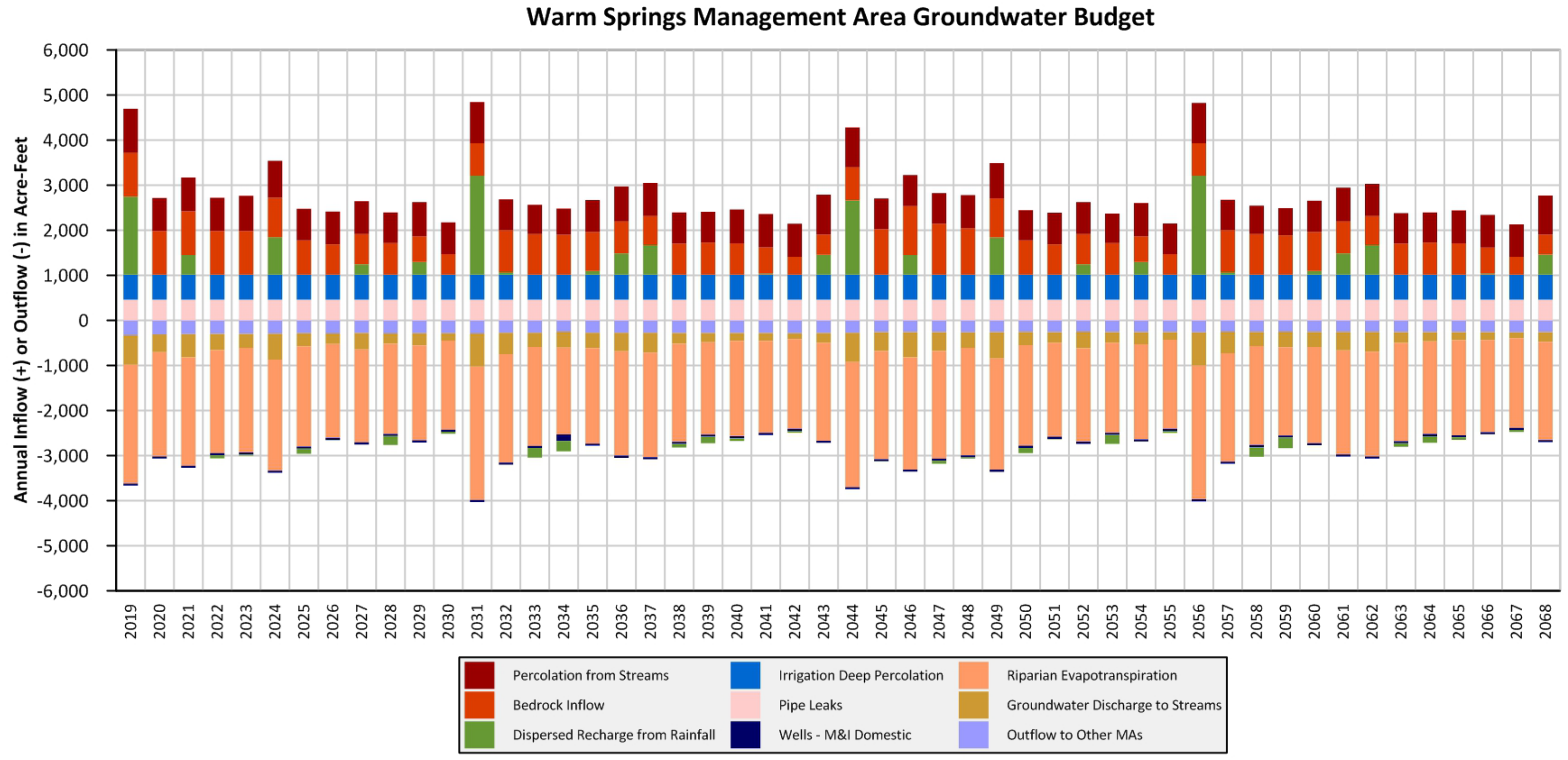
Figure 8.4 Recycled Water IPR project

Last Revised: June 23, 2021 pw://IO-PW-INT.Carollo.local:Carollo/Documents/Client/CA/EVMWD/11585A00/GIS/Fig8.4_RWIPR.mxd





