Hazen TODD GROUNDWATER

City of Simi Valley
Waterworks District No. 8

Feasibility Study to Develop the Simi Valley Basin as a Potable Water Resource

August 2018

Feasibility Study to Develop the Simi Valley Basin as a Potable Water Resource

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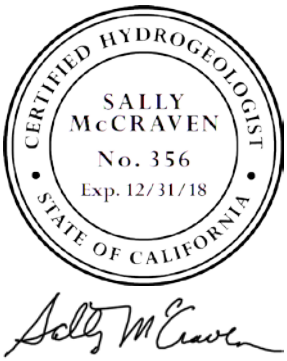
Waterworks District No. 8

Final Report
August 2018



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List of Acronyms

Abbreviation	Definition
A-F	acre feet
AFY	acre-feet per year
BSBPOs	Basin-Specific Basin Plan Objectives
°C	Degrees Celsius
Calleguas	Calleguas Municipal Water District
CASGEM	California Statewide Groundwater Elevation Monitoring Program
CCPP	calcium carbonate precipitation potential
City	City of Simi Valley
County	Ventura County
CRA	Colorado River Aqueduct
CT	Contact time
CY	Calendar Year (January 1 to December 31)
DDW	State Water Resources Control Board Division of Drinking Water (formerly California Department of Public Health)
District	Ventura County Waterworks District No. 8
DTSC	Department of Toxic Substances Control (DTSC)
DWR	California Department of Water Resources
DWSAP	Drinking Water Source Assessment Program
Fe	Iron
ft/d	feet per day
ft-msl	feet mean sea level
FWTP	finished water treatment plant
gfd	gallons per foot per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
gpm/ft^2	gallons per minute per square foot
GAMA	Groundwater Ambient Monitoring and Assessment Program
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
Hazen	Hazen and Sawyer
HGL	Hydraulic Grade Line
LARWQCB	Los Angeles Regional Water Quality Control Board
LSI	Langelier Saturation Index
MCL	Maximum Contaminant Level
Metropolitan	Metropolitan Water District of Southern California
MGD	million gallons per daymg-min/L Milligram-minute per liter
Mn	Manganese
MWD	Metropolitan Water District of Southern California
NA	not applicable
ND	Non detectable/not detected
NL	Notification Level
NPSHR	net positive suction head required
NRC	National Research Council
O&M	Operations and Maintenance
OEHHA	Office of Environmental Health Hazard Assessment

PCE	perchloroethylene
PFD	Process Flow Diagram
psi	pounds per square inch
PWPS	product water pump station
PWTM	product water transmission main
ppm	parts per million
SCADA	supervisory control and data acquisition
SGMA	Sustainable Groundwater Management Act
SMCL	Secondary Maximum Contaminant Level
SMP	Salt Management Pipeline
SNMP	Salt and Nutrient Management Plan
S/Ns	salts and nutrients
SWP	State Water Project
SWRCB	State Water Resources Control Board
TCE	trichloroethelene
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
Todd	Todd Groundwater
TP	Treatment Plan
µg/L	micrograms per liter
USBOR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency

Executive Summary

Purpose and Objectives

This report, "Feasibility Study to Develop the Simi Valley Basin as a Local Water Resource" (Study) was commissioned by the City of Simi Valley, Ventura County Waterworks District No. 8 (District) to evaluate the feasibility and cost effectiveness of producing groundwater from the Simi Valley Groundwater Basin as a drinking water source to serve its customers. A location map of the Study area is presented in Figure ES- 1.

The Study relies and builds upon the data and findings from the "Characterization and Water Supply Assessment, Simi Valley Basin" (Todd Groundwater, March 2016) (Characterization Study) that was also commissioned by the District. The Characterization Study found the sustainable yield of the Basin to be approximately 9,000 acre-feet per year (AFY) and determined that groundwater from the Basin has a high concentration of salts making it unsuitable for drinking water.

In order to make a suitable source of drinking water, groundwater treatment is necessary and was evaluated as part of the Study. Treatment for salts in a water source requires brine disposal and the planned extension of the Calleguas Municipal Water District's (Calleguas) Salinity Management Pipeline (SMP) to Simi Valley within the next 5 years, provides an ideal brine disposal alternative.

The objectives of the Study were as follows:

- Identify potential well sites to maximize production from the Simi Valley Basin,
- Estimate the production capacity for each well,
- Determine the water treatment processes needed to meet the current drinking water standards,
- Identify project site(s) for a groundwater treatment plant,
- Determine availability of power to the site(s),
- Determine the infrastructure requirements to convey the raw well water to the water treatment plant site(s),
- Determine the water quality requirements and infrastructure requirements to connect the treated water (finished product water) to the existing potable water system,
- Determine the infrastructure to convey the brine from the water treatment plant site to the salinity management pipeline (SMP), and
- Estimate the engineering, capital and operating costs for each alternative.

Findings

The Study determined that groundwater could be extracted from the Basin using standard water extraction wells and piped to a centralized groundwater treatment facility to reduce/remove hardness, sulfates and total dissolved solids present in the water to make it suitable for drinking water and meet the current drinking water standards. The treatment process would also result in brine waste that would need to be conveyed for disposal.

To produce between 5,160 to 5,483 AFY of drinking water, the Study recommends the following facilities:

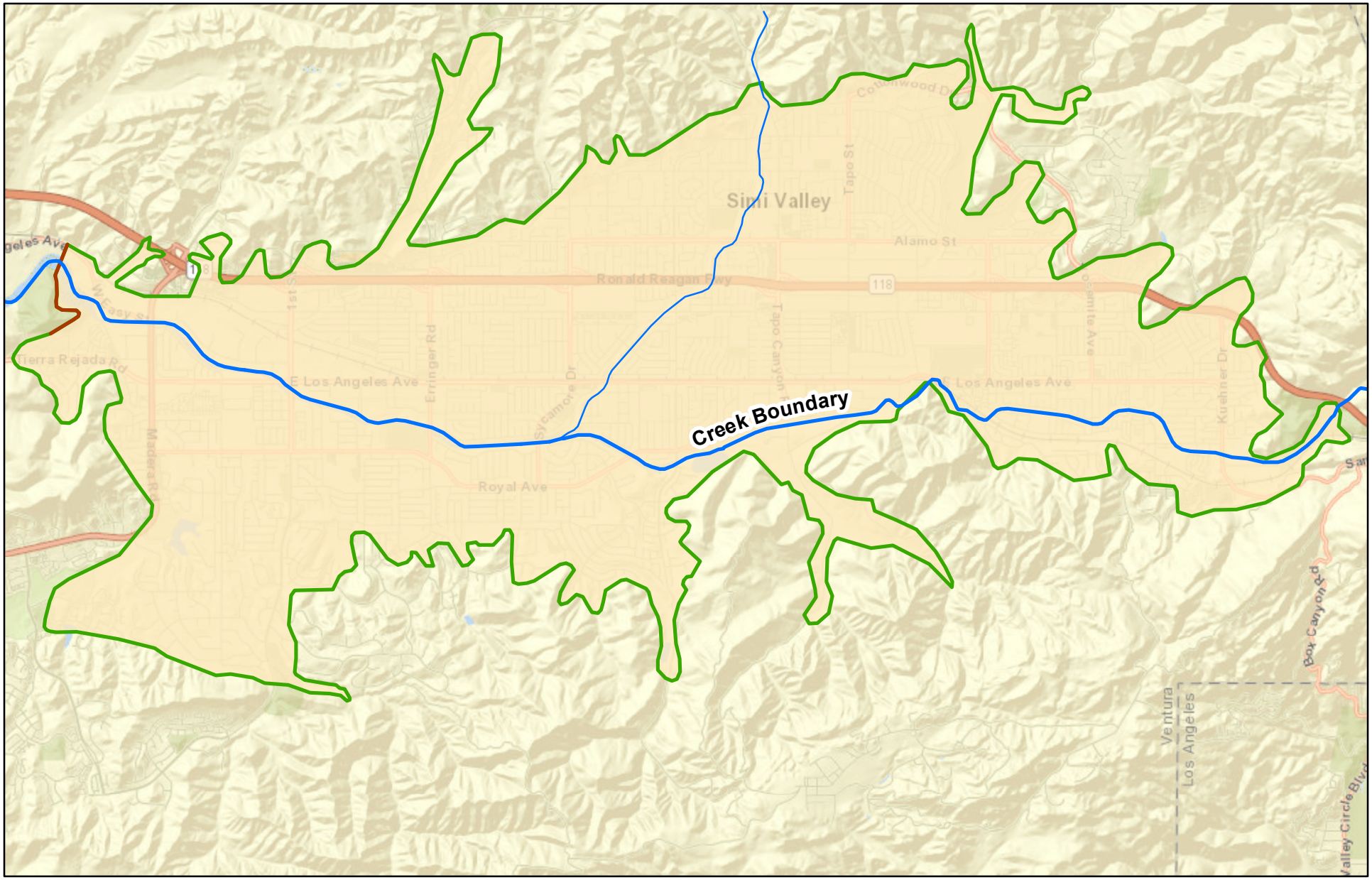
- Six 1,000 gpm groundwater production wells (four operating and two standby),
- A 4,000 gpm raw water treatment facility utilizing dual-stage reverse osmosis filtration, green-sand filtration, chloramine disinfection, and fluoridation,
- A 34,000 gallon finished water tank,
- A 3,400 gpm finished water booster pump station,
- Pipelines (buried in streets) to convey well water to the treatment plant; treated water to the water distribution system; and brine to the Calleguas SMP.

The Study evaluated three alternative project locations, as shown in Figure ES- 2, Figure ES- 3, and Figure ES- 4. Alternative 1, as shown in Figure ES- 2, is recommended as the preferred alternative.

Customer demands averaged 17,300 AFY during 2014-2017. The recommended treatment facility would expand the diversity of the community's water supply portfolio by providing approximately 5,500 AFY of drinking water, or about 30 percent of the Districts water demands, and will significantly improve the community's water supply reliability.

The Study estimated the capital cost and the annual operations and maintenance cost to be $87 million and $6 million, respectively, for Alternative 1. Right-of-way acquisition for the treatment plant site and well sites are additional costs.

The Study concluded that the development of the Basin to produce up to 5,500 AFY of local drinking water is feasible and that further study and project development, including environmental analysis, groundwater yield analysis, real estate acquisition, project design, financing, and construction, is required to develop a specific project.



0 0.5 1 2 Miles

Figure ES-1
Location Map

Simi Valley Basin
Groundwater Development Feasibility Study

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FACILITY	SITE	LOCATION
Treatment Plant	Vacant Lot - Private	SE Cor of E Los Angeles Ave and 3rd St
Well No. 2	Mayfair Park	2550 Caldwell Ave
Well No. 3	Parkview Elementary School	1500 Alexander St
Well No. 4	Parkview Elementary School	1500 Alexander St
Well No. 5	Citrus Grove Park	2100 Marvel Ave
Well No. 6	Justin Elementary School	2245 Justin Ave
Well No. 7	Open Space - Private	2244 Justin Ave

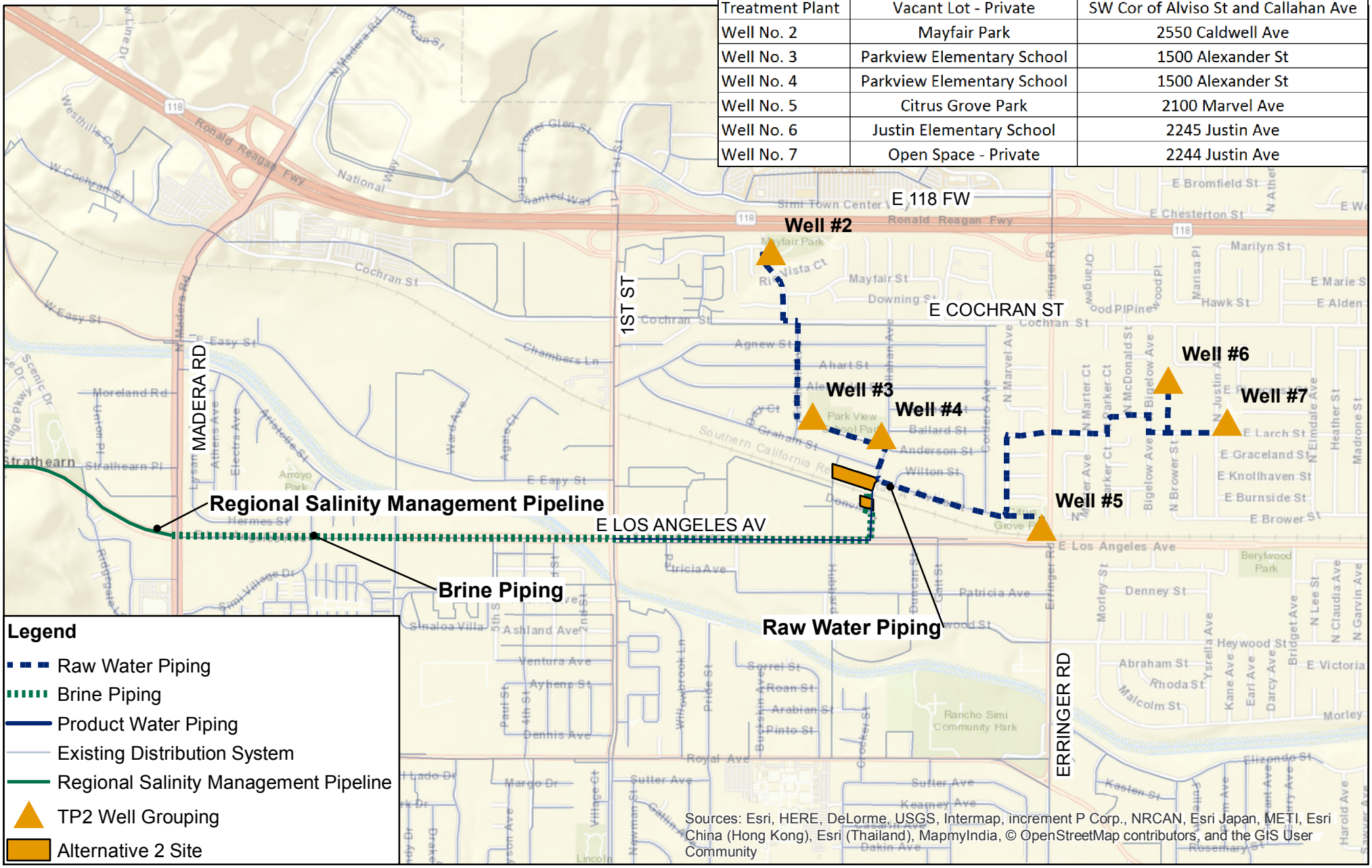
0 0.15 0.3 0.6 Miles

Figure ES-2
Alternative 1

Hazen TODD GROUNDWATER

Simi Valley Basin
Groundwater Development Feasibility Study

FACILITY	SITE	LOCATION
Treatment Plant	Vacant Lot - Private	SW Cor of Alviso St and Callahan Ave
Well No. 2	Mayfair Park	2550 Caldwell Ave
Well No. 3	Parkview Elementary School	1500 Alexander St
Well No. 4	Parkview Elementary School	1500 Alexander St
Well No. 5	Citrus Grove Park	2100 Marvel Ave
Well No. 6	Justin Elementary School	2245 Justin Ave
Well No. 7	Open Space - Private	2244 Justin Ave



0 0.15 0.3 0.6 Miles

Figure ES-3
Alternative 2

Hazen TODD GROUNDWATER

Simi Valley Basin
Groundwater Development Feasibility Study

FACILITY	SITE	LOCATION
Treatment Plant	Vacant Lot - Private	NE Cor of Tapo Canyon Rd and 118 Fwy
Well No. 14	Santa Susana High School	3570 Cochran St
Well No. 15	Santa Susana High School	3570 Cochran St
Well No. 16	Grove Elementary School	2250 Tracy Ave
Well No. 17	Rancho Tapo Community Park	3700 Avenida Simi
Well No. 18	Simi Valley Library	2969 Tapop Canyon Rd
Well No. 19	Simi Valley Police Department	3901 Alamo St

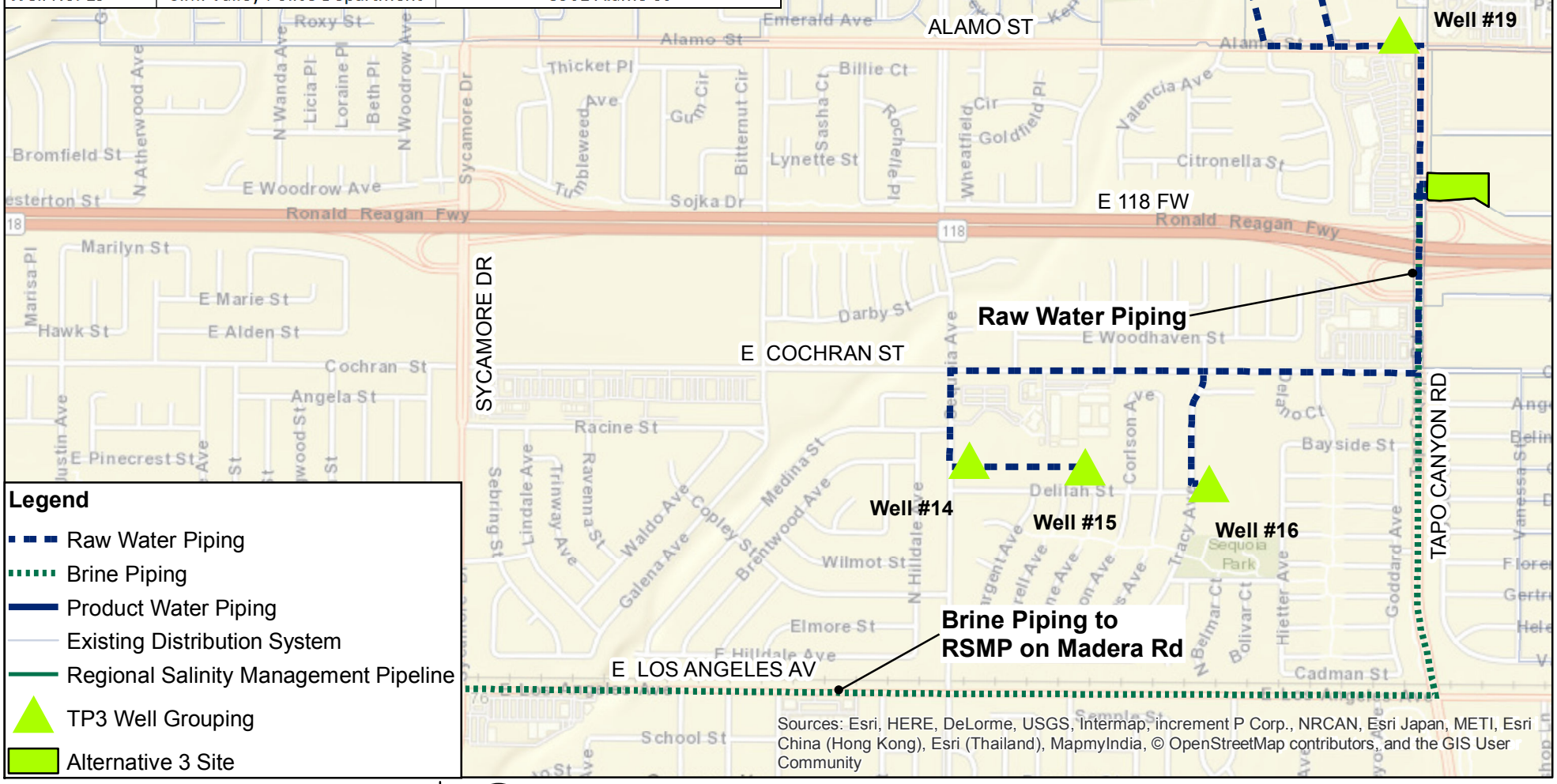


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Figure ES-4
Alternative 3

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Simi Valley Basin
Groundwater Development Feasibility Study

1. Introduction

The Ventura County Waterworks District No. 8 (District), part of the City of Simi Valley (City), currently relies almost entirely on imported water for its water supply. With concerns over climate change, the recent drought, and increasing costs and uncertainty of imported water supplies, the District is looking to utilize groundwater from the Simi Valley Basin to add to its water supply portfolio and improve water supply reliability.

The ”Characterization and Groundwater Supply Assessment for Simi Valley Basin” (Todd Groundwater, March 2016) estimated the perennial yield for the Simi Valley Basin to be 9,000 acre-feet per year (AFY) and found the groundwater across most of the Simi Valley Basin to be of naturally poor quality being and high in salinity, requiring treatment or blending with imported water to make it suitable for use as a potable water supply. The planned extension of the Calleguas Municipal Water District (Calleguas) Salinity Management Pipeline (SMP) to the City presents an important opportunity for the District to develop its Simi Valley groundwater resources, through treatment and export of residual brine.

This study presents three alternatives to develop the Simi Valley Groundwater Basin as a potable water supply. Each alternative includes extracting 4,000 gallons per minute (gpm) of groundwater (approximately 6,450 AFY) and treating the groundwater to reduce salinity to produce between 5,160 to 5,483 AFY of potable water to serve District customers. Alternatives evaluate well locations, treatment plant locations, type of treatment required, distribution system requirements, brine discharge requirements, and the capital, engineering and annual operations and maintenance (O&M) costs.

1.1 Purpose and Scope

Building on the information obtained from the Characterization and Groundwater Supply Assessment for Simi Valley Basin Study (Todd, 2016), the Hazen team developed three alternatives that:

- Identify potential well sites to maximize production from the Simi Valley Basin,
- Estimate the production capacity for each well,
- Determine the water treatment processes needed to meet the current drinking water standards,
- Identify project site(s) for a groundwater treatment plant,
- Determine availability of power to the site(s),
- Determine the infrastructure requirements to convey the raw well water to the water treatment plant site(s),
- Determine the water quality requirements and infrastructure requirements to connect the treated water (finished product water) to the existing potable water system,
- Determine the infrastructure to convey the brine from the water treatment plant site to the salinity management pipeline (SMP), and
- Summarize capital, engineering and O&M costs for each alternative identified.

In addition to identifying the well sites, treatment technologies, and other components that make up an implementable project, an evaluation of the feasibility of partial treatment and blending to achieve the water quality requirements was conducted.

2. Current Simi Valley Water Supplies and Dewatering Operations

2.1 Water Supplies

The District currently serves approximately 68 percent of the customers in the City of Simi Valley (90,100 customers), and unincorporated areas located southeast and north of the incorporated City boundary (Kennedy/Jenks, 2017). Most of the remaining 32 percent of the customers in the City of Simi Valley are served by the Golden State Water Company, an investor-owned public utility company.

Currently, the District water supply is primarily imported water that is purchased from Calleguas. The total water demand in the District's service area has averaged approximately 17,300 AFY from 2014 to 2017. Up to 3 percent of the demand is supplied from local sources including groundwater pumped from the Tapo/Gillibrand Basin (Figure 2-1), which is located to the north of the Simi Valley Basin, and recycled water from the Simi Valley Water Quality Control Plant.

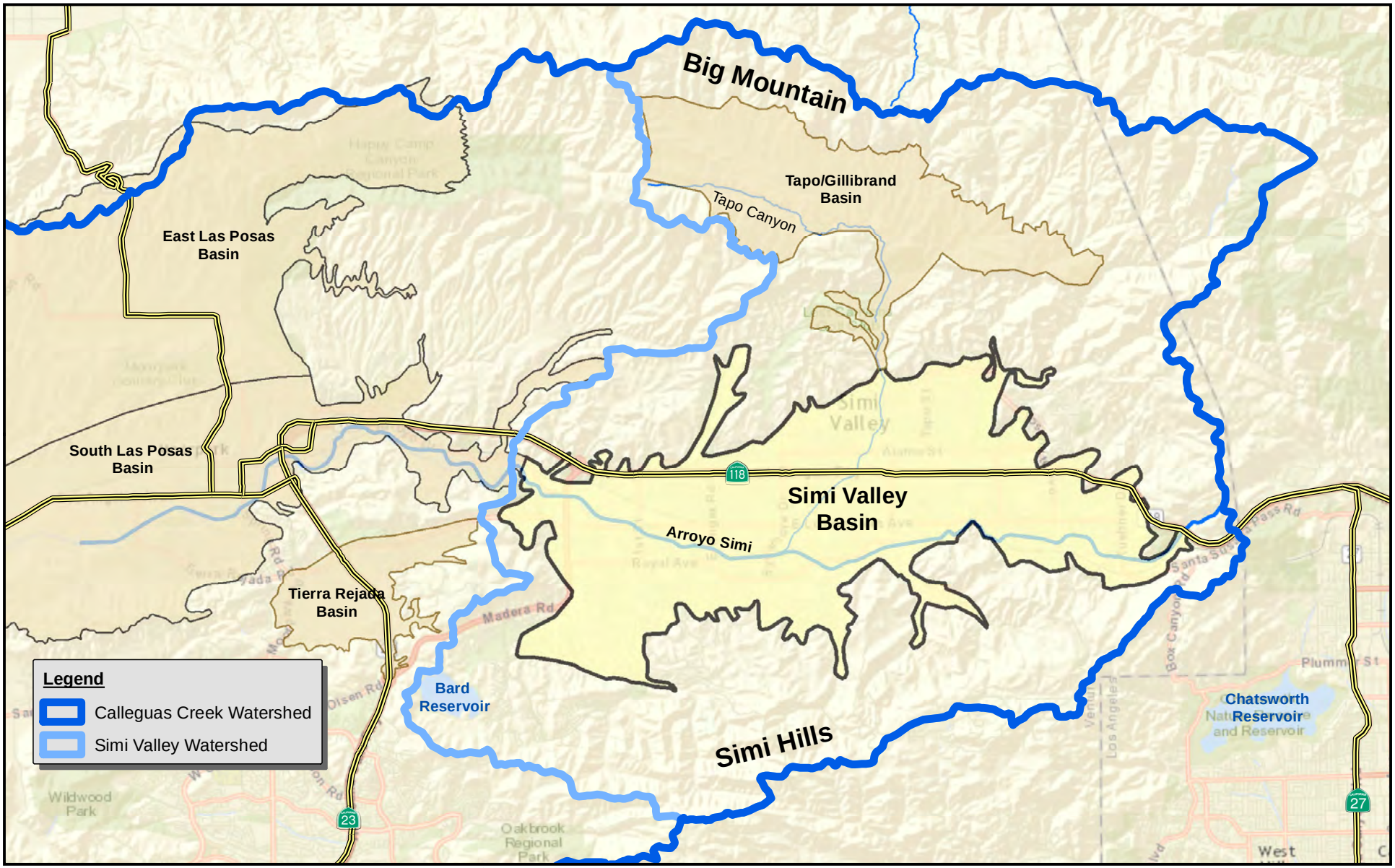
The District pumps groundwater from the adjacent Tapo/Gillibrand Basin wells. Three wells supply groundwater to nearby customers in the Tapo/Gillibrand Basin for irrigation uses and feed water to the Tapo Canyon Water Treatment Plant for use in the Simi Valley Basin.

The District produces about 20 million gallons per year (or about 60 acre-feet per year [AFY]) of recycled water, which is used predominantly for landscape irrigation.

Golden State Water Company has two active groundwater wells within the Simi Valley Basin that have typically provided less than 10 percent of Golden State Water Company's total water supply, with the remainder being imported water. The groundwater has elevated salts and is blended with imported water to lower the overall salinity in the potable water delivered to customers.

Groundwater production by Golden State Water Company has varied considerably from year to year but has averaged about 750 AFY from 2006 to 2014 (Todd, 2016).

There are a few other private domestic and agricultural wells in the basin. In addition to the District's dewatering wells discussed below and the Golden State Water Company's two municipal wells, there are about 34 other active production wells in the valley identified by Ventura County as shown on Figure 2-2. Of these, 26 are agricultural, 7 are domestic and one has an unknown use. The wells are not metered, so the volume of groundwater pumped is not known, but is presumed to be relatively small compared to municipal pumping and dewatering.



0 1.25 2.5 5 Miles

Figure 2-1
Study Area

Simi Valley Basin
Groundwater Development Feasibility Study

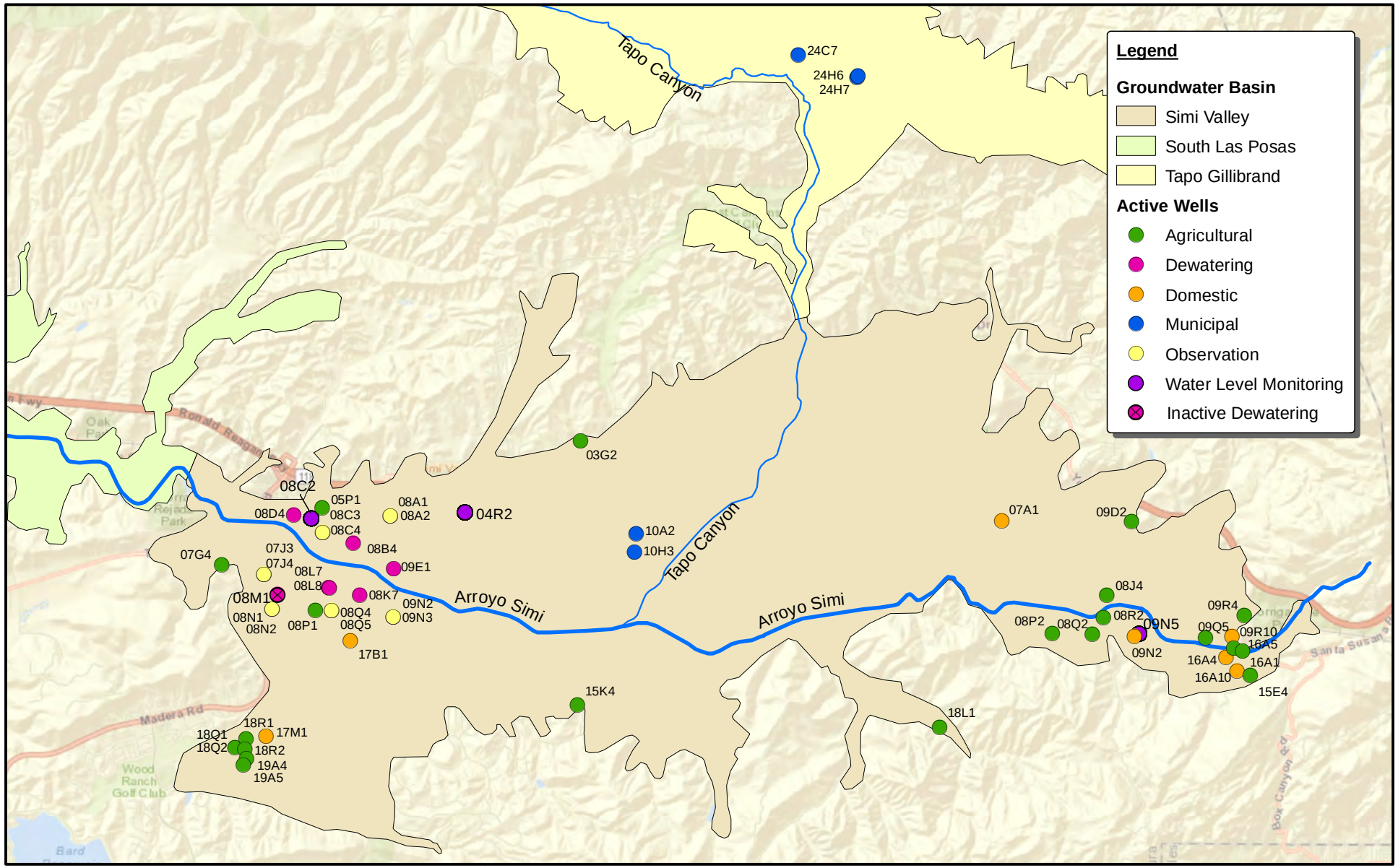


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Figure 2-2
Active Wells

Simi Valley Basin
Groundwater Development Feasibility Study

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2.2 Dewatering Operations

The west end of the Simi Valley Basin is comprised of a shallow unconfined water bearing zone, a zone of confining deposits, and an underlying deeper confined to semi-confined aquifer. Upward leakage of groundwater occurs from the lower confined/semiconfined aquifer to the shallow water-bearing zone along both natural and manmade pathways. Manmade conduits include poorly sealed or improperly abandoned wells.

In 1987, the District began installing and operating a network of dewatering wells screened in the deeper aquifer to mitigate problematic high groundwater conditions in the west end of the basin (Leighton, 1988). The dewatering facilities currently include six extraction wells as shown on Figure 2-2 (Ward (08B4), Chain (08D4), Pacific (08K7), Sinaloa 2 (08L7), Sinaloa 3 (08L8), and First Street (09E1)).

Due to historical agricultural, urban and industrial land uses contributing contaminants to the basin, the groundwater quality in the west end of the Simi Valley Basin is poor and not suitable for potable or irrigation purposes without substantial treatment. The constituents that have historically been observed that exceed the water quality objectives are TDS (total dissolved solids), sulfate, nitrate and boron. Accordingly, the dewatering water is discharged to the storm drain system and ultimately to the Arroyo Simi, a creek that flows from east to west through the Simi Valley Basin. Historic records show that the average annual dewatering pumping from 2007 to 2015 was approximately 1,700 acre-feet (AF) (Todd, 2016).

3. Salinity Management Plan and Future Groundwater Use

Currently, groundwater is not heavily developed in Simi Valley because of its high salinity. Even if the District were to pump and treat the groundwater, currently there is not a means in which to discharge the brine. However, as part of the Salinity Management Plan for the region, Calleguas is constructing a Regional SMP, extending from an outfall in Port Hueneme to Simi Valley which will provide the City a method for disposing of the brine. The fourth and final phase of the project will extend the SMP to Simi Valley as shown in Figure 3-1: Regional Salinity Management Pipeline. At the time of this writing, the final alignment for the SMP was under development and not yet available. The pipeline to Simi Valley is scheduled for completion in 2022 to align with the salt Total Maximum Daily Loads (TMDL) compliance schedule. The SMP would allow the District to treat Simi Valley Basin groundwater with higher mineral content and dispose of the concentrated brine via the pipeline with ultimate discharge to the ocean.