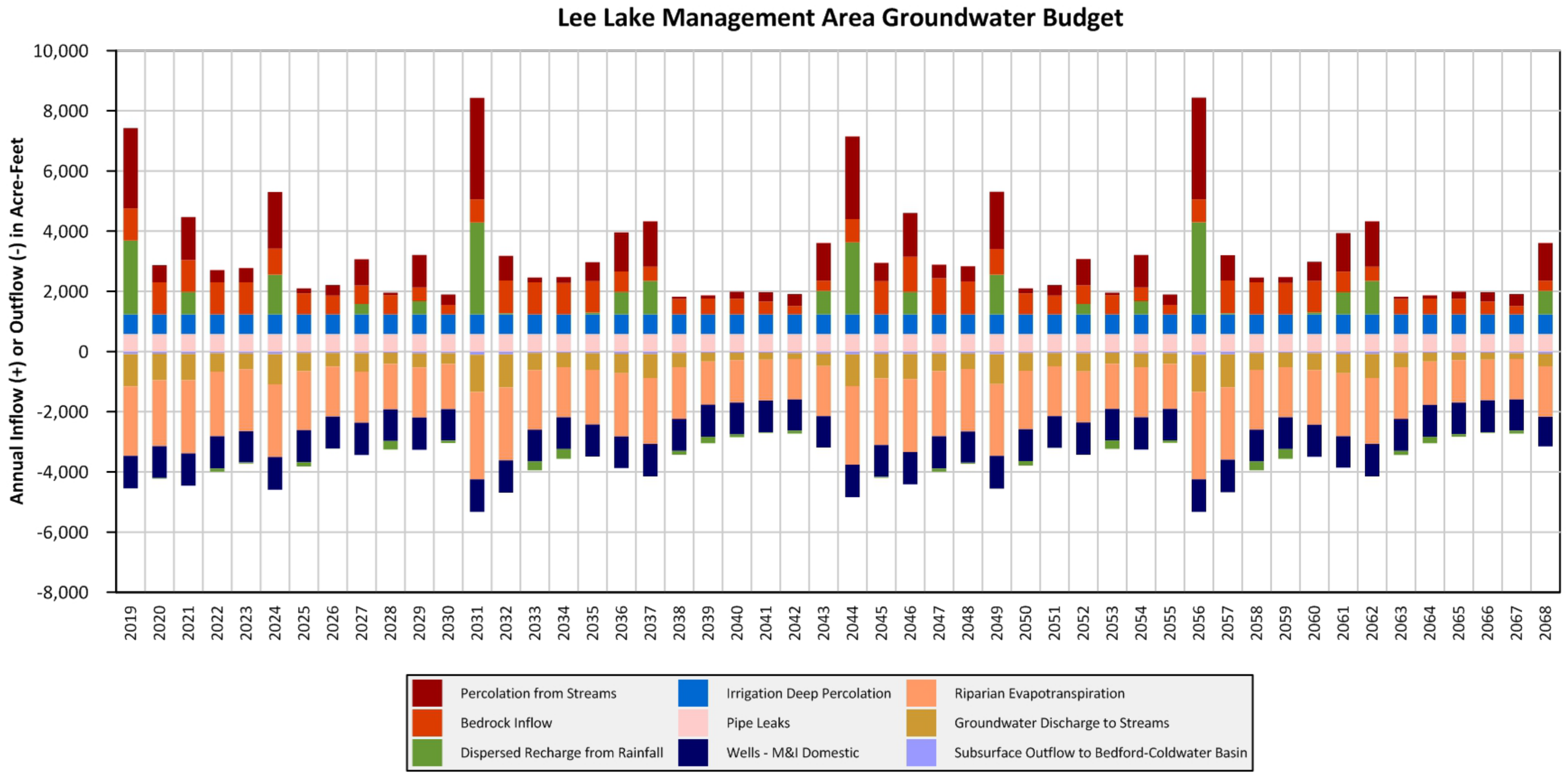


Figure 8.5 Annual Groundwater Budgets, Growth With IPR, Septic, and Palomar Well Projects

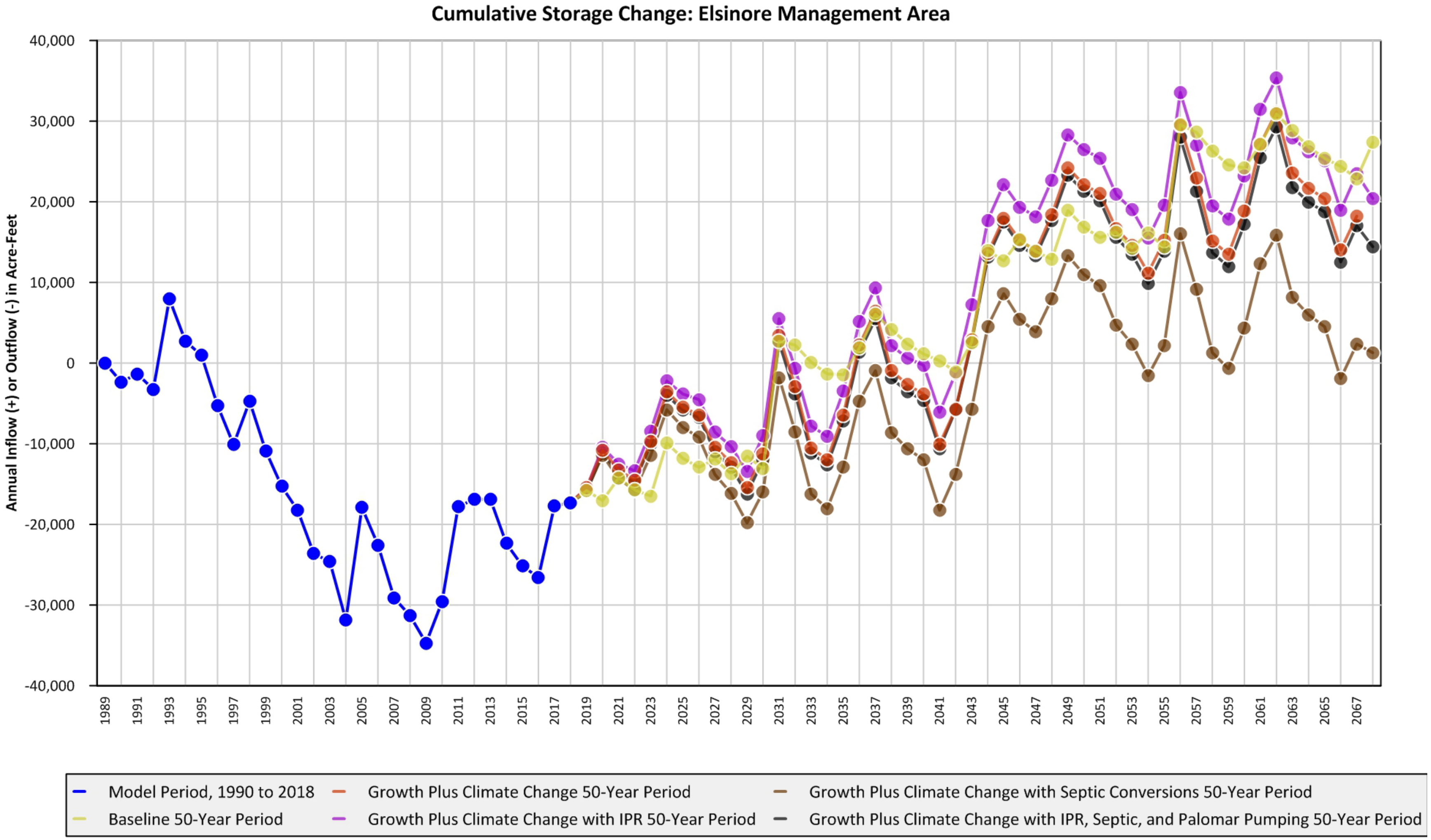


Figure 8.6 Cumulative Storage Change With and Without Projects

8.3.3.7 Expected Benefits

Expected project benefits include increased groundwater levels, salinity management, drought tolerance, and reduced dependency on imported water.

Increased Groundwater Levels: At the end of Phase 2, the project is expected to supply 6,750 AFY of IPR water to the groundwater basin at five different locations. This will help mitigate decreasing groundwater levels, particularly in the Elsinore Area (Kennedy/Jenks Consultants 2017).

Salinity Management: The anti-degradation water quality objectives for TDS objectives for the District's groundwater quality is 480 mg/L. The existing TDS levels have been slightly elevated. The IPR project utilizes advanced treatment to remove TDS and inject this product water into the basin, providing a direct reduction effect on TDS and nitrogen (Kennedy/Jenks Consultants 2017).

Drought Tolerance: The product water source for this project is wastewater generated within the District's service area. This source is generally not affected by drought conditions (indoor uses remaining relatively constant) and is also projected to grow due to anticipated population increase within the District.

Reduced Dependency on Imported Water: This project reduced the need to receive imported water, thus diversifying the District's supply portfolio.

8.3.3.8 How the Project will be Accomplished

The IPR project will utilize wastewater generated within the District's service area for its source water. Flows into the District's Regional WRF are currently projected to increase to approximately 18,000 AFY (16 mgd) by 2040, leaving approximately 7,500 AFY (6.7 mgd) of water available for an IPR project in the region. Product water will travel to the basin via a product water pump station and approximately 6-mile pipeline. The water will be injected into the basin via five injection wells located in the Back Basin in the Elsinore MA. The injected water will be extracted from existing production wells.

8.3.3.9 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. EVMWD has the water rights to the flows into the REGIONAL WRF and can use it as they please as long as Temescal Wash and Lake Elsinore obligations are met.

8.3.3.10 Estimated Costs and Funding Plan

The recycled water IPR project is projected to incur the following costs (in 2016 dollars), by phase.