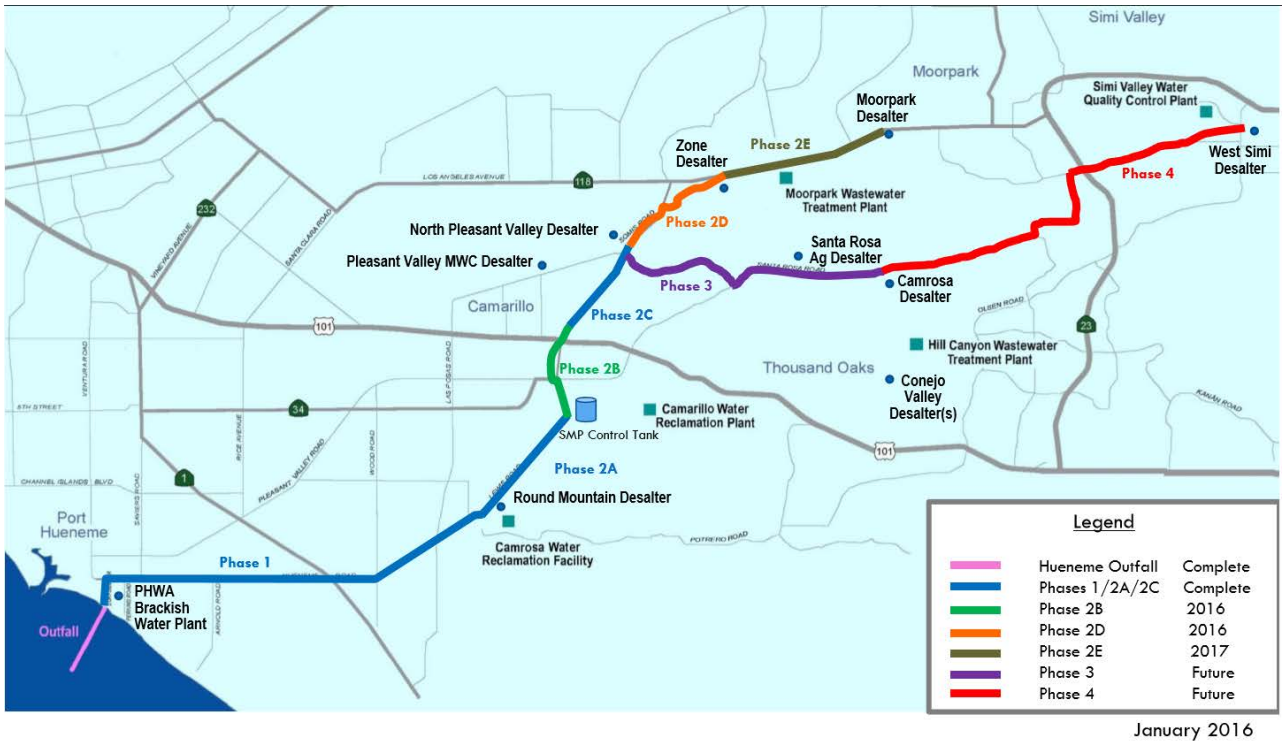


Figure 3-1: Regional Salinity Management Pipeline

(Source: Calleguas, 2016)

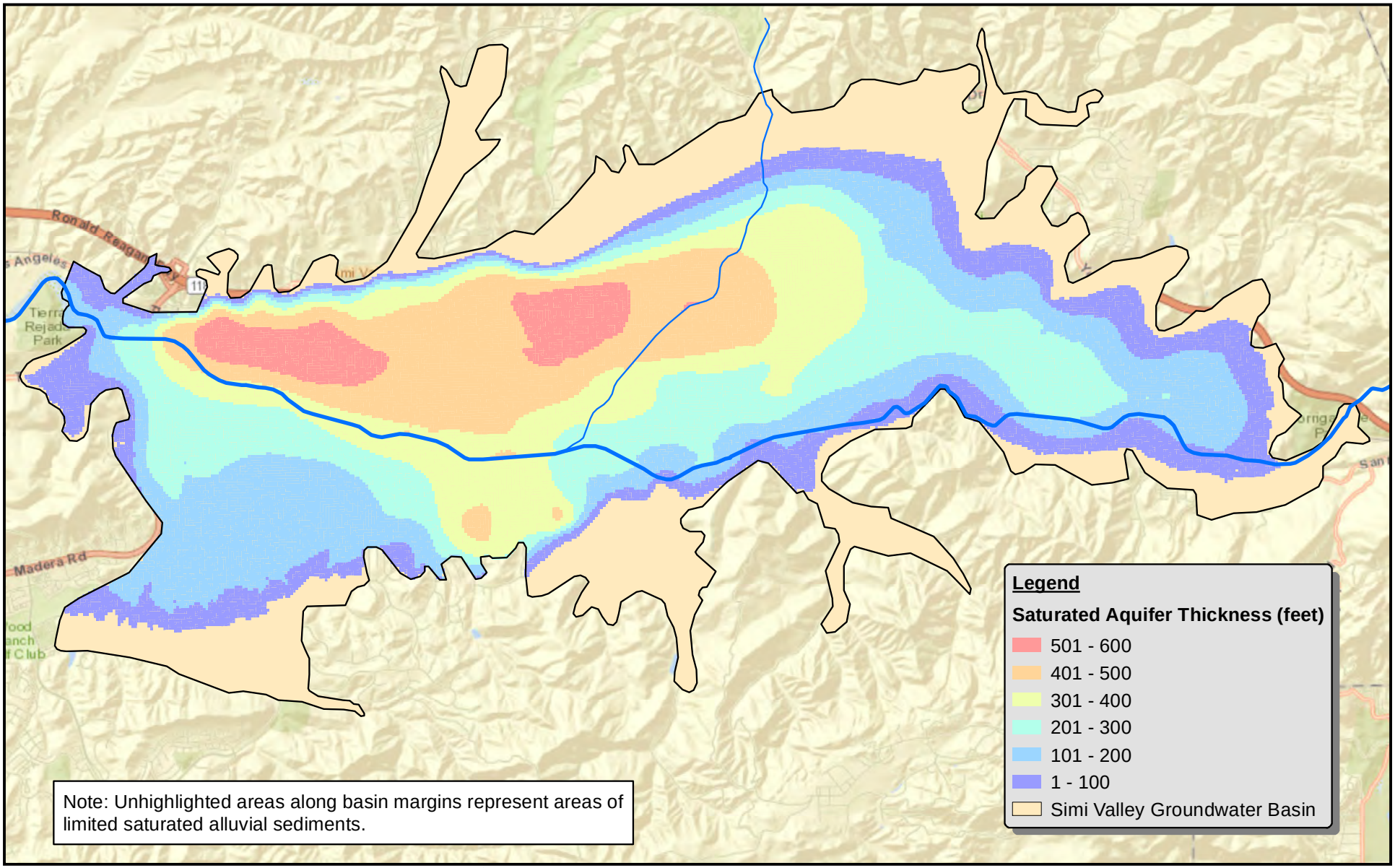
4. Hydrogeologic Conceptual Model Overview

A more detailed description of the Simi Valley Basin hydrogeologic conditions is presented in the report entitled *Characterization and Groundwater Supply Assessment for the Simi Valley Basin* (Todd, 2016), also referred to as the Simi Valley Basin Study. The Simi Valley Basin is composed of unconsolidated alluvial deposits reaching thicknesses up to 800 feet in the central portion of the basin. Figure 4-1 shows the estimated aquifer saturated thickness. Fractured and porous formations under the alluvium also yield some groundwater to wells. Unconfined aquifer conditions occur in the eastern and central portions of the basin, while semi-confined to confined aquifer conditions occur in the western portion of the basin with a shallower overlying water bearing zone. Current groundwater levels in the basin are stable, with general groundwater flow from east to west across the basin. Groundwater levels in the confined to semi-confined aquifer are above the ground surface or artesian in some portions of the western basin. As previously discussed, the District operates a network of dewatering wells in the western portion of the basin to mitigate rising, nuisance groundwater conditions. Due to its poor quality, groundwater from dewatering wells is currently discharged to Arroyo Simi without beneficial use in the basin.

The Simi Valley Basin is capable of yielding sufficient groundwater to supply municipal wells. Based on aquifer properties (i.e., well yields, transmissivity and saturated thickness), the general area recommended for new production wells is shown in Figure 4-2**.** The figure shows estimated transmissivity and pumping rates for wells within the basin. Most of these wells are no longer in use and presumably have been destroyed. Transmissivity is an indication of the productivity of an aquifer. If an aquifer has a transmissivity less than about 1,000 gallons per day per foot (gpd/ft), it can supply only enough water for domestic wells or other low-yield uses. With a transmissivity of about 10,000 gpd/ft or more, well yields are adequate for industrial and municipal purposes (Driscoll, 1986). Yields from properly designed, developed, and maintained wells in this area are expected to range between approximately 500 and 1,000 gpm.

Perennial yield is the rate at which water can be withdrawn perennially under specified operating conditions without producing an undesired result (Todd and Mays, 2005). This term recognizes that the yield is mostly dependent on when and where the pumping occurs and the potential undesirable results. Undesirable results in Simi Valley could include:

- Chronic lowering of groundwater levels.
- Significant and unreasonable reduction of groundwater storage.
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
- Significant and unreasonable land subsidence that interferes with surface land uses.
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.
- The Simi Valley Basin Study included a preliminary estimate of basin perennial yield, recognizing that the estimate should be refined as additional data become available to assess potential groundwater development and management scenarios, and to evaluate the potential for undesirable results.



0 0.5 1 2 Miles

Figure 4-1
Saturated Aquifer Thickness
Simi Valley Basin
Groundwater Development Feasibility Study

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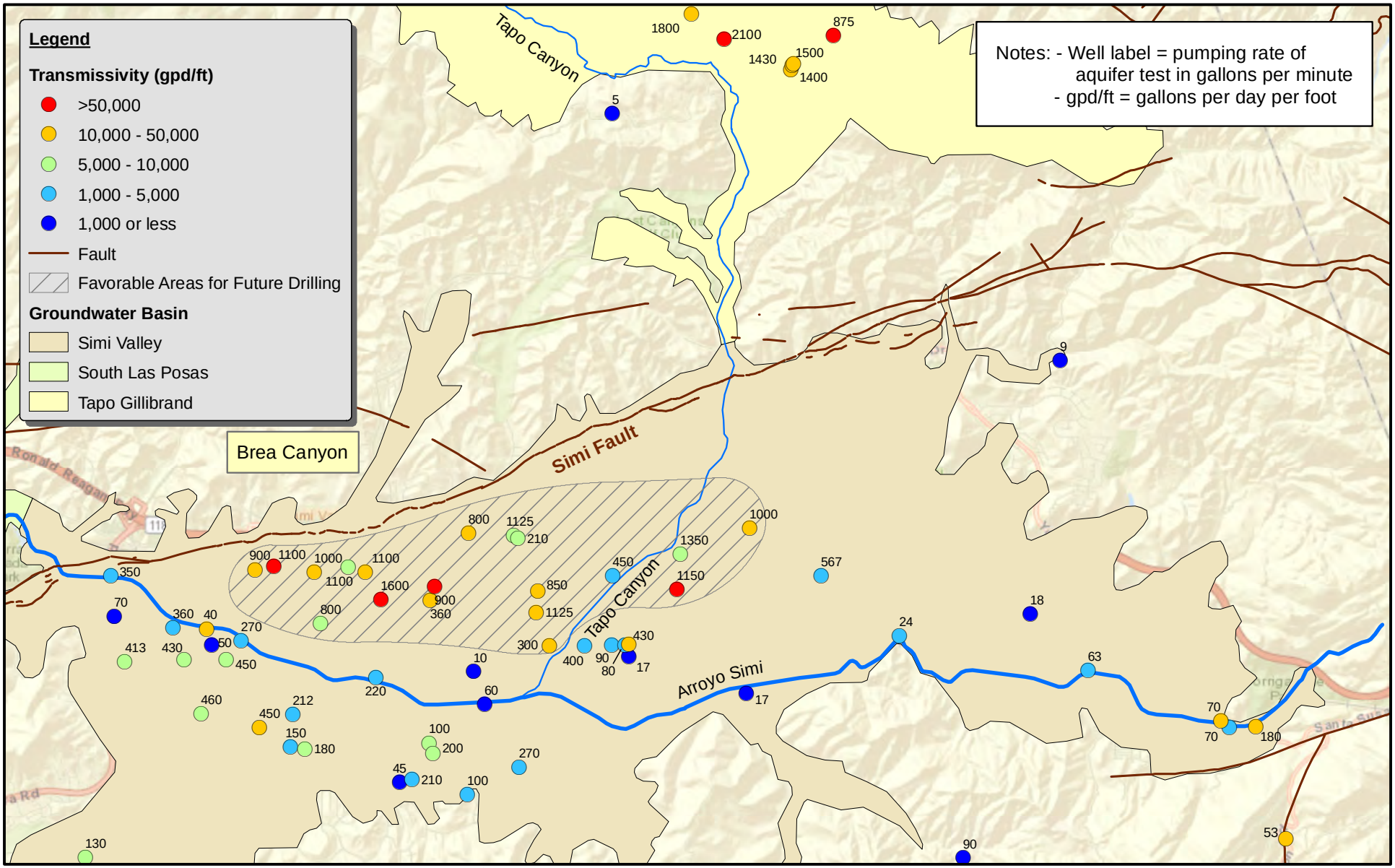

0 0.5 1 2 Miles

Figure 4-2
Favorable Areas for Future Drilling
Simi Valley Basin
Groundwater Development Feasibility Study

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Mindful of the above potential impacts, a preliminary perennial yield can be estimated as water removed from storage that is replaced in time through groundwater inflow. In the case of the Simi Valley Basin, the water balance indicated an average of 8,774 AFY of inflow from deep percolation, return flows, mountain front recharge and subsurface inflow for water years[1] 1994 to 2014. The average estimated inflow of 8,774 AFY provides a general annual yield guideline that should be regularly reevaluated as groundwater resources are developed over time, additional data are collected, and more sophisticated analysis tools are applied to evaluate the water balance and assess undesired results.

5. Groundwater Development Assessment

5.1 Groundwater Development Yield Goal

Based on the preliminary perennial yield estimate of 8,774 AFY (Todd, 2016), the City set a groundwater development goal of 6,500 AFY, which is equivalent to 4,000 gpm. It is estimated that six wells would be required to achieve this goal assuming four wells pumping at a rate of 1,000 gpm with two additional wells for backup production in case well yields are lower than expected, decline over time, and to accommodate downtime for well maintenance.

5.2 Well Siting

Results of the hydrogeologic evaluation indicate that development of municipal supply wells in the study area is feasible. Within the Simi Valley Basin, favorable areas for groundwater development include the area of adequate thickness of permeable sand and gravel deposits tapped by historical wells south of Brea Canyon, bounded generally by the Arroyo Simi to the south and the drainage exiting Tapo Canyon to the east (see Figure 4-2). As indicated, well yields in this area commonly exceed 1,000 gpm, suggesting potentially productive municipal well sites. Pumping in this area would also help to further mitigate high groundwater level conditions that limit recharge from stream leakage and deep percolation of precipitation.

Nineteen potential well locations were identified within the favorable area for groundwater development. Wells were sited on schools properties, parks, city-owned property, and a few private parcels with significant open space identified on aerial photographs. It was assumed that each well site would require a minimum footprint of 100 x 100 feet and that wells would be located at least 800 feet apart to minimize the effects of well interference and to spread the pumping out over a reasonably large area. Per California Department of Water Resources (DWR) water well standards, water supply wells are required to have a 50-foot setback from the sewer line. Figure 5-1 and 5-1a show initial and revised potential well locations, respectively, as well as three potential treatment plant locations which are discussed in further detail in the Conveyance and Infrastructure Section 7.1. Initial groupings of six wells were selected for each treatment plant location based on proximity. The initial well groupings were modified slightly due to parcel availability and conveyance considerations. Table 5-1 lists the initial and revised wells associated

[1] A water year runs from October 1 to September 30 and is designated by the year in which it ends.

with each treatment plant location option. Some wells were not included in any grouping due to the distance from the treatment plant sites

Table 5-1: Well Groupings

Treatment Plant	Initial Well Groupings	Revised Well Groupings
TP-1	1,2,3,4,5,8	2,3,4,5,6,7
TP-2	1,2,3,4,6,7	2,3,4,5,6,7
TP-3	14,15,16,17,18,19	14,15,16,17,18,19

Table 5-2: Well Parcel Information

Well No.	Location	Comment
1	Simi School Headquarters	Parcel no longer available
2	Mayfair Park	
3	Parkview Elementary School	
4	Parkview Elementary School	
5	Citrus Grove Park	
6	Justin Elementary School	
7	Private residential park with open space	
8	Berylwood Park	Parcel located south of E. Los Angeles Ave. and railroad tracks deemed undesirable for conveyance reasons
9	Vista Elementary School	
10	Atherwood Elementary School	
11	Sycamore Elementary School	
12	Sycamore Elementary School	
13	Privately owned with Open Space	
14	Santa Susanna High School	

Well No.	Location	Comment
15	Santa Susanna High School	
16	Grove Elementary School	
17	Ranch Tapo Community Park	
18	Between Muni Court and Library (City Owned)	
19	Simi Valley Police Department	