- Phase 1 – Capital Cost ($45.7 million), O&M Cost ($12.4 million, over five years).
- Phase 2 – Capital Cost ($25.5 million), O&M Cost ($86.6 million, over 20 years).

The project will likely be funded through a combination of District funds and grant programs. There are currently several eligible grant programs for IPR projects through both federal and state agencies.

8.3.3.11 Management of Groundwater Extractions and Recharge

Monitoring wells and DMS are used to record and compare groundwater elevations in the Basin to evaluate pumping impacts and ongoing sustainability. Municipal groundwater extraction is monitored by metering municipal production wells operated by EVMWD.

See Chapter 7 for additional information on the existing and proposed monitoring network.

8.3.3.12 Relationship to Additional GSP Elements

The IPR project will be constructed and managed to minimize negative impacts to the groundwater basin and the other GSP projects outlined in this chapter. The project will aid in groundwater replenishment by recharging the basin with purified recycled water. Increased groundwater levels will improve the region's sustainability goals and improve basin water quality.

8.3.4 Septic Tank Conversions

8.3.4.1 Project Description

EVMWD conducted a study on the impacts of nitrate from septic tanks on groundwater quality in the Elsinore MA (Kennedy/Jenks Consultants 2013). Based on GIS data at the time, EVMWD estimated that approximately 3,900 parcels within the Elsinore MA were connected to individual septic systems, and these septic systems generated approximately 1,000 AFY of recharge to the subbasin (Kennedy/Jenks Consultants 2013).

The study found that the removal of septic systems over a 20- to 40-year period would lead to significantly lower groundwater nitrate concentrations, as compared to continued use of the septic systems (Kennedy/Jenks Consultants 2013). Furthermore, the study recommendations included a phased approach, where specific areas were prioritized based on anticipated benefit of conversion from septic systems to the sewer system.

A subsequent study was conducted to evaluate the sources and processes affecting groundwater nitrate contamination within the Elsinore MA (Sickman 2014). Sources of nitrate were identified using stable isotope measurements. Key conclusions of the study included:

- Nitrate from septic systems is entering the groundwater, and it is possible that much or most of the nitrate in some wells is coming from septic tanks.
- Denitrification is occurring, and the process of denitrification makes it challenging to assess the degree of septic contamination using only nitrate concentrations.
- Denitrification is stimulated by septic system inputs and is helping remove nitrate from the aquifer.

Groundwater modeling shows that aquifer travel time is 8 to 31 years without irrigation or 3 to 8 years with irrigation (WEI 2018). Therefore, there may be some delayed impacts to nitrate levels in groundwater due to existing nitrate in the vadose zone and lingering nitrates after septic tanks have been removed.

8.3.4.2 Measurable Objective

The SGMA set a benchmark date of January 1, 2015, requiring GSPs to address water quality deterioration beyond the baseline benchmark values. Septic systems contribute nitrate to the Subbasin. Chapter 6 establishes MTs for nitrate concentrations in the Elsinore, Lee Lake and Warm Springs, MAs. Nitrate concentrations have increased in the Subbasin over the decades, and nonetheless has been used for beneficial purposes, primarily municipal and domestic purposes. Nitrate is monitored at 24 wells throughout the Subbasin, and nitrate monitoring would be continued as septic systems are phased out to confirm nitrate concentration is decreasing as expected as described in Chapter 7.

As septic systems are phased out and connected to the sewer system, less water will infiltrate to the Subbasin. Table 8.2, above, presents the groundwater budget in the Subbasin accounting for population growth, climate change, the IPR project, and septic tank conversions. Phasing out septic systems is expected to reduce the sustainable yield of Elsinore MA by 330 AFY, assuming implementation of the IPR project, as less water is infiltrating to the Subbasin. This number is less than the total reduction in septic flows, because flows will be connected to sewer system, providing additional flows to the IPR project. This project will have no impacts to sustainable yield of the Warm Springs and Lee Lake MAs because septic conversions are planned to take place in the Elsinore MA only. The groundwater budget accounting for septic project implementation is also shown in graphical format in Figure 8.5, above.

Figure 8.6, above, shows modeling results for cumulative storage change in the Elsinore MA incorporating climate change assumptions, the IPR project, and the septic conversion project. As shown in the figure, septic conversions decrease recharge because less water will be infiltrating into the Subbasin as septic systems get connected to the sewer system.

Model results show that storage will be essentially at the same level at the end of the planning horizon as the 1989 levels set as the “zero” value.

8.3.4.3 Circumstances for Implementation

To accomplish a conversion of this scale, the District needs to first secure a reliable source of outside funding. At this current time, there are very few funding opportunities that exist for septic system conversions.

Financing septic system conversions can be a complex issue in terms of cost burden. Presently, there is no federal or state mandate requiring these to be converted, so the cost share between the District, sewer rate payers, and septic system owners remains complex, and funds are not currently available for such a project.

8.3.4.4 Public Noticing

The City of Lake Elsinore has created a fact sheet introducing the public to septic tank contamination issues and the logistics of converting to central sewer (City of Lake Elsinore 2010). This handout originated from a prior grant funding initiative in 2010 and is currently available on the City website. It is anticipated that additional, updated public education will occur when a more viable funding source is available.

8.3.4.5 Overdraft Mitigation and Management Actions

This project provides has little impact on overdraft mitigation in the Subbasin. Currently, septic systems infiltrate approximately 1,000 AFY of water into the groundwater basin. Phasing out septic systems and connecting to the sewer system will reroute this water to the Regional WRF, technically causing a net water loss of approximately 330 AFY to the Subbasin. Ultimately, this water will be treated and injected back into the Subbasin when the previously mentioned IPR project is constructed and operational.

8.3.4.6 Timetable for Implementation

Previous studies have recommended a phased removal of septic systems in the Subbasin taking place over a period of 20 to 40 years. Table 8.3 represents a suggested phasing for a 20-year timeframe (MWH 2016).

Table 8.3 Suggested Phasing for A 20-Year Timeframe

Septic Area	Conversion Timeframe
Sedco Hills	2026-2030
Wildomar and Palomar	2031-2035
North Basin	2036-2040
Lakeland and NE Lakeshore	2041-2045

Figure 8.7 shows the locations of these proposed septic conversion priority areas.

8.3.4.7 Expected Benefits

This project is expected to improve groundwater quality throughout the basin. Without this project, it is projected that 183 tons of nitrate reach the Subbasin annually, and this project would remove that nitrate from entering the groundwater basin (Kennedy/Jenks Consultants 2013).

8.3.4.8 How the Project will be Accomplished

This project needs an adequate source of funding to be secured prior to implementation.

8.3.4.9 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.

8.3.4.10 Estimated Costs and Funding Plan

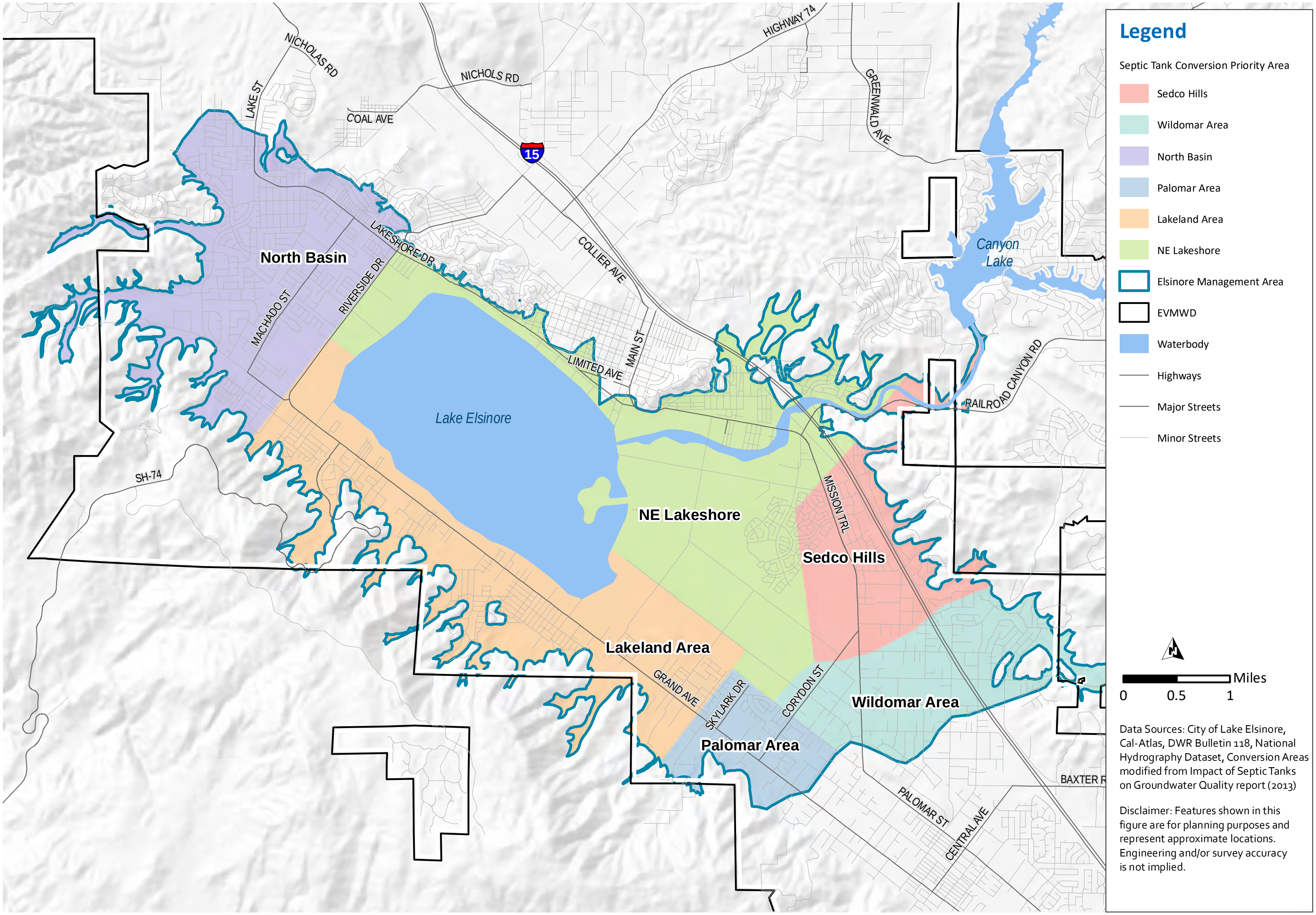
Specific costs for this project are estimated at $30,000 per customer. The project will not move forward until an outside source of funding has been secured.

8.3.4.11 Management of Groundwater Extractions and Recharge

Monitoring wells and DMS are used to record and compare groundwater elevations in the Basin to evaluate pumping impacts and ongoing sustainability. Municipal groundwater extraction is monitored by metering municipal production wells operated by EVMWD. Nitrate is monitored at 24 wells throughout the subbasin.

8.3.4.12 Relationship to Additional GSP Elements

Septic systems contribute approximately 1,000 AFY in infiltration to the Elsinore MA. As septic systems are phased out and connected to the sewer system, anticipated recharge losses to the groundwater basin will be made up with increased wastewater flow and subsequent increased recharge from the previously mentioned IPR project. The anticipated IPR project is assumed to produce 90 percent product water, 10 percent brine. So technically there would be a 100 AFY loss incurred from the conversion from septic systems to the sewer system (Kennedy/Jenks Consultants 2017).



Data Sources: City of Lake Elsinore, Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset, Conversion Areas modified from Impact of Septic Tanks on Groundwater Quality report (2013)

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Figure 8.7 Septic Tank Conversions

8.3.5 Shallow Monitoring Well Installation

8.3.5.1 Project Description

Up to six shallow monitoring wells will be drilled in areas with interconnected surface water (Temescal Wash and Horsethief Canyon) if feasible sites can be located. Figure 8.8 shows the proposed, approximate location of these monitoring wells.

The approximate locations have been identified based on existing groundwater conditions and land access. Final locations will be determined by a feasibility study that will be completed that will evaluate permitting challenges, easement access, and habitat conservation restrictions.

8.3.5.2 Measurable Objective

This project will allow for continuous monitoring at sites with known surface water connection. Groundwater levels in these wells will be incorporated into the interconnected surface water sustainable management criteria in the 5-year GSP update.

8.3.5.3 Circumstances for Implementation

Implementation is contingent on the results of the initial feasibility study.

8.3.5.4 Public Noticing

The public will be notified per CEQA requirements, see Chapter 9 for detailed info on the CEQA process.

8.3.5.5 Overdraft Mitigation and Management Actions

This project provides increased monitoring to aid in overdraft mitigation and protection of interconnected surface waters and associated riparian habitat.

8.3.5.6 Timetable for Implementation

The feasibility study is anticipated to initiated prior to 2026. Design and construction will be completed subsequently to completion of the study should sites be identified.

8.3.5.7 Expected Benefits

The installation of these monitoring wells will allow the District to track groundwater levels in the Temescal Wash and Horsethief Canyon, identifying timing and triggers for future management actions, if needed.

8.3.5.8 How the Project Will be Accomplished

Pending results of the feasibility study, shallow monitoring wells will be drilled at Temescal Wash and Horsethief Canyon in locations of known connection to the shallow groundwater table. The wells will be approximately 20 to 30 feet in depth and 6 to 8 inches in diameter with 2-inch polyvinyl chloride (PVC) casings and screens, drilled with a hollow stem auger.

8.3.5.9 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.

8.3.5.10 Estimated Costs and Funding Plan

The District estimates approximately $200,000 in capital expenses for the completion of a siting feasibility study, design, and installation of six new shallow monitoring wells. The project will be financed from existing District budgets or outside funding sources, if available.

8.3.5.11 Management of Groundwater Extractions and Recharge

Monitoring wells and DMS are used to record and compare groundwater elevations in the Basin to evaluate pumping impacts and ongoing sustainability.

See Chapter 7 for additional information on the existing and proposed monitoring network.