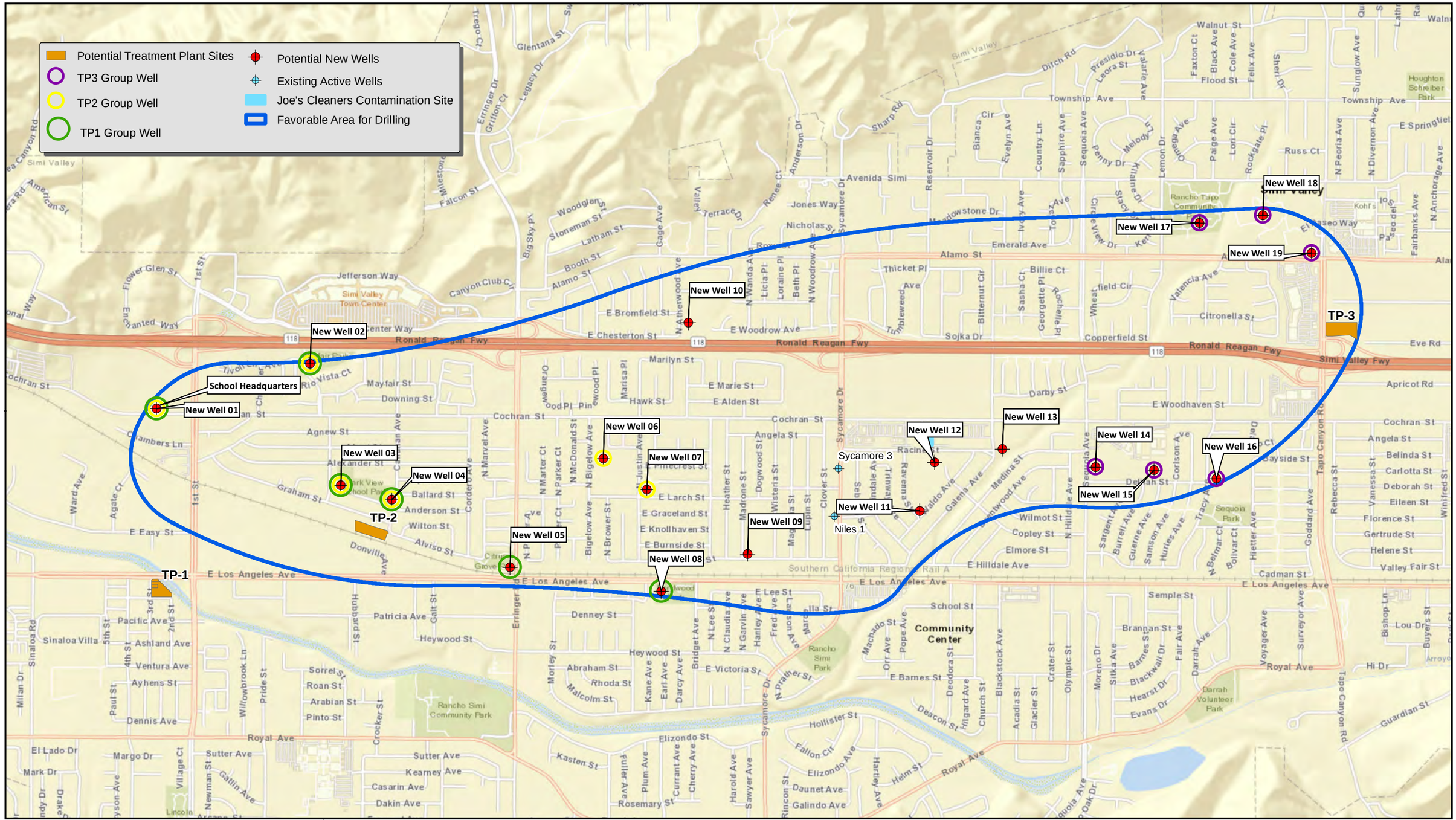

Figure 5-1
Potential New Well Sites

Simi Valley Basin
Groundwater Development Feasibility Study

Hazen TODD GROUNDWATER

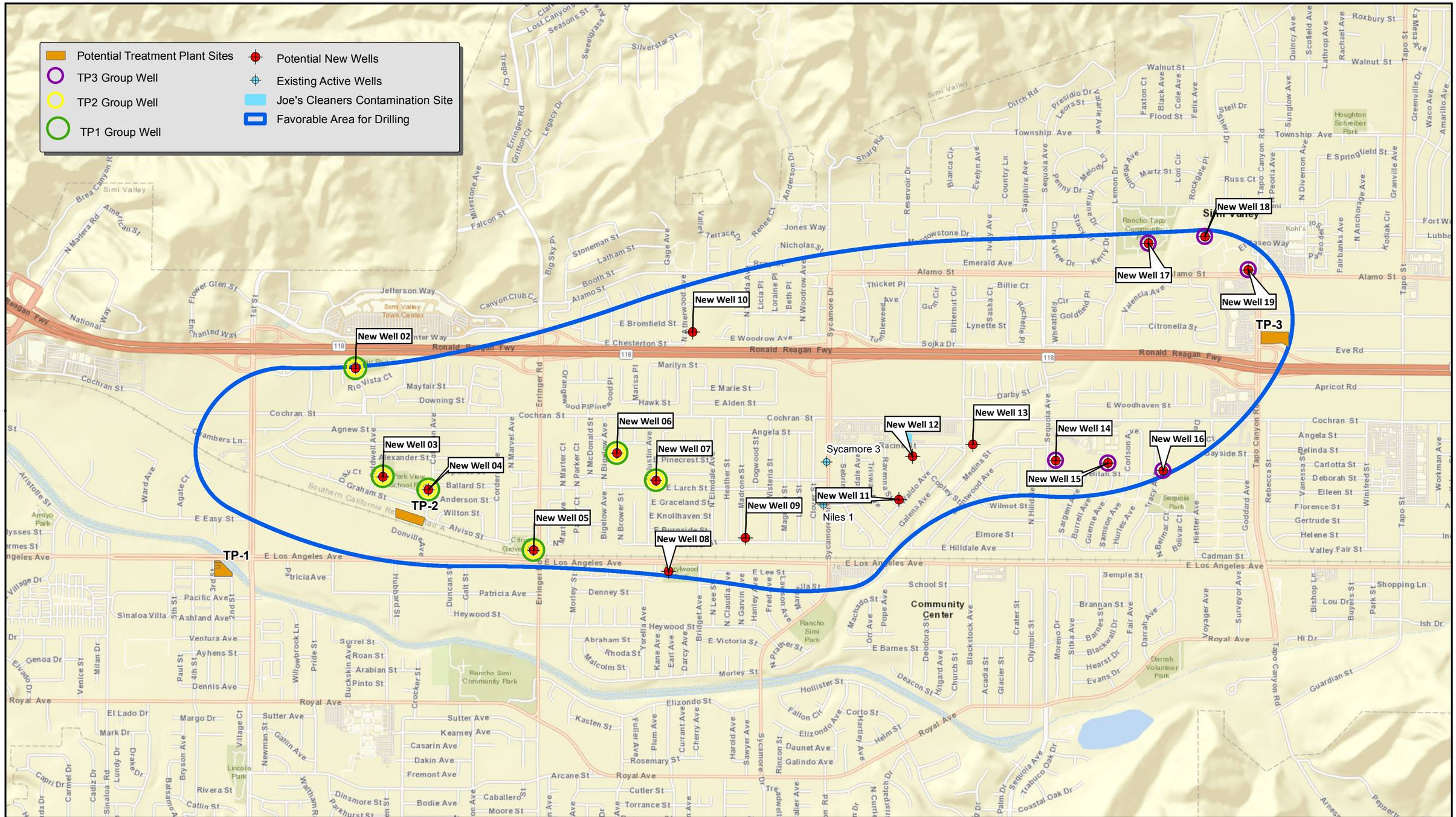

Figure 5-1a
Revised Potential New Well Sites

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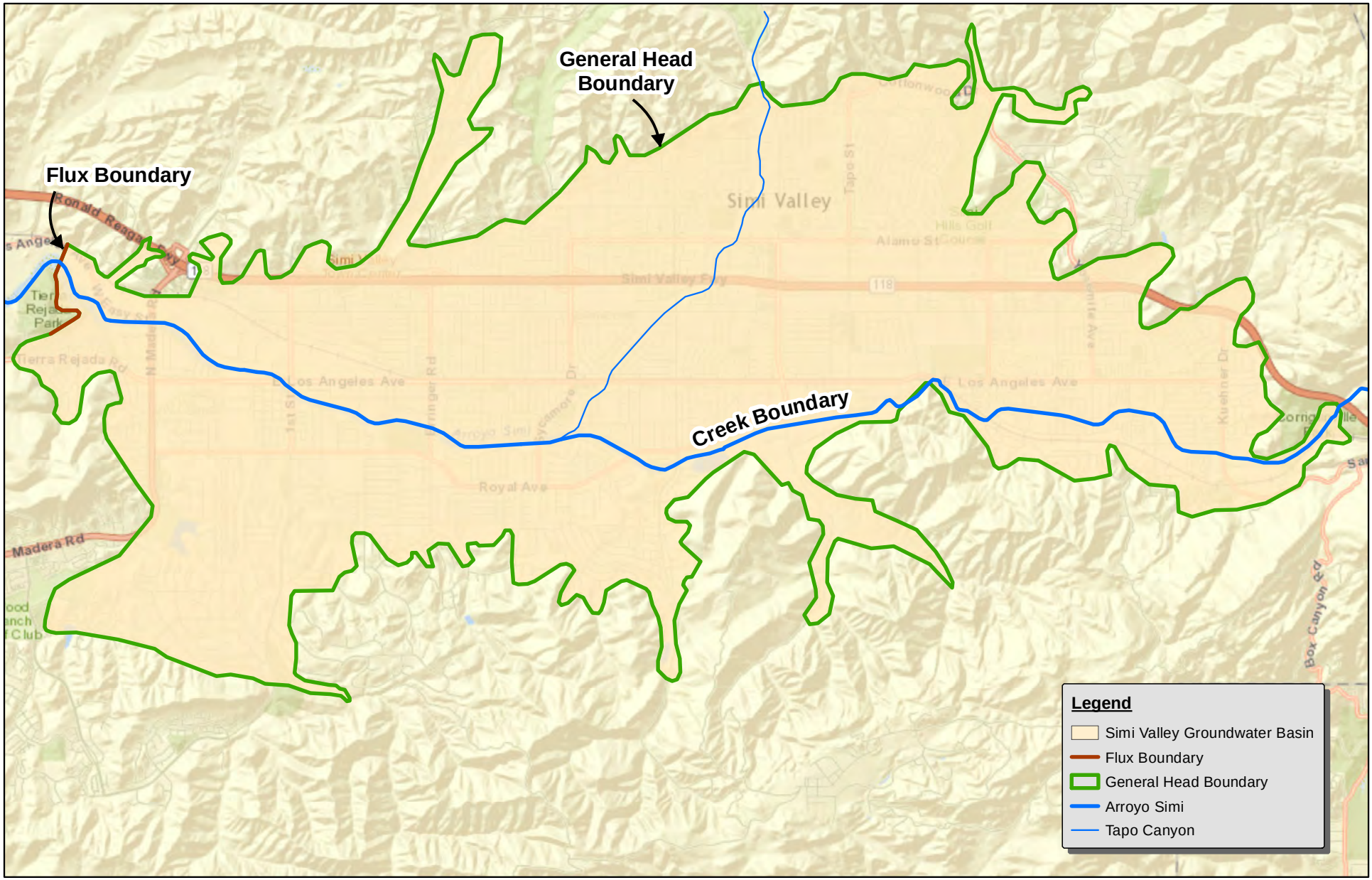
Simi Valley Basin
Groundwater Development Feasibility Study

5.3 Numerical Groundwater Modeling

A three-dimensional MODFLOW numerical flow model was constructed to assess the groundwater basin response to the groundwater production well alternatives groupings. The MODFLOW model simulates groundwater flow in the alluvial aquifer underlying Simi Valley. The MODFLOW model includes estimated inflow from the adjacent hills, interactions with the Arroyo Simi and pumping from existing production wells. A baseline model was first calibrated to measure recent groundwater flow conditions, then used to simulate additional groundwater production via new municipal supply wells.

5.3.1 Model Domain Grid and Layering

The MODFLOW model area corresponds to the edge of the Simi Valley Groundwater Basin (Figure 5-2). The active model area covers approximately 21 square miles. The finite difference model grid has rows oriented east to west and uses 200-foot rectangular cells, for a total of 129 rows and 255 columns. Two model layers were used to simulate flow within the alluvium. Model Layer 1 simulates the upper 100 feet of the saturated alluvium. The base of Model Layer 1 slopes from east to west and was defined by extrapolating recent groundwater elevations measured in wells and subtracting 100 feet. The top of Model Layer 1 was defined as the ground surface, although the saturated thickness of Layer 1 is the difference between the simulated water table and base of the Model layer. Model Layer 2 simulates flow in the lower portion of the aquifer where it is thickest in the central-western portions of the basin and extends below Model Layer 1 to the estimated bedrock surface. The maximum thickness of Model Layer 2 is around 460 feet in the western portion of the basin (for a total aquifer saturated thickness of around 560 feet), where depth to bedrock is greatest. Model Layer 2 is inactive around the edges of the basin in areas where the saturated thickness of the alluvial aquifer is less than 100 feet. In these areas simulated flow occurs only in Model Layer 1. Figure 5-3 and Figure 5-4 show the active areas and bottom elevation surfaces for Model Layers 1 and 2, respectively.



0 0.5 1 2 Miles

Figure 5-2
Model Area and Boundary Conditions
Simi Valley Basin
Groundwater Development Feasibility Study

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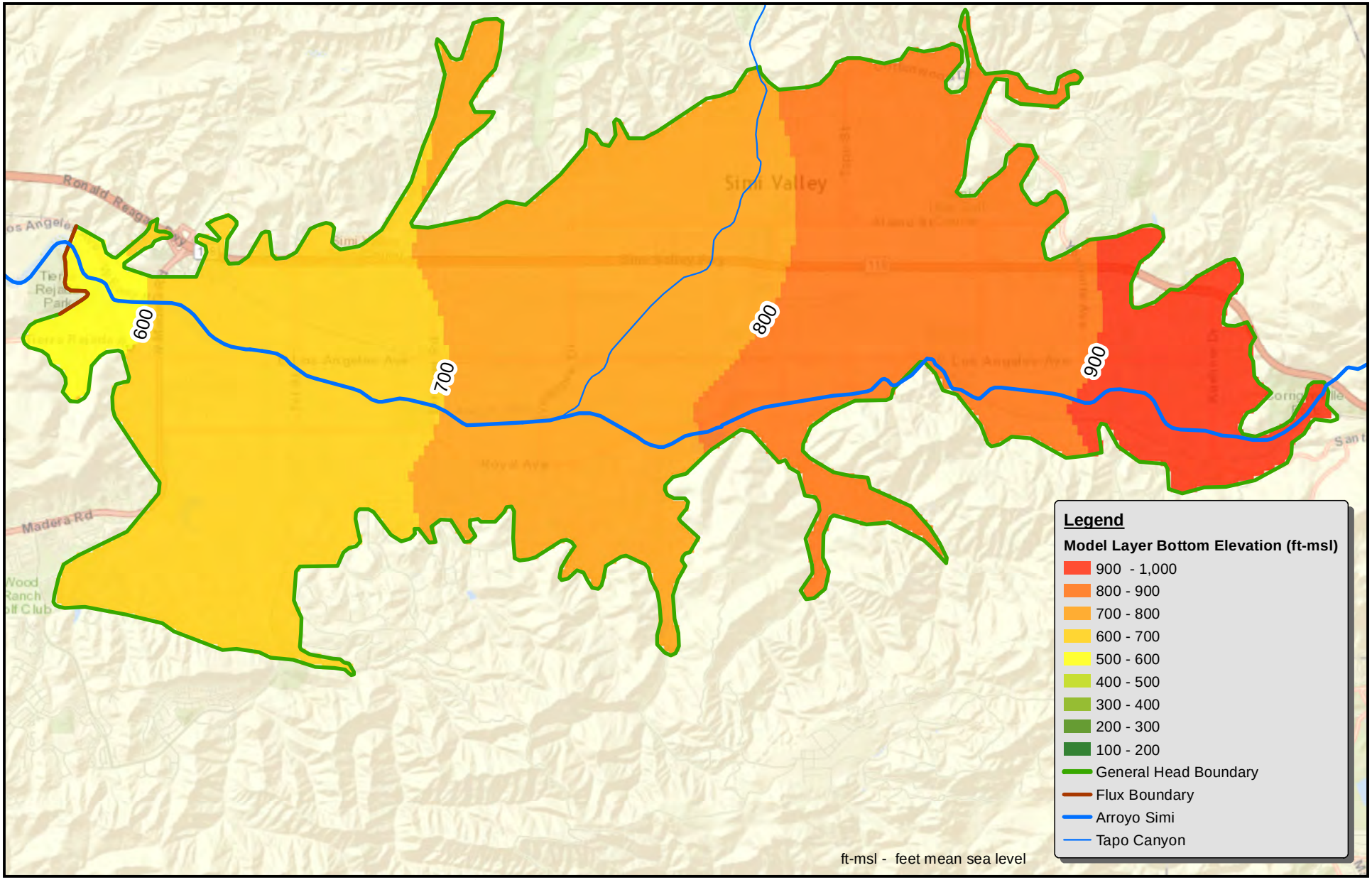
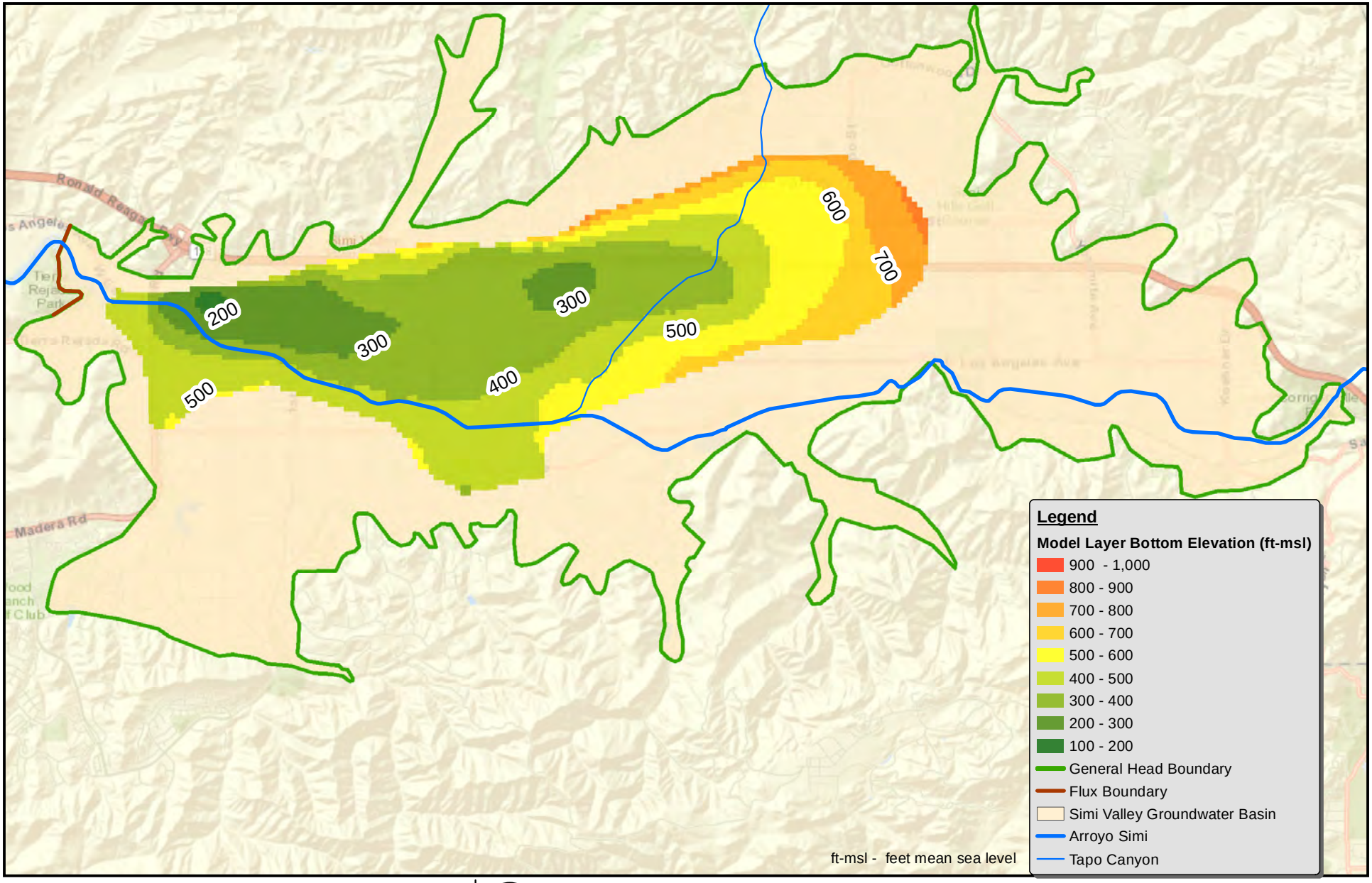


0 0.75 1.5 3 Miles

Figure 5-3
Elevations of Bottom of Model Layer 1

Simi Valley Basin
Groundwater Development Feasibility Study

Hazen TODD GROUNDWATER



0 0.75 1.5 3 Miles

Figure 5-4
Elevations of Bottom of Model Layer 2
Simi Valley Basin
Groundwater Development Feasibility Study

Hazen TODD GROUNDWATER

5.3.2 Aquifer Hydraulic Properties

Aquifer hydraulic properties used in the MODFLOW model were based on the aquifer transmissivity values estimated from the reported well specific capacities (Todd, 2016). Transmissivities for numerous wells in the basin were plotted and interpolated to the model grid. Transmissivity is greatest in the thickest portion of the alluvial aquifer in the central and western portion of the basin. Horizontal hydraulic conductivities were calculated as the ratio of the transmissivity and saturated thickness, which are larger in the central and western portions of the basin. Accordingly, a zone of high hydraulic conductivity was defined in this area, with a horizontal hydraulic conductivity of 30 feet per day (ft/d) in both model layers. The remainder of the aquifer was assigned a hydraulic conductivity of 10 ft/d. A horizontal to vertical anisotropy of 3:1 was used throughout the model.