8.3.5.12 Relationship to Additional GSP Elements

The monitoring wells serve to fill data gaps with respect to interconnected surface water in the Subbasin and may inform future management actions or projects required.

8.4 Identified Projects and Management Actions That May Be Considered in the Future (Group 3)

Although it is anticipated that the Subbasin will achieve sustainability with the implementation of Group 1 and Group 2 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 Subbasin sustainability.

It should be noted that conservation is not considered a Group 3 management action. The District is intending to pump the sustainable yield amount from the Subbasin. Any conservation in the region will reduce the amount of imported water purchased and will not modify the amount of groundwater pumped.

8.4.1 Stormwater Capture and Recharge

Stormwater capture projects have been considered in the McVicker and Leach Canyons. The Leach Canyon site can capture runoff from the adjacent Santa Ana Mountains. However, this runoff currently recharges the Elsinore subbasin or flows into Lake Elsinore and is accounted for in EVMWD's lake replenishment obligation (Kennedy/Jenks Consultants 2017). Past studies concluded that project implementation would be expensive due to large property acquisition and space requirements. Property acquisition for such sites may not be possible. Furthermore, the resulting project would have low reliability due to sporadic precipitation in the region (EVMWD 2017).

8.4.2 Imported Water Recharge and Recovery

Both MWDSC and EVMWD have benefitted from ASR in the Elsinore Valley Basin. EVMWD has stored approximately 8,000 AF during wet periods in the basin for use during prolonged drought (EVMWD 2017). EVMWD injected and recovered imported water from 2004 to 2013 but the program was stopped due to mechanical concerns with the well pumping equipment.

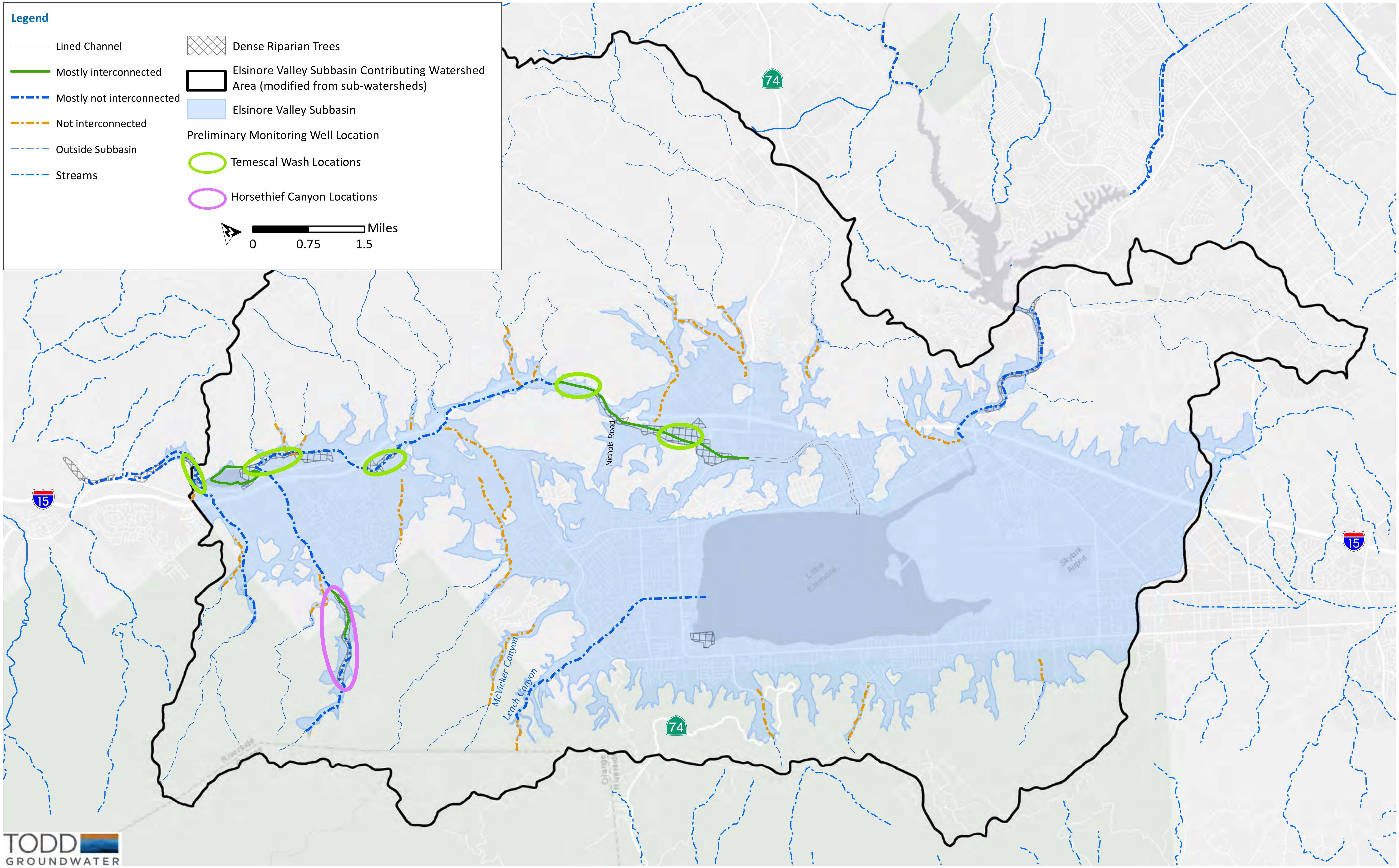


Figure 8.8 Preliminary Shallow Monitoring Well Locations

EVMWD can receive both treated and untreated imported water via MWDSC. Untreated imported water is delivered via the San Jacinto River into Canyon Lake (EVMWD 2017), while treated water is delivered through Auld Valley and Temescal Valley pipelines or via the CLWTP. Both raw or treated imported water could be recharged into the groundwater basin via spreading basins or direct injection if infrastructure exists.

Spreading basins are currently not feasible due to space constraints in the region.

Injection wells using treated imported water could be used if water were available at a price that makes this economically attractive, however, as EVMWD has moved away from dual injection/extraction wells due to past mechanical failures, new injection wells would be required. In addition, previously offered incentivized, discounted rates from MWDSC for imported groundwater recharge are not available at this time.

Injection wells using raw imported water would require piping from Canyon Lake to a series of new injection wells as there is currently no infrastructure to move untreated water from Canyon Lake into the groundwater basin. Furthermore, MWDSC has previously offered incentivized, discounted rates for imported groundwater recharge that are not available at this time.

8.4.3 Begin Groundwater Pumping in Warm Springs Management Area for Municipal Use

The Warm Springs MA currently has a single well used for non-potable irrigation purposes but has never been utilized for potable water purposes. In 2018, EVMWD drilled an exploratory well to evaluate the feasibility of installing a future municipal well in the Warm Springs MA. The well was dry, and no water was found in the well. Hydrologic studies estimated a range of safe yield in the Warm Springs MA from 910 to 2,410 AFY (Geoscience and Kennedy/Jenks 2017).