5.3.3 Boundary Conditions

Several types and values of boundary conditions were tested during model construction and calibration, including specified head, specified flux, and a combination of the two types. The final calibrated model used specified (general) heads around most of the model perimeter, with a specified outflow flux of 100 AFY assigned to the western basin boundary (Figure 5-2). This combination was selected to allow for estimation of the potential increase in mountain front recharge via the specified head boundaries that may be achieved during future pumping operations. The specified heads and fluxes were assigned to Model Layer 1 only. The assigned head values along the boundary arcs were based on interpolation of groundwater elevations along the boundaries. During model calibration, the general head and conductance values at the boundaries were adjusted until the inflow to the alluvial aquifer was similar to the amount estimated from the basin water balance (Todd, 2016). For the calibrated steady-state model, groundwater elevations of up to 1,085 feet above mean sea level (ft-msl) were assigned to the easternmost model boundary, with lower specified head values based on measured water levels assigned to the other segments of the boundary.

5.3.4 Groundwater Recharge

Surface recharge within the basin occurs via agricultural irrigation return flow, municipal irrigation return flow, water system losses, septic systems, and infiltration of precipitation (Todd, 2016). A combined steady-state recharge rate of 0.000917 feet per day was applied uniformly to the top of Model Layer 1 to simulate recharge from these various water sources. The total amount of surface recharge simulated was approximately 4,500 AFY.

5.3.5 Groundwater Pumping

Current groundwater production via existing wells was simulated for the baseline scenario. The average pumping rate between 1997 and 2014 was used for the municipal and dewatering wells (Todd, 2016). Private wells are not metered and were simulated as pumping at 0.5 gpm. Municipal production and dewatering wells were simulated as pumping from Model Layer 2, while private wells were simulated as pumping from Model Layer 1. The total amount of pumping simulated was approximately 2,500 AFY.

5.3.6 Arroyo Simi Inflow and Outflow

Groundwater recharge from and discharge to Arroyo Simi and Tapo Canyon Creek were simulated using the MODFLOW River Package. Creek stage values were estimated based on land surface elevations, and creek bed conductance values were adjusted until reasonable groundwater elevation calibration and creek in/outflow amounts were achieved. The net groundwater outflow via creeks in the calibrated model was approximately 600 AFY.

5.3.7 Baseline Model Calibration

Initial steady-state simulations were performed using the average pumping rates described in Section 5.3.5, average recharge and creek stage elevations, and outflow boundary conditions. Figure 5-5 and Figure 5-6 show the simulated steady-state groundwater elevations in Model Layers 1 and 2, respectively. The simulated groundwater elevations reflect groundwater flow from east to west through Simi Valley, with a maximum groundwater elevation of 1,086 ft-msl at the eastern model boundary and a minimum elevation of 686 ft-msl at the western boundary. Small deflections in the simulated groundwater elevation contours are apparent adjacent to the creeks, reflecting gains and losses between the creeks and groundwater system.

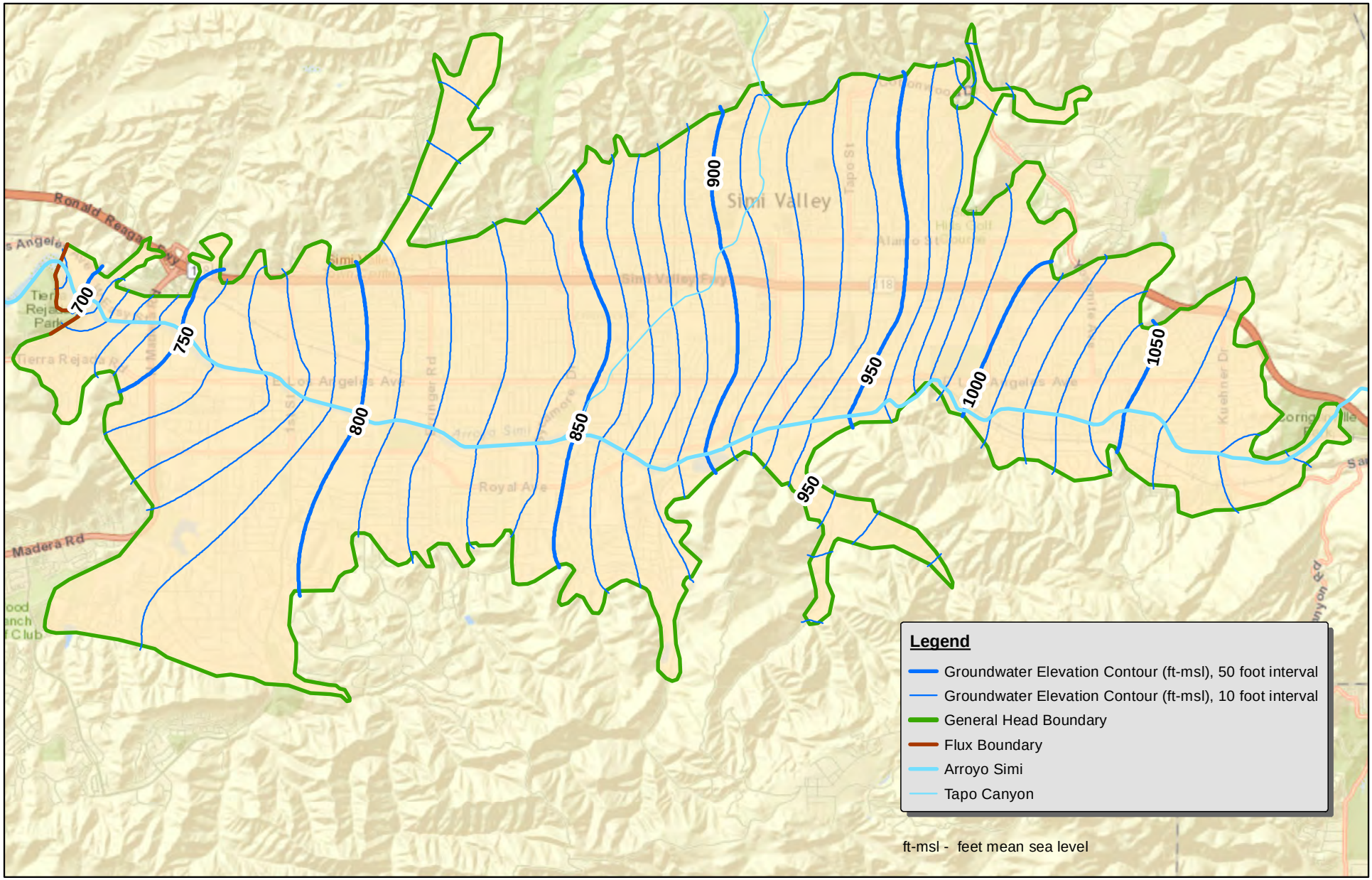
5.3.8 New Production Well Simulations

Using the calibrated steady-state model as the baseline condition, three future steady-state groundwater production alternatives were simulated using groups of six pumping wells, pumping a combined total of 4,000 gpm (667 gpm each). The same boundary conditions, creek stages, recharge rates, and baseline average pumping rates used for the historical calibration were used for the predictive simulations. The amounts and distribution of drawdown for each of the scenarios was simulated. The production well pumping was based on the initial well groupings. Drawdowns for the revised well groupings are not expected to significantly alter the results or feasibility of the alternatives based on groundwater levels.

Figure 5-7 and Figure 5-8 show the simulated drawdowns in Model Layers 1 and 2, respectively, for the Treatment Plant No. 1 (TP-1) alternative. For this alternative, production well pumping was simulated at potential well sites No. 1, 2, 3, 4, 5, and 8. A cone of depression is simulated as extending across the groundwater basin, with maximum drawdown of around 53 feet simulated near the center of the TP-1 well field. Drawdown decreases away from the well field, but drawdown is simulated at the edges of the alluvial aquifer, due to the use of general heads along the boundary arcs, which permit drawdown.

Figure 5-9 and Figure 5-10 show the simulated drawdowns in Model Layers 1 and 2, respectively, for the TP-2 alternative. For TP-2, production well pumping was simulated at potential well sites Nos. 1, 2, 3, 4, 6, and 7. Since this alternative is similar to TP-1, the simulated cone of depression for TP-2 is similar to TP-1, and extends across the groundwater basin, with maximum drawdown of around 52 feet simulated near the center of the TP-2 well field. As with TP-1, drawdown decreases away from the well field toward the edges of the basin.

For alternative TP-3, production well pumping was simulated at potential well sites Nos. 14, 15, 16, 17, 18, and 19. Due to thinning of the aquifer in the eastern portion of the basin, this alternative resulted in excessive drawdown in the pumping wells and much of the model went dry indicating that these well locations are not feasible from a hydrogeologic perspective.



0 0.75 1.5 3 Miles

Figure 5-5
Simulated Baseline Groundwater Elevations in Model Layer 1

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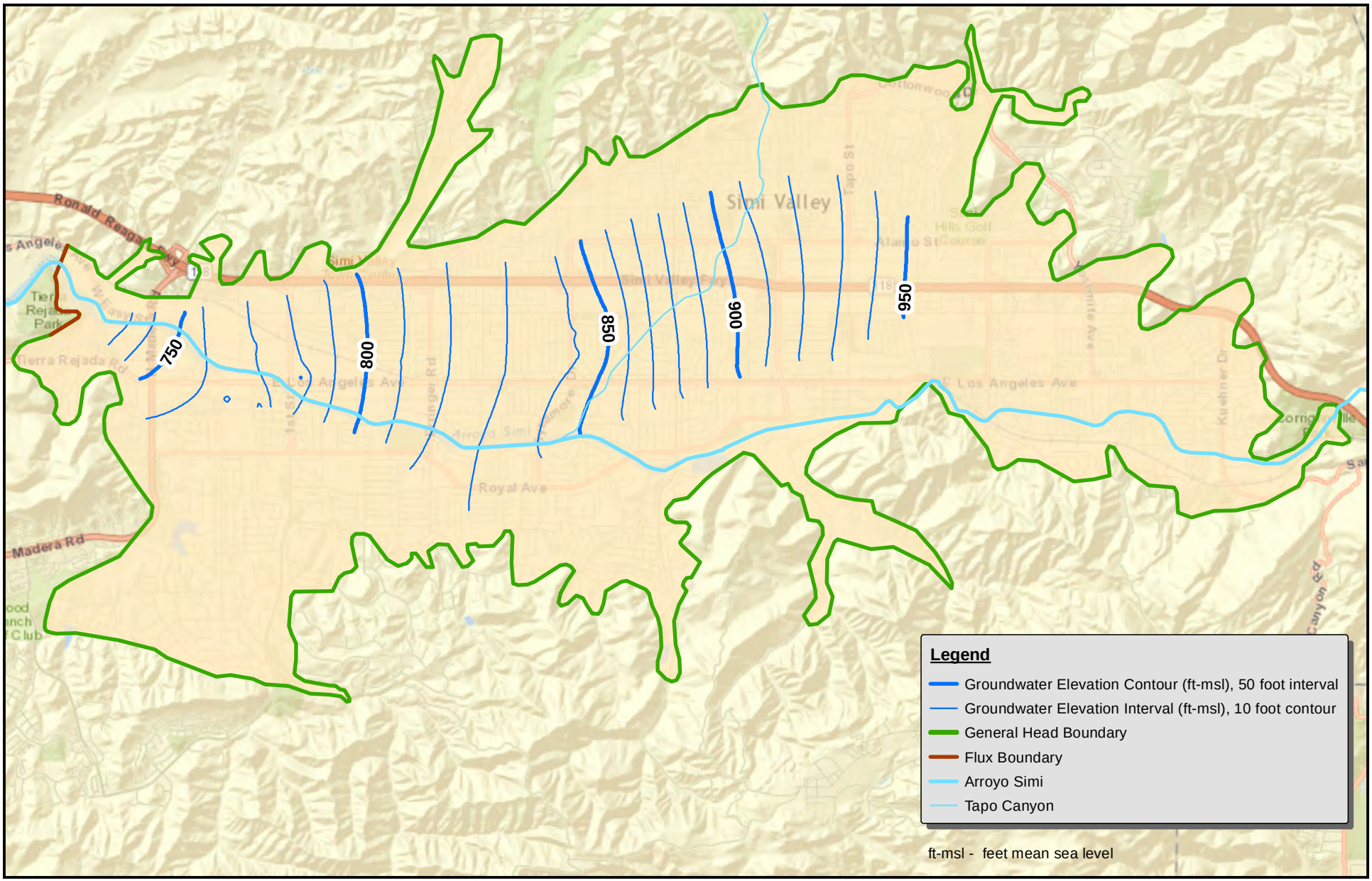
Simi Valley Basin
Groundwater Development Feasibility Study

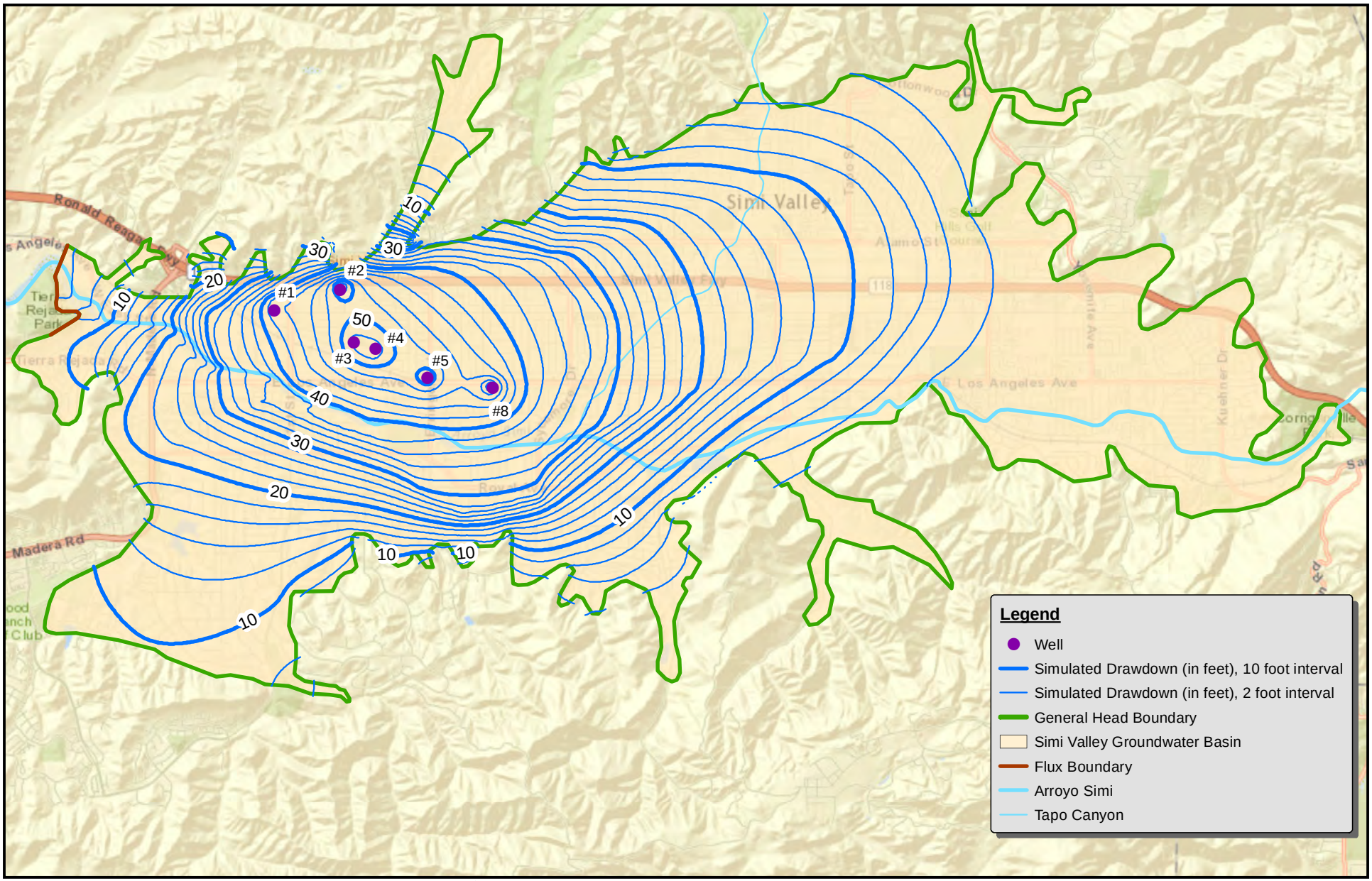


0 0.75 1.5 3 Miles

Figure 5-6
Simulated Baseline Groundwater Elevations in Model Layer 2

Hazen TODD GROUNDWATER

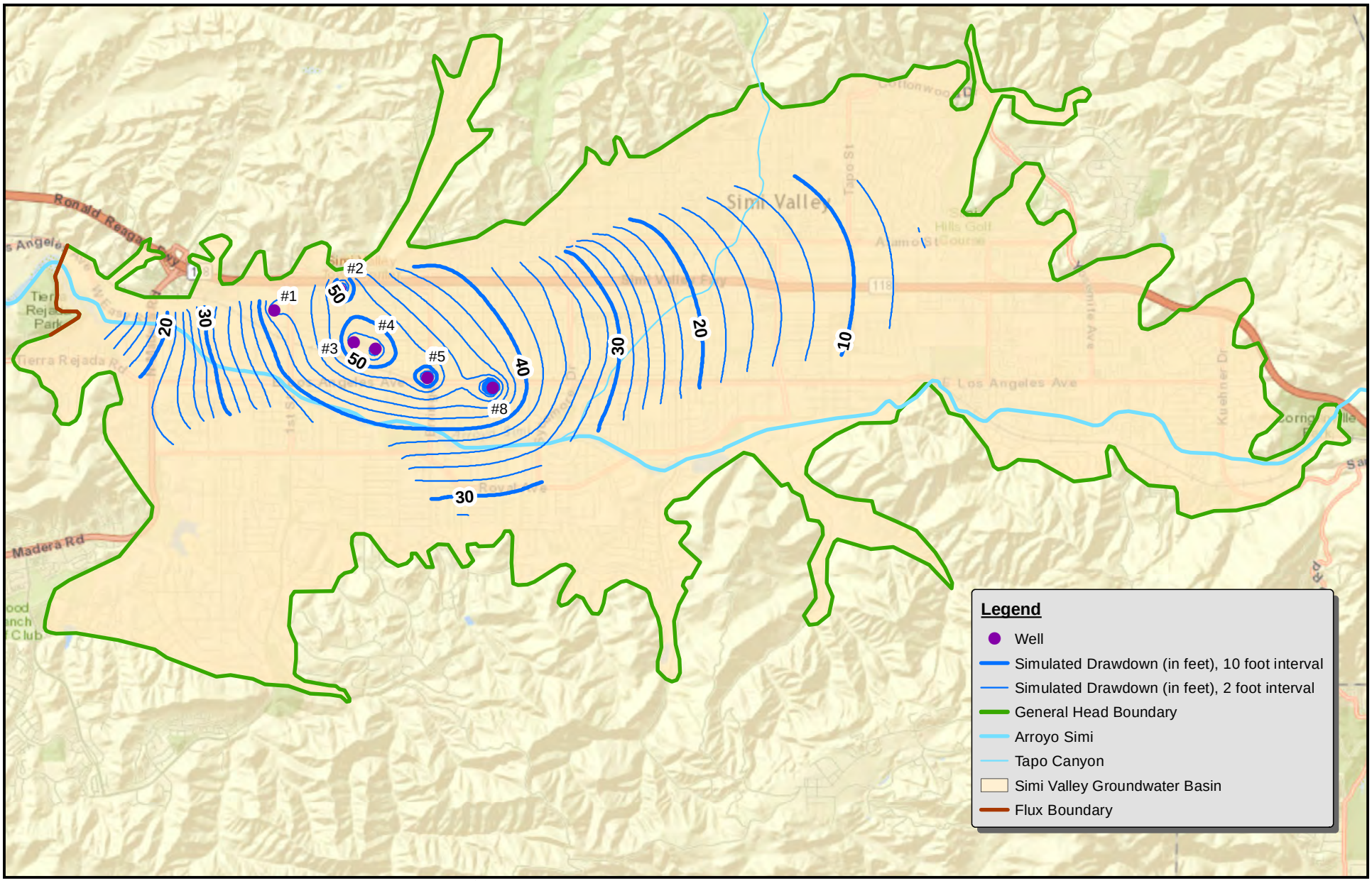
Simi Valley Basin
Groundwater Development Feasibility Study