Based on the groundwater modeling performed as part of this GSP, the sustainable yield in the Warm Springs MA is approximately 950 AFY in the Future Growth plus Climate Change scenario as discussed in Chapter 5. However, due to the difficulty in siting a well with water in the Warm Springs MA, EVMWD has no plans to begin pumping from the Warm Springs MA for municipal use at this time. Also, due to the high historical TDS levels in the area, significant treatment may be necessary to use this water as a potable source. EVMWD may, in the future, choose to use the Warm Springs MA as a potable water source, but has no plans to do so at the time this GSP was developed.

8.5 Recommended Plan

Table 8.2, above, includes the water budget for the recommended projects as part of this GSP. Figures 8.5 and 8.6, above, graphically depict the water budget and the storage change, respectively, for the recommended projects. The recommended plan includes the following projects:

- Groundwater Well Replacements (including replacement of Palomar Well).
- Manage Pumping in Elsinore MA with In-Lieu Recharge due to Conjunctive Use Agreements.
- Begin Groundwater Pumping in Lee Lake MA for Municipal Use.
- Rotate Pumping Locations and Flows.
- Recycled Water IPR.
- Septic Tank Conversions.

With these projects implemented, the model recommends the following quantities pumped from each respective MA:

- Elsinore MA: 13,467 AFY.
- Warm Springs MA: 2,907 AFY.
- Lee Lake MA: 3,682 AFY.

Detailed water budgets for each of the three MAs is included in Appendix I.

Chapter 9

ENVIRONMENTAL COMPLIANCE AND PERMITTING

9.1 California Environmental Quality Act

The CEQA does not apply to the preparation and adoption of a GSP, however any projects implemented as a result of an adopted GSP or management actions approved by the GSA or other public agency would be subject to CEQA as discretionary actions. The appropriate CEQA compliance document will vary depending on the implementation action or project. The following environmental compliance documents may be appropriate for future projects and management actions:

- *Notice of Exemption (NOE)*- A NOE filed with the County Clerk and State Clearinghouse would be the appropriate CEQA compliance document if the proposed project is categorically or statutorily exempt as defined in the Public Resources Code (Articles 18 and 19).
- *Negative Declaration (ND) or Mitigated Negative Declaration (MND)*- An ND or MND would be prepared for projects or management actions that require discretionary approval but that would not result in significant impacts. The ND or MND would document any potential environmental impact caused by the implementation or operation of a project or action in compliance with Appendix G of the CEQA Guidelines. An ND or MND must include a 20 to 30-day public review period prior to being adopted by the lead agency. A Notice of Determination (NOD) would be filed with the County and with the State Clearinghouse.
- *Environmental Impact Report (EIR)*- An EIR would be prepared if a project could potentially result in a significant environmental impact. The EIR would document any potential environmental impact caused by the implementation or operation of a project or action in compliance with Appendix G of the CEQA Guidelines. An EIR describes impacts and mitigation measures and is the only appropriate CEQA document when a significant impact of the project would be unavoidable and that no feasible mitigation measures are identified that could reduce the impacts to below an established threshold. An EIR may also be an appropriate CEQA compliance document for projects that are is controversial in nature, or that require substantial stakeholder engagement. An EIR must be certified and adopted by the lead agency and the adopted mitigation monitoring and reporting program, and the NOD filed with the County and the State Clearinghouse.

9.2 Regulatory Permit Compliance

Projects may be subject to permitting requirements if they are located in areas that may affect waters of the State or the U.S. or if they could impact sensitive species or protected habitats. Locating new facilities and developing construction methods should consider the need to obtain permits required by the State, under the Porter-Cologne Water Quality Control Act, as well as the federal Clean Water Act (CWA), the state and federal Endangered Species Acts, and the California Fish and Game Code. In addition, recycled water regulations have been developed requiring permits promulgated under CCR Title 22 that regulate treatment and end uses of recycled water. The following sections provide brief overviews of these permit requirements.

Section 402 of the federal CWA regulates discharges to waters of the U.S. through the NPDES permit program implemented through the USEPA. Any discharges to local drainages including storm drain dischargers are subject to this regulation. Section 404 of the federal CWA establishes a permitting program through the U.S. Army Corps of Engineers to regulate the discharge of dredged or fill material into waters of the U.S., including wetlands. Any project that may affect waters of the U.S. is subject to this permit. Section 401 of the federal CWA requires that the State certify that the 404 permit adequately addresses potential water quality issues.

The State of California has parallel requirements to protect waters of the State under the Porter-Cologne Water Quality Control Act. The State Water Resources Control Board through the local SARWQCBs require waste discharge requirements (WDRs) for any discharge to a water of the State.

The California Fish and Game Code Section 1602 requires any person, state or local governmental agency, or public utility to notify California Department of Fish and Wildlife prior to beginning any activity that may do one or more of the following:

- Divert or obstruct the natural flow of any river, stream, or lake.
- Change the bed, channel, or bank of any river, stream, or lake.
- Use material from any river, stream, or lake.
- Deposit or dispose of material into any river, stream, or lake.

Title 22 Recycled Water Regulations outline State water quality standards for recycled water and its reuse under the Porter-Cologne Act and the SWRCB's 2019 Water Recycling Policy. Every recycled water project is required to comply with Title 22 regulations with oversight from the SWRCB and local SARWQCB.

The Riverside County Department of Environmental Health regulates well drilling within the Subbasin. A Monitoring Well Application must be completed and approved prior to drilling monitoring wells within the area. The application includes proposed well location, proposed construction methods and depth, and well driller information. There is a separate application process for the installation of drinking water or agricultural wells, requiring similar information.

9.3 GSA Projects Environmental Compliance

The following proposed projects are actions described in this GSP and are described in more detail in Chapter 8.

9.3.1 Extraction Wells and Operational Pumping Flexibility

EVMWD proposes to add two extraction wells in the subbasin with a combined average flow rate of 1,000 to 1,200 gpm. In addition, EVMWD operates a series of ten extraction or dual-purpose wells in the MA. The District is equipped to rotate pumping locations as needed should water levels drop disproportionally in one area of the basin versus the other. This will help to keep groundwater basin levels consistent throughout.

To install these wells, EVMWD has finalized a CEQA document evaluating the potential for the new wells to result in adverse environmental impacts. The proposed wells could be evaluated in an MND or EIR depending on the location and potential for resulting in significant impacts. The analysis has evaluated the potential for groundwater wells to affect GDEs. The CEQA document has identified the necessary permits needed for the project that will depend on its location, proximity to drainages and wetlands, and potential to affect habitats and species of concern.

9.3.2 Recycled Water IPR Project

EVMWD proposes to construct a 6-mgd AWTF at the existing Regional WRF site, and a series of five injection wells throughout the groundwater basin on the southeast side of Lake Elsinore. At full buildout, approximately 6,750 AFY of recycled water will be injected into the groundwater basin.