0 0.75 1.5 3 Miles

Figure 5-7
Simulated Drawdown in Model Layer 1, TP-1 Alternative
Simi Valley Basin
Groundwater Development Feasibility Study

Hazen TODD GROUNDWATER



0 0.75 1.5 3 Miles

Figure 5-8
Simulated Drawdown in Model Layer 2, TP-1 Alternative

Simi Valley Basin
Groundwater Development Feasibility Study

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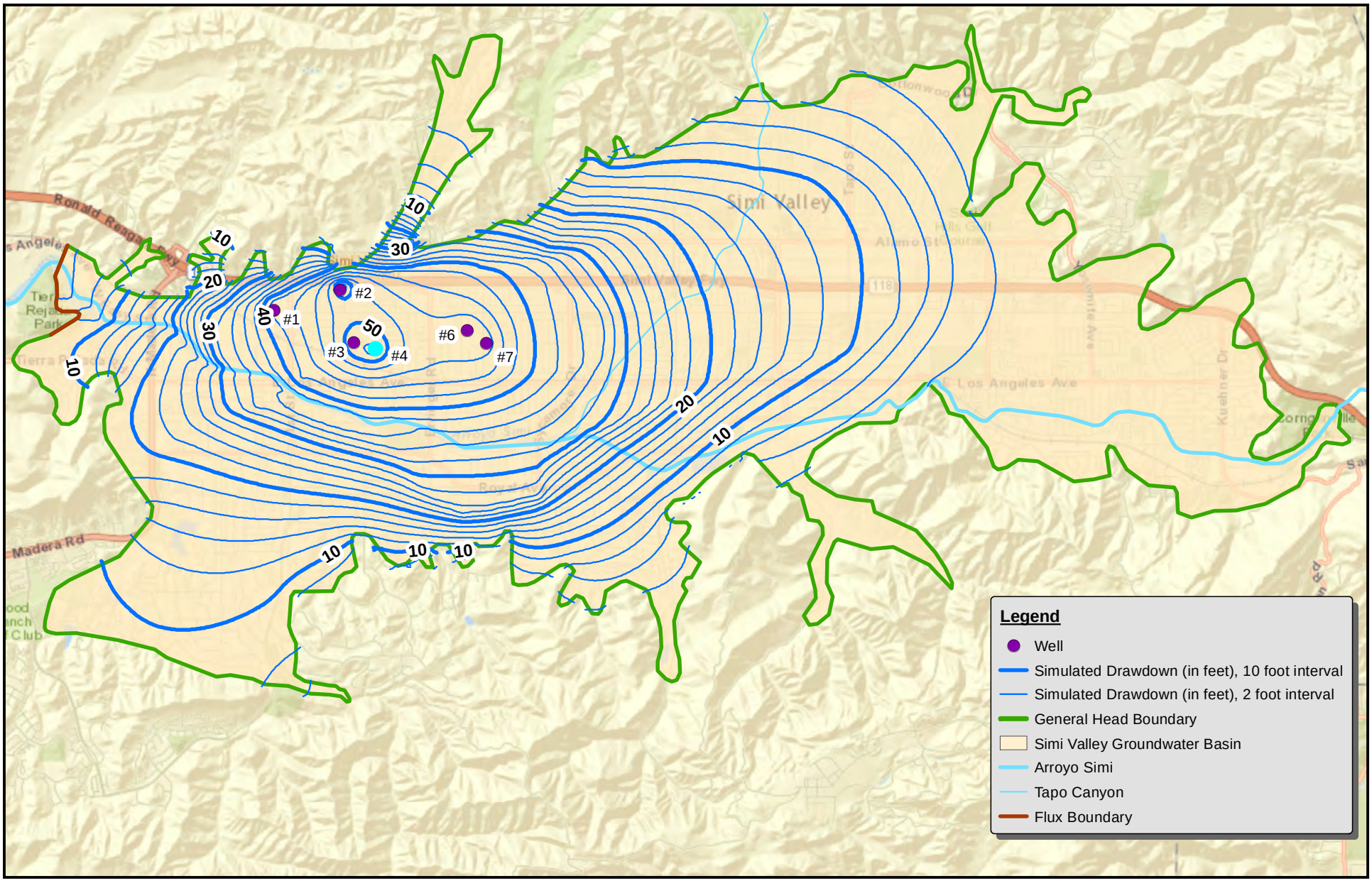
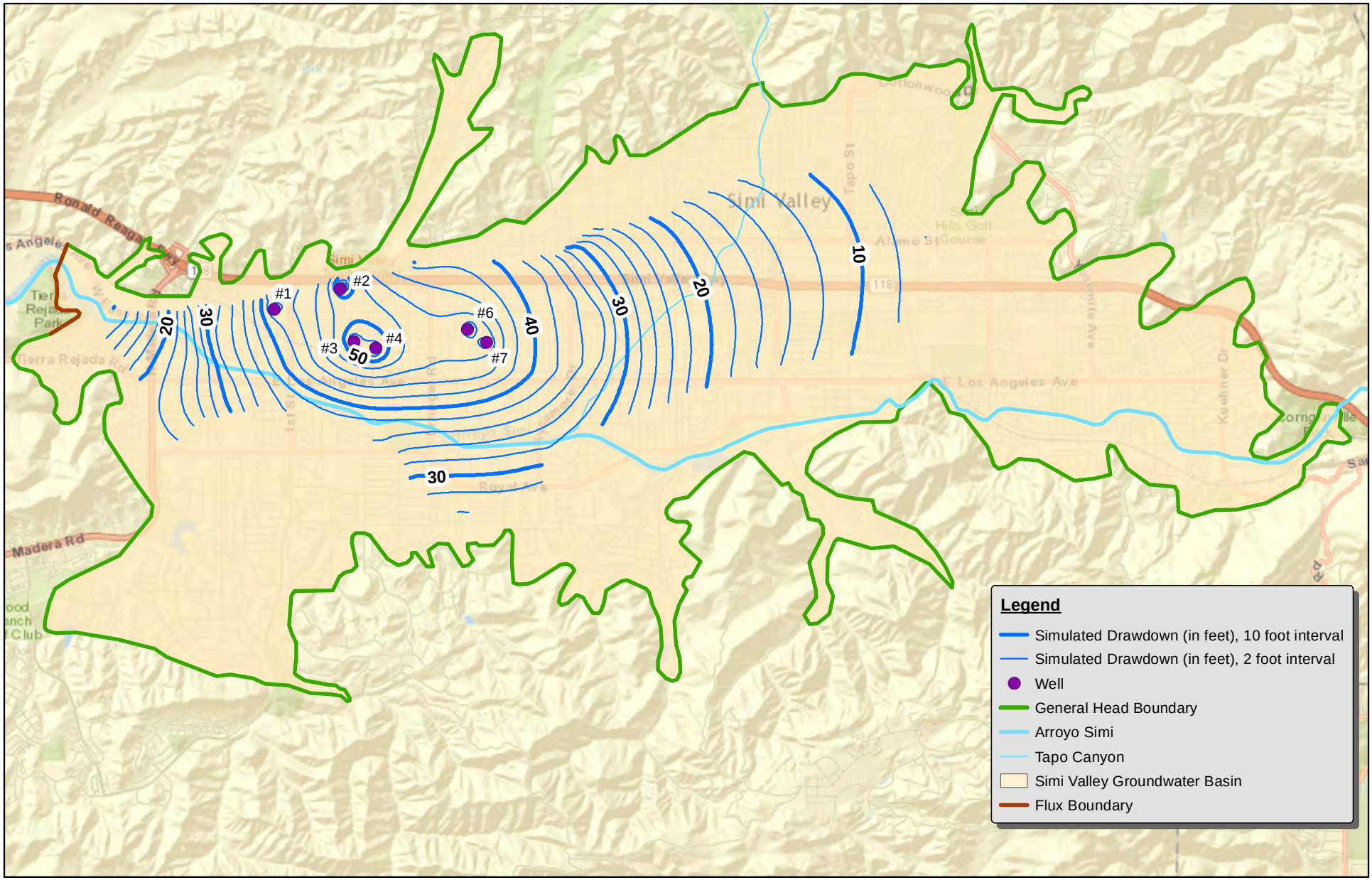


0 0.75 1.5 3 Miles

Figure 5-9
Simulated Drawdown in Model Layer 1, TP-2 Alternative

Hazen TODD GROUNDWATER

Simi Valley Basin
Groundwater Development Feasibility Study



0 0.75 1.5 3 Miles

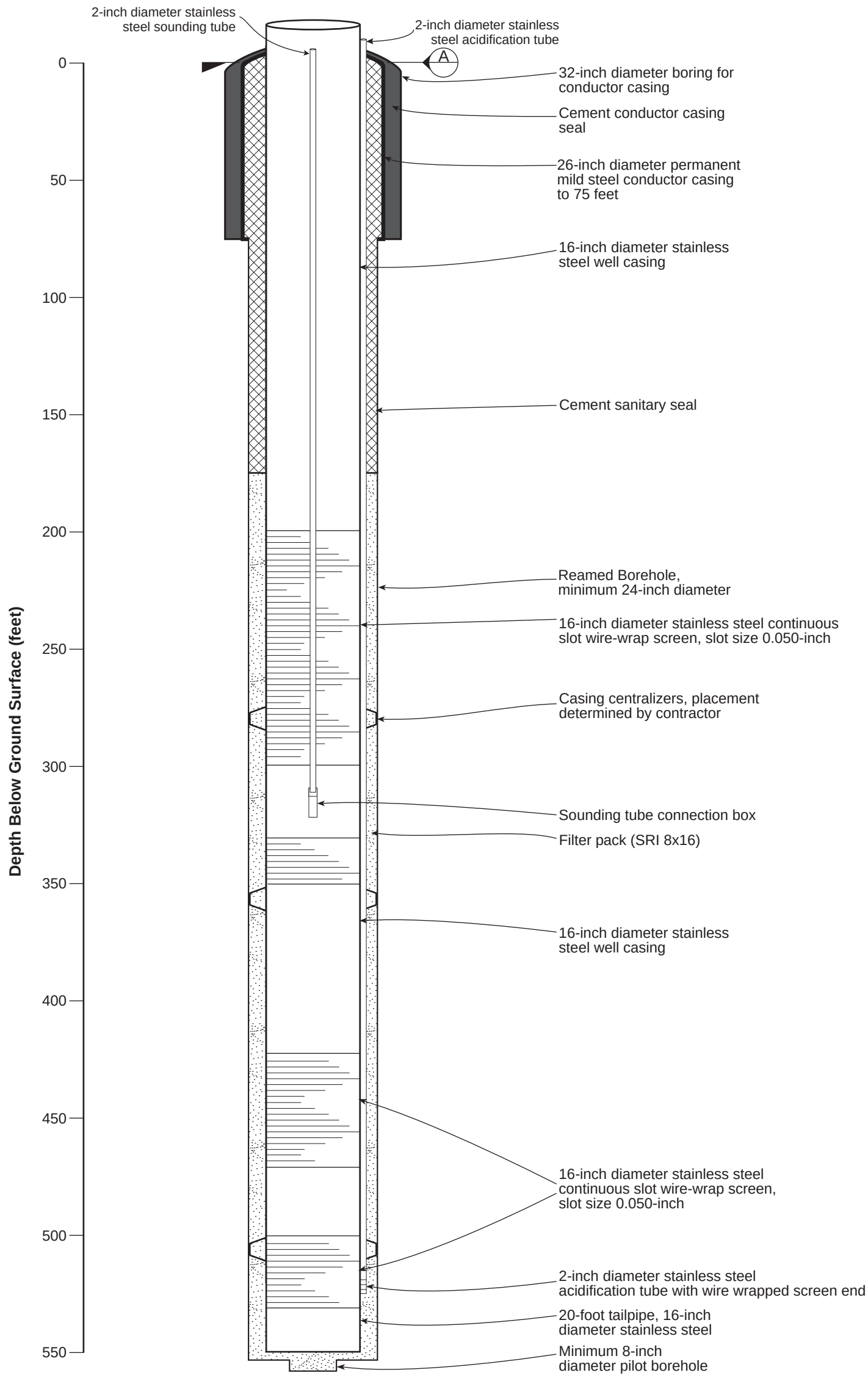
Figure 5-10
Simulated Drawdown in Model Layer 2, TP-2 Alternative

Simi Valley Basin
Groundwater Development Feasibility Study

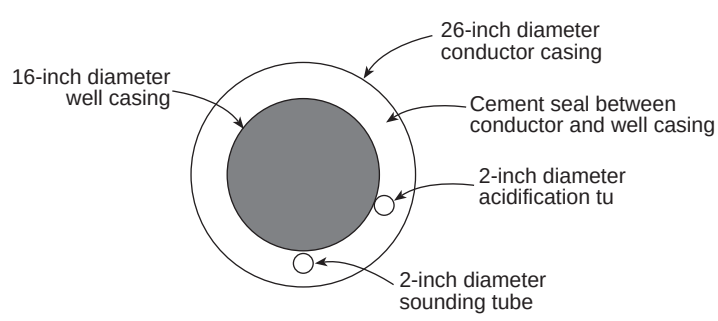
Hazen TODD GROUNDWATER

5.4 Well Design

The specific well details for well drilling, construction, development and testing are intended to represent average subsurface conditions in the identified well locations. Actual well drilling and construction details should be prepared for each selected well site prior to executing contracts with well drillers. Detailed site-specific specifications for wells are generally prepared by a hydrogeologist. The depth of new production wells will be dependent on location and conditions encountered during drilling. It is recommended that the entire alluvial thickness be drilled and logged to determine optimal well design and support further refinement of the hydrogeologic conceptual model of the basin. The wells were assumed to be 550 feet deep with 200 feet of screened intervals. This total depth is based on the estimated thickness of the aquifer averaged from each potential well location, and the screen length is based on the screened intervals in the nearby Golden State Water Company wells. The well design used for preparing the cost estimate for constructing the wells is shown in Figure 5-11. The costs are further discussed in Section 8. Other groundwater well infrastructure are discussed in Section 7.6.



Total Anticipated Well Completion Depth: 550 feet



Note: The profiles shown above represent initial designs based on existing data. Actual well construction details, including screen interval lengths and depths, will be determined for each individual Well.

Section Detail A
Wellhead surface completion

Figure 5-11
Preliminary Design Average Well Simi Valley

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Simi Valley Basin
Groundwater Development Feasibility Study

5.5 Aquifer Testing

The State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) requires demonstration of production capacity for municipal water supply wells. The Water Code includes guidelines to demonstrate new well capacity through completion of a constant rate pumping test and subsequent analysis by a qualified certified hydrogeologist, professional geologist, or professional engineer. The production rate for a constant rate pumping test is generally determined through completion of a variable rate pumping test prior to the constant rate test. Water levels in pumping wells and any nearby wells are measured throughout these tests and after pumping stops to measure hydraulic responses to pumping and recovery.

The variable rate test is commonly referred to as a step-discharge test because it involves pumping the new well at multiple discharge rates that step up over time. Variable rate tests are typically run at rates as low as 30 percent of anticipated well production capacity progressing up to as high as 150 percent of well production capacity. This progressively increasing pumping schedule provides water level response data for varying production rates, which is referred to in terms of production rate divided by water level drawdown (specific capacity). Specific capacity generally increases in response to increased pumping rate until maximum well pumping capacity has been reached, at which point specific capacity begins to decrease. Analysis of the variable rate test by an experienced hydrogeologist will provide a recommended discharge rate for the constant rate test.

The minimum constant rate test duration to comply with the requirements of the Water Code is eight hours. However, a 24-hour test is an industry standard, and it is generally advisable that the period of a long-term constant rate test for a municipal supply well be at least as long as the maximum duration of peak demand pumping. In addition, the Water Code requires that steady-state drawdown conditions be demonstrated for a minimum period of four hours during the capacity test. For these reasons, it is strongly recommended that a 24-hour constant rate test be completed on all new wells.