To construct the new AWTF, EVMWD will be required to adopt a CEQA document evaluating the potential for the project to result in adverse environmental impacts. The appropriate level of CEQA documentation will depend on the potential for significant impacts. However, construction of a new AWTF most likely would require an EIR. The CEQA document will identify the necessary permits needed for the project that will depend on its location, proximity to drainages and wetlands, and potential to affect habitats and species of concern.

9.3.3 Septic Tank Conversions

EVMWD proposes to remove septic tanks from the Elsinore Valley Subbasin over a 20- to 40-year period. The removal of the septic tanks would significantly lower groundwater nitrate concentrations.

Septic tank conversions would require installation of new sewer collection systems constructed to connect with residences and other land uses that currently are not connected to the sanitary system. This may involve a series of similar construction efforts stretched out over a long period of time. EVMWD will be required to adopt a CEQA document evaluating the potential for each of the system expansion efforts to result in adverse environmental impacts. The appropriate level of CEQA documentation will depend on the potential for significant impacts. However, construction of a large new collection system may best be accomplished all at once in a Program EIR. Otherwise, individual smaller projects may require MNDs. Categorical exemptions may also be sufficient for individual connections and pipelines less than one mile in length. The lead agency has discretion to select the most appropriate level of documentation. The CEQA document will identify the necessary permits needed for the projects that will depend on their location, proximity to drainages and wetlands, and potential to affect habitats and species of concern.

Chapter 10

IMPLEMENTATION PLAN

10.1 Implementation Plan Overview

The GSP will be adopted by the EVMWD in December 2021. Implementation of the GSP will commence after the GSP is adopted. The plan will be submitted to DWR by January 31, 2022. Within 20 days of submittal DWR will post the plan for public viewing and will initiate a 75-day public comment period. The GSP will be approved by DWR within 2 years of the closing of the public comment period. EVMWD will initiate work on the identified management actions and projects during the DWR review period.

This section describes components of the GSP plan implementation including implementation costs (administrative and project costs), funding sources/options, implementation schedule, data management, annual reporting, and periodic (5-year) evaluations.

10.2 GSP Implementation Costs

GSP implementation costs include administrative costs and project/management action costs. These costs are described in more detail in the following sections. One important component of GSP implementation is the monitoring program and associated activities including data management, analysis and reporting. The cost of the monitoring program and associated costs are included in the administrative expenses for the GSP.

10.2.1 Administrative Costs

The Administrative costs for the GSP are associated with the following major categories:

- Agency Administration Operations, and Management - This category includes administrative staff support, finance staff support and related expenses, insurance, organizational memberships and conferences, miscellaneous supplies and materials. In addition, this category includes costs associated with planning and technical needs that arise with implementation of the GSP.
- Legal – This category includes legal services in groundwater specific issues and SGMA, as needed.
- Data Collection (monitoring), Data Analysis, and Technical Studies – The monitoring program is described in Section 7. Future technical studies are described in Section 7 and include a Synoptic Study on GDEs in Temescal Wash and an Arsenic Leaching Study.
- Annual/Periodic Reporting and DMS – Annual and periodic reporting activities are described in more detail in sections 10.6 and 10.7. DWR requires annual reports on GSP implementation. In addition, period reports are required at least every 5 years or upon amendment of the GSP. Per GSP regulations, the first annual report will be due in April 2022, and the first 5-year period report will be due in 2026. Development of the annual and periodic report will rely on the availability of data collected as prescribed in

the monitoring plan. A DMS will be developed to provide a single repository for data. The DMS for the GSP is described in more detail in Section 10.5.

- Outreach and Education – EVMWD will conduct outreach and education activities to encourage public involvement in the GSP implementation. Specifically, this category covers costs for ongoing maintenance of the GSP website.

EVMWD will be responsible for all administrative costs associated with implementation of the GSP. EVMWD may hire consulting firms to develop the GSP Annual Reports, 5-Year Periodic Reports, maintenance of the DMS, and other components associated with implementation of the GSP. If this is the case, then EVMWD may want to include the specific expenses in their annual budget. GSP implementation related services that may be provided by external consulting (or other) firms, and associated budget estimates are as follows:

- Reporting Requirements:
  - Annual Reports: The first annual report will be $100,000 (2022), future annual reports will be $75,000 annually.
  - Five Year Periodic Report: The five-year report will be $500,000 (2026). An annual report will not be required this year.
- Technical Studies:
  - Synoptic Study on GDEs in Temescal Wash: Approximate cost is $200,000. To be performed when funds are available. Additional information is available in Section 7.7.3.
  - Arsenic Leaching Study: Approximate cost is $200,000. To be performed when funds are available. Additional information is available in Section 7.7.3.

10.2.2 Project and Management Action Costs

The identified projects and management actions of the GSP are described in Section 8. The projects and management actions of the GSP were grouped into the following three groups:

- Group 1 - Baseline Projects and Management Actions.
- Group 2 - Projects and Management Actions Evaluated Against the Sustainable Management Criteria.
- Group 3 - Identified Projects and Management Actions That May Be Evaluated in the Future.

The projects and management actions in Group 3 are conceptual at this time and require further evaluation, including development of cost estimates. This section describes the costs associated with the projects and management actions included in Group 1 and Group 2. The project and management action costs are summarized in Table 10.1.

Table 10.1 Project and Management Action Costs

Project	Capital Cost	Additional Considerations
Groundwater Well Replacements	$5.1 million for Palomar Well	Wells will be replaced as needed.
Manage Groundwater Pumping in Elsinore MA with In-Lieu Recharge Due to Conjunctive Use Agreements	NA	This is an ongoing management action, and no changes are anticipated in response to implementation of the GSP. No additional budget needs to be identified to maintain this practice.

Project	Capital Cost	Additional Considerations
Begin Groundwater Pumping in Lee Lake MA for Municipal Use (Two New Extraction Wells)	$8.6 million	Estimated capital cost is $8.6 million. This cost is offset by $3.0 million through SARCCUP IRWM grant.
Rotate Pumping Locations and Flows	NA	EVMWD is presently equipped to rotate pumping locations as needed.
Recycled Water IPR Project	Phase 1 - $45.7 million Phase 2 - $25.5 million	Total planned IPR treatment capacity is 6 mgd (Phase 1 and Phase 2 each at 3 mgd).
Septic Tank Conversions	Approx. $30,000 per customer	Septic tank conversions will be implemented with funding is available.
Shallow Monitoring Well Installation	$200,000	Final well quantities and locations will be determined by an initial feasibility study.

Note:
(1) Includes costs for projects and management actions in Group 1 and Group 2.

10.3 Funding Sources

Funding for implementation of the GSP is described in the following sections.

10.3.1 Administrative Expenses

Administrative expenses will be funded by EVMWD. Since this GSP was developed and will be implements by a single agency, EVMWD, there is not an opportunity for cost sharing.

10.3.2 Project Costs

Project cost and management actions will be funded by EVMWD. Since this GSP was developed and will be implements by a single agency, EVMWD, there is not an opportunity for cost sharing, unless grant funding is available.

10.3.3 Grant Funding

If grant funding opportunities arise then EVMWD will pursue grant funding for GSP projects and management actions.

10.4 Implementation Schedule

The GSP implementation schedule includes Group 1 and Group 2 projects and management actions. The schedules for individual projects and management actions are described in Section 8. Table 10.2 includes a summary of project start and completion dates.

Table 10.2 GSP Implementation Schedule

Project	Start Date	Completion Date	Additional Considerations
Groundwater Well Replacements	Ongoing	NA	
Manage Groundwater Pumping in Elsinore MA with In-Lieu Recharge Due to Conjunctive Use Agreements	Ongoing	NA	
Begin Groundwater Pumping in Lee Lake MA for Municipal Use	Construction beginning 2022	Construction completed by 2023, and operational by 2024	Design of the Lee Lake Wells is ongoing and final design expected to be completed by summer 2022
Rotate Pumping Locations and Flows	Ongoing	Not Applicable	Rotating pumping locations and flows will be conducted as needed, in response to water levels dropping disproportionally in one area of the basin versus the other.
Recycled Water IPR Project	Research and Piloting - To be determined(2) Phase 1 Design start – 1 year after completion of pilot testing	Research and Piloting - 1 year after start date Phase 1 operational - 5 years after completion of Phase 1 Design Phase 2 - 5 years after operation of Phase 1	
Septic Tank Conversions	Unknown	Not specified	Septic tank conversions will likely occur in a phased implementation schedule over a 20- to 40-year period if funding is available.
Shallow Monitoring Well Installation	Feasibility study initiating by 2026	Unknown at this time	

Notes:

(1) Includes schedules for projects and management actions in Group 1 and Group 2.

(2) Flow at the RWRF will need to exceed 9.5 mgd before an IPR project will be implemented. As flows increase and flow projections are updated EVMWD will be able to better estimate the IPR implementation schedule. Piloting should begin approximately 7 years before the target date for Phase 1 IPR Implementation.

10.5 Data Management System

GSA are required to develop and maintain a DMS that is capable of storing and reporting information relevant to the development or implementation of the Plan and monitoring of the basin (SGMA regulations 352.6). The DMS will serve as a single repository for data aggregation and analysis to support development of the annual and periodic reports, with data updated on a regular basis. The DMS will include:

- Well locations, type, construction details.
- Groundwater elevations.
- Seasonal groundwater contours.
- Groundwater quality.
- Groundwater production/extraction.
- Groundwater recharge.
- Streamflow.
- Precipitation.
- Storage and change in storage.

10.6 Annual Reports

Preparation and submittal (to DWR) of an annual report the implementation of the GSP is required by SGMA regulations. Annual reports are due by April 1 each year following the adoption of the GSP. DWR has prepared a "GSP Annual Report Element Guide" (Groundwater Sustainability Plans (ca.gov)).

Per SGMA regulations and GSP Annual Report Element Guide, the annual report should generally include the following components for the preceding water year:

- General Information.
- Basin Conditions.
- Plan Implementation Progress.

Table 10.3 presented the proposed outline for the annual report, and a brief description of each section based on the GSP Annual Report Element Guide.

Table 10.3 Proposed Annual Report Outline

Report Outline(1)	Description
Executive Summary	
Chapter 1 - Introduction	• General information on the basin and location. • Sustainable management criteria.
Chapter 2 – Basin Conditions	
2.1 Groundwater Level	• Groundwater elevation contour maps. • Groundwater elevation hydrographs and water year type (January 2015 to reporting year).
2.2 Groundwater Use	• Groundwater extraction by water use sector.
2.3 Surface Water Use	• Surface water used for recharge for in-lieu purposes.
2.4 Total Water Use	• Total waste use by sector and water source.
2.5 Groundwater Storage	• Change in groundwater storage for each principal aquifer. • Water year type, groundwater use, change in storage, and cumulative change in storage since January 2015.

Report Outline[1]	Description
Chapter 3 – Plan Implementation Progress	
3.1 Monitoring Program Changes	• Adjustments to the monitoring program, as needed.
3.2 Groundwater Projects and Management Actions Status	• Interim milestones and progress in implementation of management actions.

Note:
(1) Based on SGMA Regulation § 356.2.

10.7 Periodic (5-Year) Reports

Per SGMA regulations, EVMWD is required to conduct period evaluations of the GSP at least every 5-years (5-Year Periodic Report) and whenever the GSP is amended. The objective of the periodic evaluation is to assess changing conditions in the basin and make adjustment, as needed, to the plan objectives and components. The 5-Year Periodic Report will focus on the evaluating the implementation actions in the context of meeting the GSP objectives and sustainability goals.

The 5-Year Periodic Report will require a review of all items in the GSP, updating portions as needed. While the annual reports will inform the 5-Year Periodic Report, it is assumed that the 5-Year Periodic Report will require updated groundwater modeling analysis and an update to necessary portions of the GSP. The 5-year periodic evaluations will be significantly more detailed than the annual reports.

Required elements for the 5-Year Periodic Report are included in SGMA regulations. The proposed outline for the 5-Year Periodic Report is presented in Table 10.4.

Table 10.4 Proposed 5-Year Periodic Report Outline

Report Outline[1]	Description
Executive Summary	
Chapter 1 – Introduction	• General information on the basin and location. • Sustainable management criteria.
Chapter 2 – Sustainability Evaluation	• Current groundwater conditions for each applicable sustainability indicator relative to measurable objectives, overall sustainability, progress towards interim milestones and minimum thresholds, groundwater elevations in relation to MTs. In addition, identification of attainment of adaptive management triggers and plans for implementing adaptive management.
Chapter 3 – Implementation Progress - Projects and Management Actions	• Description of the status of projects and management actions, assessment of activation of adaptive management triggers, and an updated implementation schedule and any new projects. • Description of the effect of on groundwater conditions resulting from implementing management actions and projects.

Report Outline(1)	Description
Chapter 4 – Revised Plan Elements	• Revisions (as needed based on new information) to plan elements including the basin setting, MAs, sustainability criteria, or the identification of undesirable results and the setting of MTs and MOs. • Revisions, as needed, to changes to groundwater uses or supplies and outcomes of project implementation. • Revisions based on any new information available since the last 5-Year Period Report.
Chapter 5 – Mitigation Measures	• Identification of measures to mitigate overdraft conditions, if identified in the evaluation
Chapter 6 – Monitoring Program	• Description of the monitoring network, assessment of monitoring network function, monitoring network data gaps, and actions necessary to improve the monitoring network.
Chapter 7 – Regulatory Actions	• Description of relevant actions, including regulations or ordinances implemented by DWR since the previous 5-Year Period Report.
Chapter 8 – Enforcement Actions	• Description of any enforcement or legal actions related to furthering the sustainability goal for the basin.
Chapter 9 – Plan Amendments	• Description amendments to the GSP including adopted amendments, current/ongoing amendments, and proposed future amendments.
Chapter 10 – Agency Coordination	• Summary of coordination with other agencies
Chapter 11 – Reporting to Stakeholders and Public	• Reporting on outreach activities associated with implementation of the GSP.

Note:

(1) Based on SGMA Regulation §356.4.