The cost estimate presented in Section 8 includes both variable rate and 24-hour aquifer tests and analysis following completion of each well. All testing should be conducted to exceed the minimum requirements set forth in the Water Code as required by the DDW. The cost estimate also includes estimates for hydrogeologic consulting for observation during testing, analysis of test results, and reporting to comply with DDW requirements. The District has noted that disposal of pumped water from aquifer testing to the storm drain or sewer may be problematic from a regulatory perspective given the poor-quality groundwater and Arroyo Simi TMDL limitations. The cost estimate assumes that pumped water can be discharged to the storm or sewer system or disposed to the ground surface.

5.6 Well Maintenance

The City has experienced declining well yields in its dewatering wells since 2012 (Todd, 2016). Leighton (1988) identified well problems including corrosive water, calcium carbonate cementation and iron bacteria encrustation. City efforts to rehabilitate the dewatering wells have met with limited success in some cases. Accordingly, special design features discussed above and a regular maintenance and redevelopment program are highly recommended for new production wells to increase their life and

efficiency. Due to the quality of the water in the Simi Valley Basin, a more frequent and rigorous monitoring and maintenance program is recommended than would be required in a basin with better water quality. The supervisory control and data acquisition (SCADA) system and downhole camera data will help identify when maintenance is required. For costing purposes, it is assumed that rehabilitation will be required every two years and this cost has been included in the annual O&M cost estimate in Section 8.

6. Groundwater Treatment Overview

6.1 Groundwater Quality

Groundwater quality in the basin is naturally poor, particularly in the central and western portions. Historical agricultural, urban and industrial land uses have also contributed contaminants to the basin. The typically-observed concentrations for TDS, sulfate, nitrate, iron, manganese and boron in the Simi Valley Groundwater Basin exceed water quality objectives and the groundwater will require treatment to make the water acceptable for drinking water use. In addition, siting of new production wells should avoid the local areas where environmental release sites in the unconfined portion of the basin have contaminated groundwater at significant depths.

Groundwater quality data are available from several sources including the SWRCB Division of Drinking Water (DDW) for purveyors having more than 15 connections, DWR special studies, Ventura County from regular monitoring from selected wells, and the online GeoTracker Groundwater Ambient Monitoring and Assessment (GAMA) program. The GeoTracker GAMA groundwater information system integrates and displays water quality data on an interactive, searchable map (http://geotracker.waterboards.ca.gov/gama/). The system contains data records from different sources such as cleanup sites, well logs, DDW, DWR, California Department of Pesticide Regulation, the GAMA Priority Basin Project, the GAMA Domestic Well Project, and the GAMA Special Studies Project. The USGS has collected groundwater samples in the Simi Valley Basin as part of the California GAMA Priority Basin Project (2011).

The water quality discussion addresses the main production zones of the basin. Data available for environmental contamination sites, which typically monitor shallow groundwater, are not considered here.

Water quality objectives or standards have been developed for many constituents that occur in groundwater. The DDW establishes primary and secondary maximum contaminant levels (MCLs and SMCLs). The U.S. Environmental Protection Agency (USEPA) also adopts MCLs under the federal Safe Drinking Water Act. The primary MCL is the maximum allowable limit for a contaminant in drinking water and is protective of human health. Primary MCLs reflect the chemicals' health risks, factors such as detectability and treatability, as well as the cost of treatment. SMCLs are derived based on aesthetic considerations such as taste and odor. Notification levels (NLs) are published for chemicals for which there is no drinking water MCL. Notification levels are based mainly on health effects. NLs are advisory to water suppliers. If the Threshold 1 NL is exceeded, local government notification is required and customer notification is recommended. If Threshold 2 NL is exceeded, it is recommended that the drinking water source be taken out of service.

The Los Angeles Regional Water Quality Control Board (LARWQCB) has established Basin-Specific Basin Plan Objectives (BSBPOs) for the confined aquifers of the Simi Valley Basin for TDS, sulfate, chloride, and boron (LARWQCB, 2011). BSBPOs have not been established by the LARWQCB for the unconfined aquifers in the Simi Valley Basin. MCLs, BSBPOs and NLs for selected constituents are provided in Table 6-1.

Table 6-1: Regulatory Limits for Potential Constituents of Concern in Groundwater in Simi Valley

Constituent	Primary MCL (mg/L)	SMCL (mg/L)	BSBPO Simi Valley Basin Confined Aquifers (mg/L)	Notification Level (mg/L)	
				Threshold 1	Threshold 2
TDS	NA	500/1,000/1,500	1,200	NA	NA
Sulfate	NA	250	600	NA	NA
Chloride	NA	250/500/600	150	NA	NA
Iron	NA	0.3	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA
Manganese	NA	0.05	NA	NA	NA
Boron	NA	NA	1.0	1.0	10
Nitrate as Nitrate (NO_3)	45	NA	45	NA	NA
Perchlorate	0.006	NA	0.006	NA	NA
Gross Alpha Radioactivity[1]	15	NA	15	NA	NA

[1] In units of picocuries per liter

6.1.1 Total Dissolved Solids (TDS)

Total salinity is commonly expressed in terms of total dissolved solids (TDS) as mg/L or parts per million (ppm). As established by the DDW, the SMCL for TDS is 500 mg/L, with an upper limit of 1,000 mg/L, and a short-term limit of 1,500 mg/L. While TDS can be an indicator of anthropogenic impacts, there are also natural background TDS levels found in groundwater. The background TDS concentrations in groundwater can vary considerably based on purity and the crystal size of the minerals, rock texture and porosity, the regional structure, origin of sediments, the age of the groundwater, and many other factors (Hem, 1989).

Figure 6-1 shows average TDS concentrations in groundwater with colored circles representing different ranges of concentrations for three selected time periods including 1950 to 1969, 1970 to 1989, and 1990 to 2016. The most comprehensive groundwater monitoring was conducted during the 1950 to 1969 time

period because a large number of wells still existed in the basin and DWR performed significant monitoring.

As shown in the figure representing the 1950 to 1969 time period, TDS concentrations frequently exceeded the upper SMCL of 1,000 mg/L and the short-term limit of 1,500 mg/L. TDS concentrations were significantly lower in the eastern portion of the basin with concentrations progressively increasing toward the west, where concentrations could exceed 3,000 mg/L. The figure also shows a pattern of slightly higher TDS concentrations in the northern portion of the basin compared with the southern portion of the basin.

For the 1970 to 1989 and 1990 to current time periods, there are significantly fewer data points and it is difficult to discern any patterns or changes in groundwater quality given the limited data. However, for the available data, concentrations appear similar for recent data compared with historical data.

The widespread elevated TDS concentrations above the upper SMCL (1,000 mg/L) and short-term limit (1,500 mg/L) indicates that in order to utilize the groundwater for a domestic water supply, the groundwater will need to be blended with better quality water or treated to reduce salts with subsequent export of salts. The planned SMP, brine line extension, to Simi Valley will provide a mechanism to improve groundwater quality in the basin over time through the export of salts.

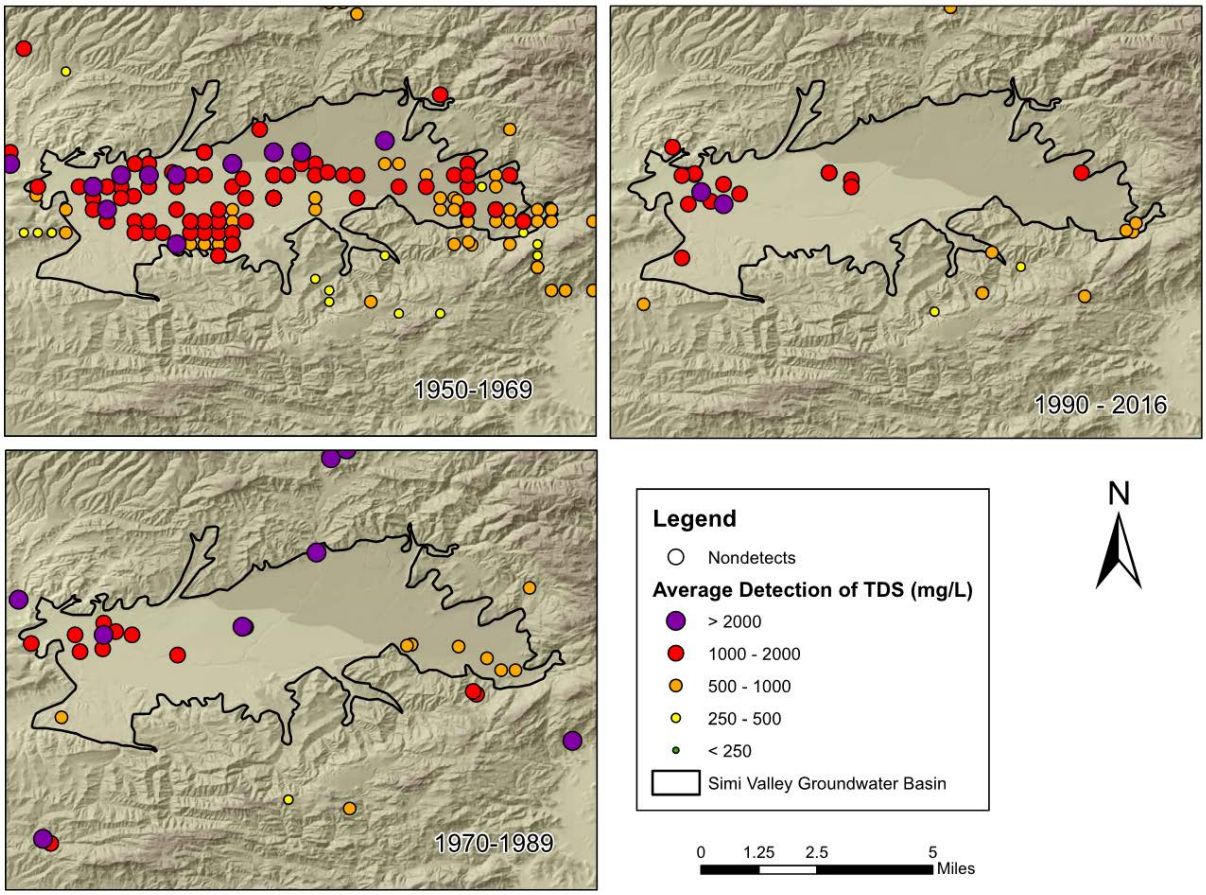


Figure 6-1: TDS Concentration Map

6.1.2 Sulfate

Sulfate occurs naturally in drinking water, and also has anthropogenic sources. Health concerns regarding sulfate in drinking water have been raised because of reports that diarrhea may be associated with the ingestion of water containing high levels of sulfate. Of particular concern are groups within the general population that may be at greater risk from the laxative effects of sulfate when they experience an abrupt change from drinking water with low sulfate concentrations to drinking water with high sulfate concentrations. Sulfate in drinking water currently has a SMCL of 250 mg/L, based on aesthetic effects (i.e., taste and odor). The BSBPO for sulfate is 600 mg/L.

Sulfate concentrations in the Simi Valley Basin groundwater typically exceeds both the SMCL and the BSBPO. Sources of elevated sulfate include irrigation return flows and oxidation of reduced sulfur in sulfide minerals in the marine sediments of the surrounding hills and aquifer matrix as well as organic matter in sediments (USGS, 2011). Due to elevated sulfate, groundwater will need to be blended or treated to reduce sulfate concentrations for potable uses.

6.1.3 Nitrate

Nitrate is a colorless, odorless, and tasteless ion that is often present in groundwater. Nitrate is a health concern due to methemoglobinemia, or "blue baby syndrome," which affects infants. Elevated levels may also be unhealthy for pregnant women (SWRCB, 2010). The BSBPO and primary MCL for nitrate is 45 mg/L.

High levels of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment and disposal facilities. Additionally, airborne nitrogen compounds discharged from industry and automobiles are deposited on the land in precipitation and as dry particles, referred to as dry deposition. These sources also contribute to nitrate loading in groundwater. Nitrate can occur naturally in groundwater, but levels are generally very low, typically less than 10 mg/L.

Figure 6-2 shows nitrate concentrations for similar time periods as discussed for TDS concentrations. For the 1950 to 1969 time period, only two wells in the eastern portion of the basin showed nitrate concentrations above the 45 mg/L primary MCL. The 1970 to 1989 time period shows two wells in the western basin with nitrate levels exceeding the primary MCL. In the 1990 to 2016 time period, nitrate levels in five wells exceeded the MCL. As with TDS, it is difficult to assess trends, due to the relatively limited recent period data.

Based on the available data, it appears possible that water supply wells developed in the Simi Valley Basin could contain nitrate at concentrations above the primary MCL. Water from such wells would require either blending with better quality water or treatment to reduce concentrations below the primary MCL.

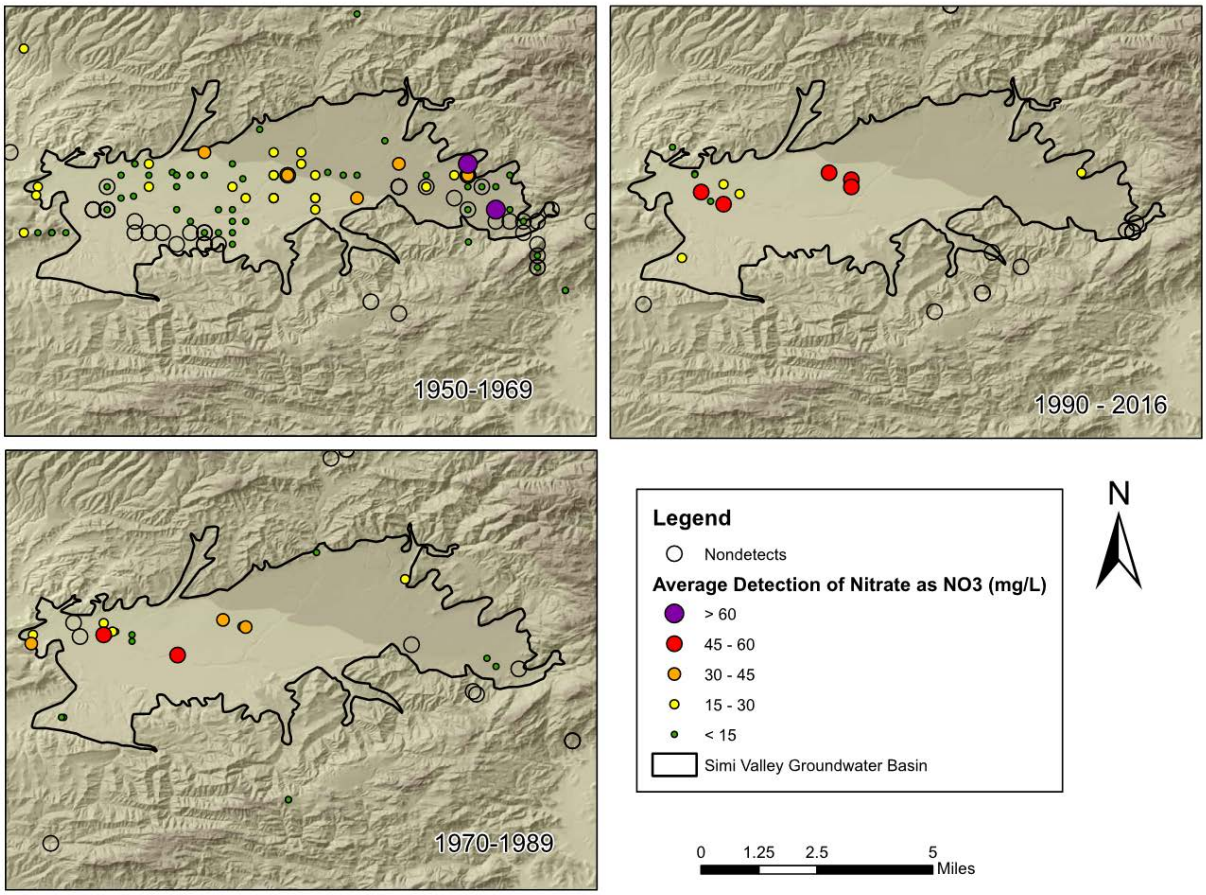


Figure 6-2: Nitrate Concentration Map

6.1.4 Chloride

Chloride occurs naturally in groundwater, but concentrations can be increased by human activities. As established by the DDW, the recommended SMCL for chloride is 250 mg/L, with an upper limit of 500 mg/L and a short-term limit of 600 mg/L. The BSBPO for chloride is 150 mg/L.

Similar to TDS, elevated chloride concentrations are undesirable for aesthetic reasons related to taste, odor, or appearance of the water and not for health reasons. However, elevated chloride concentrations in water can damage crops, affect plant growth, and damage municipal and industrial equipment. Chloride is mobile in the environment and conservative (meaning that it does not readily interact with subsurface media (vadose zone and saturated zone) and is not readily attenuated in the subsurface). Accordingly, chloride is an ideal indicator of groundwater quality trends. Chloride is typically detected at concentrations below the SMCL of 250 mg/L in the Simi Valley Basin.

6.1.5 Boron

Boron is a naturally-occurring element in soil and groundwater and concentrations depend mostly on the local geology. Anthropogenic boron sources include industrial waste discharges and municipal sewage because boron is found in household detergents. Most human exposure to boron comes from either boric acid or borax. Boric acid is the form of boron most likely to be encountered in drinking water, and can be lethal at high concentrations. Other symptoms of boric acid ingestion include gastrointestinal tract distress, vomiting, abdominal pain, diarrhea, and nausea. Animal studies have observed reproductive and developmental effects when boron was ingested at high levels (SWRCB, 2010).

Boron is typically detected in Simi Valley Basin groundwater at concentrations near or above the Notification Level (NL). Groundwater with concentrations above the NL would require blending or treatment to reduce concentrations. Figure 6-3 shows average Boron concentrations in groundwater for three selected time periods described above. Boron is frequently detected above the BSBPO.

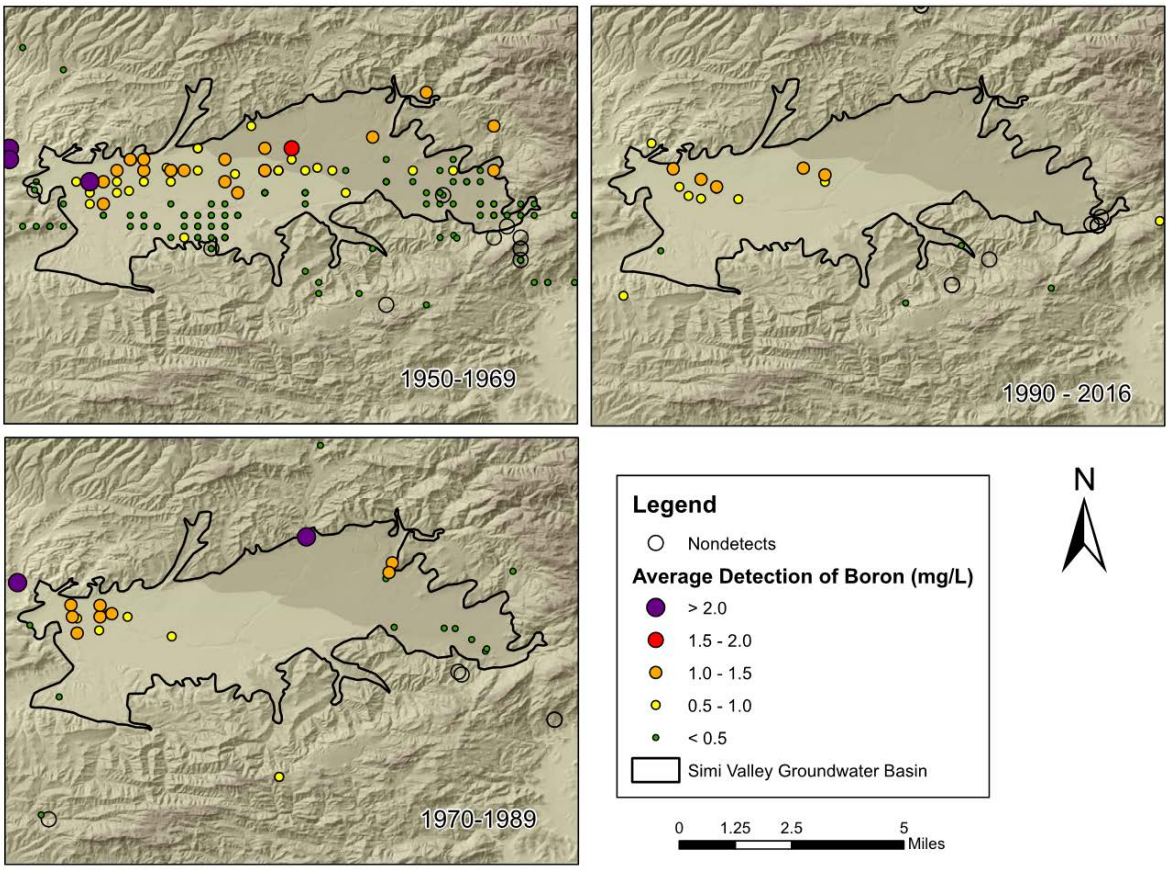


Figure 6-3: Boron Concentration Map

6.1.6 Iron

Sources for iron in groundwater are both natural and anthropogenic. Iron is leached from sediments in subsurface aquifers and, under corrosive conditions, from steel pipes used for construction of water wells and distribution systems. The SMCL for iron in drinking water is 0.3 mg/L. High concentrations of iron in water can stain plumbing fixtures and clothing, encrust well screens, clog pipes, and may impart a salty taste. While these problems are recognized, iron also is an essential nutrient for human health, and does not pose significant health effects except in special cases.

Iron is typically detected in the Simi Valley Basin groundwater below the SMCL. Figure 6-4 shows average iron concentrations in groundwater or the three selected time periods. Iron is frequently detected above the SMCL.

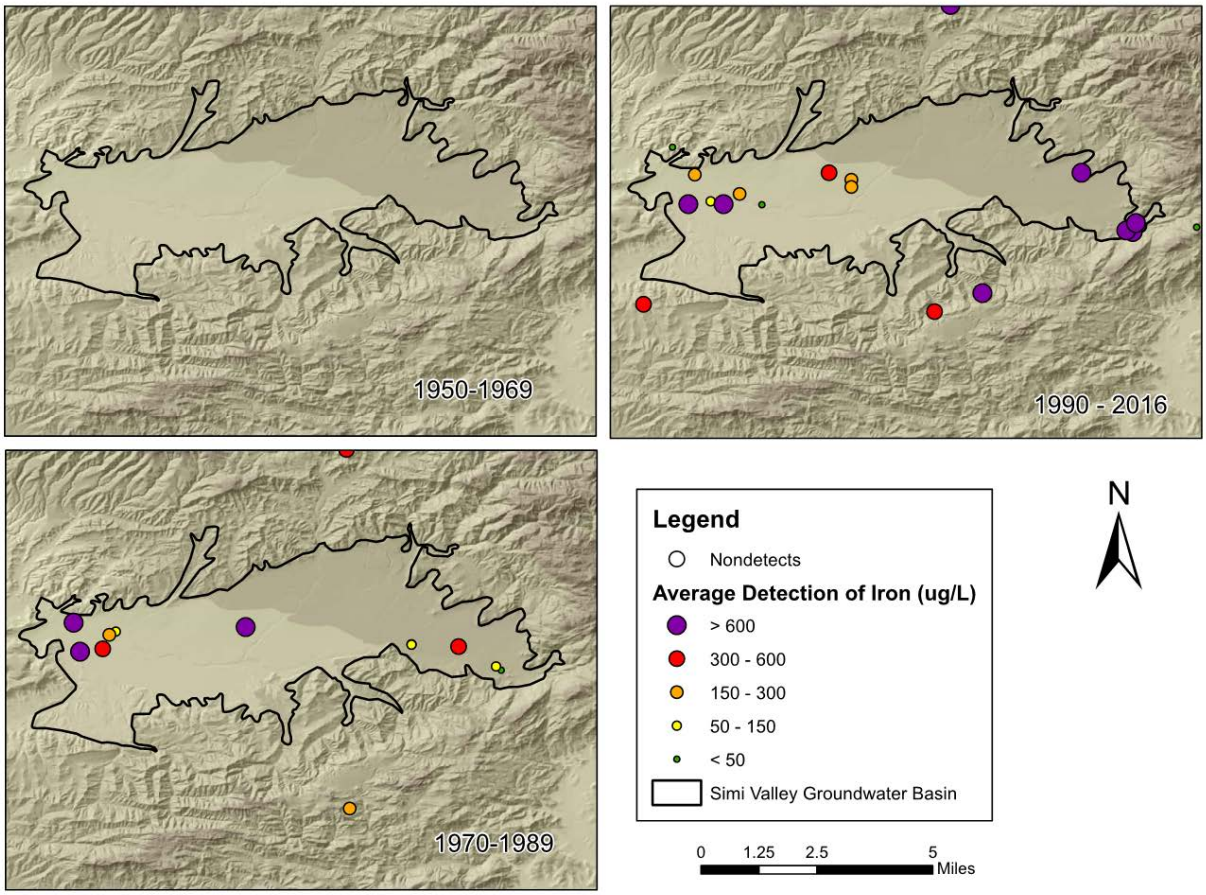


Figure 6-4: Iron Concentration Map

6.1.7 Manganese

Manganese is naturally-occurring and is objectionable in water in the same general way as iron. Stains caused by manganese are black and are more unsightly and harder to remove than those caused by iron. While manganese is considered an essential nutrient for human health at low levels, a SMCL of 0.05 mg/L is established for manganese due to its undesirable aesthetic qualities.

Manganese in the Simi Valley Basin groundwater is typically detected below the SMCL. Figure 6-5 shows average manganese concentrations in groundwater the for three selected time periods. Manganese is frequently detected above the SMCL.

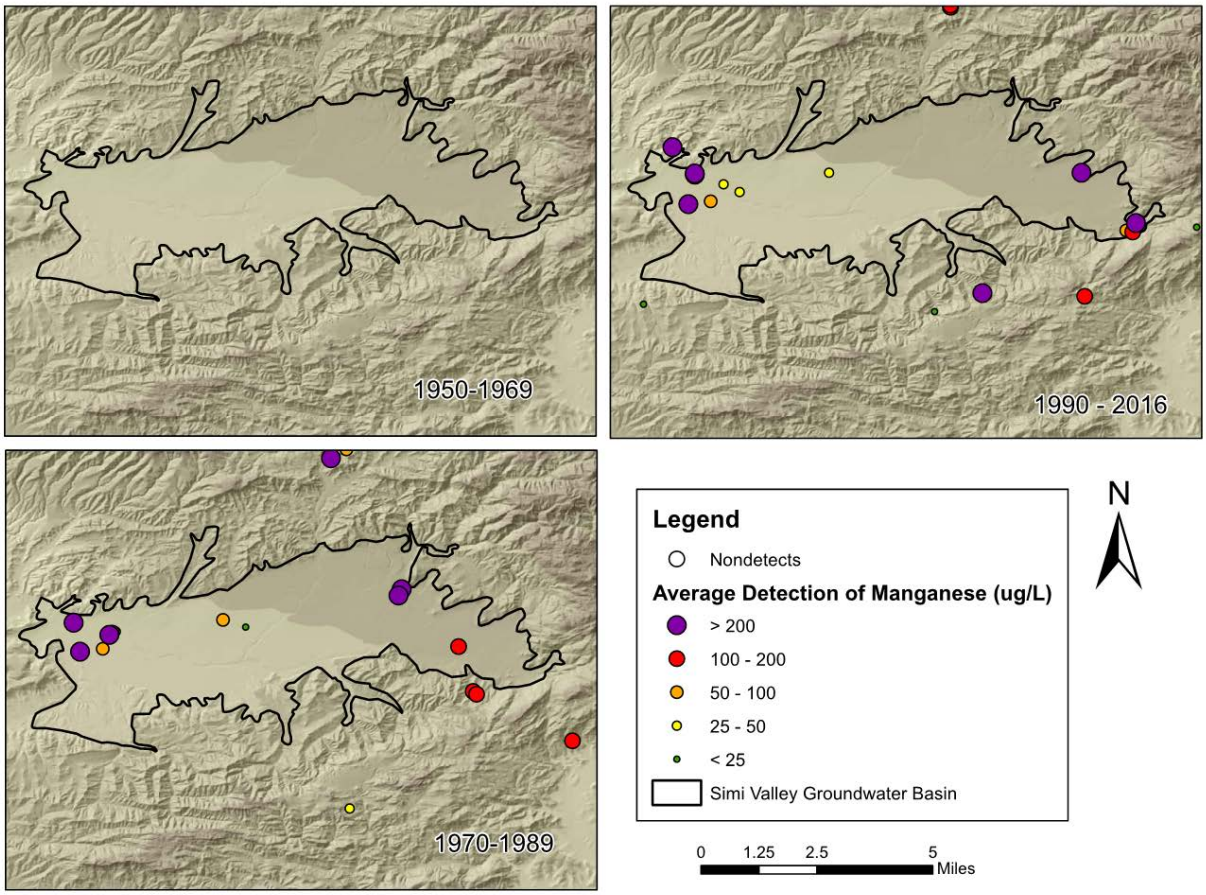


Figure 6-5: Manganese Concentration Map

6.1.8 Gross Alpha Radioactivity

Radionuclides often are naturally occurring in rocks and sediments and emit ionizing radiation – alpha particles, beta particles, and gamma rays – when they decay. Alpha-emitting substances in natural water are mainly isotopes of radium and radon. Gross alpha radioactivity in groundwater is typically reported in picocuries per liter (pCi/L).

The health effects of alpha particles depend primarily upon how exposure takes place. External exposure (external to the body) is of far less concern than internal exposure, because alpha particles lack the energy to penetrate the outer dead layer of skin. However, if alpha emitters have been inhaled, ingested (swallowed), or absorbed into the blood stream, sensitive living tissue can be exposed to alpha radiation. The resulting biological damage increases the risk of cancer. In particular, alpha radiation is known to cause lung cancer in humans when alpha emitters are inhaled. The primary MCL for gross alpha radioactivity is 15 pCi/L.

While typically detected below 15 pCi/L, alpha radioactivity has been occasionally detected in the Simi Valley Basin groundwater at concentrations above the primary MCL.

6.1.9 Perchlorate

Perchlorate is both a naturally-occurring and an anthropogenic chemical. Perchlorate is widespread in the environment at low concentrations (NRC, 2005; USEPA, 2008; and OEHHA, 2008). Natural sources with relatively high concentrations include Chilean nitrate deposits used as fertilizers and other deposits in arid areas. Chilean fertilizer has been widely used in the U.S., particularly for citrus.

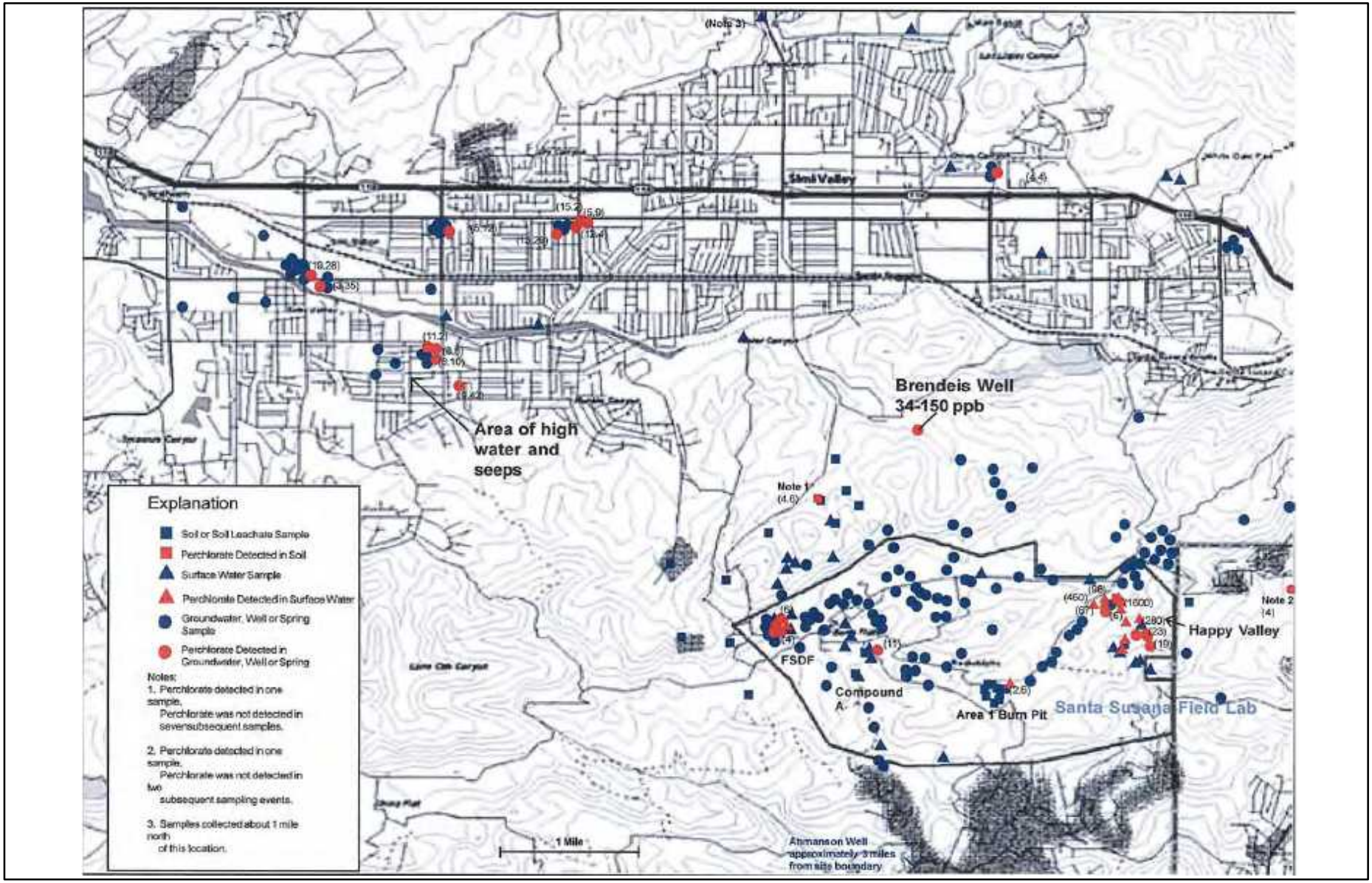
Perchlorate is also found in a number of anthropogenic products including rocket propellant, road flares, fireworks, blasting agents and explosives (Motzer, 2001). Perchlorate has been detected in soil and groundwater at the Boeing (former Rocketdyne) Santa Susana Field Laboratory located in the Simi Hills south of Simi Valley (CH2MHILL, 2007).

In 1999, perchlorate was found in shallow, non-drinking water wells (environmental release site monitoring wells such as gasoline stations) in Simi Valley (DTSC, 2003). Following these detections, the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) and the LARWQCB conducted an extensive program to sample soil, wells, springs, and surface water drainages throughout Simi Valley. Perchlorate was detected in 15 of 66 wells sampled. Most detections were scattered within the valley at depths of less than 20 feet at environmental release site monitoring wells. Concentrations of perchlorate ranged from 4 to 19 ug/L. Review of the DDW water quality data for municipal supply wells indicates sporadic detection of perchlorate in two water supply wells at concentrations between non detect (ND) and 5.6 ug/L. These wells are screened to depths of 450 and 534 feet. In addition, sampling by the USGS (2011) showed a detection of 4.2 ug/L in a water supply well screened to a depth of 290 feet.

Perchlorate was not detected in any surface water samples from Arroyo Simi sampled by DTSC, but it was detected in two surface water seeps in the area of high groundwater in the southwestern portion of the valley (CH2MHILL, 2007).

Figure 6-6 shows the DTSC sampling results in Simi Valley along with results at the Rocketdyne site south of the valley. Perchlorate is detected in soil, surface water and groundwater at the Rocketdyne facility. Concentrations in groundwater at the Rocketdyne site are found at concentrations up to 1,600 ug/L (CH2M HILL, 2007). Perchlorate has also been detected in an offsite well (Brandeis Well, see Figure 6-6) although detections have shown significant variability when sent to different laboratories for confirmation sampling (DTSC, 2003). Other contaminants are also detected in groundwater at the Rocketdyne facility, predominantly volatile organic compounds (VOCs) (Boeing, 2015).

The source or sources of perchlorate detections in the Simi Valley have not been determined. Chilean fertilizer used for citrus irrigation is a possible source. Given the distribution of perchlorate detections, new groundwater supplies developed in the valley may contain low levels of perchlorate. However, based on the reported detections and well depths, detections in new deeper water supply wells may be below the primary MCL.



From DTSC, 2003

Figure 6-6
Perchlorate Sampling in and near Simi Valley

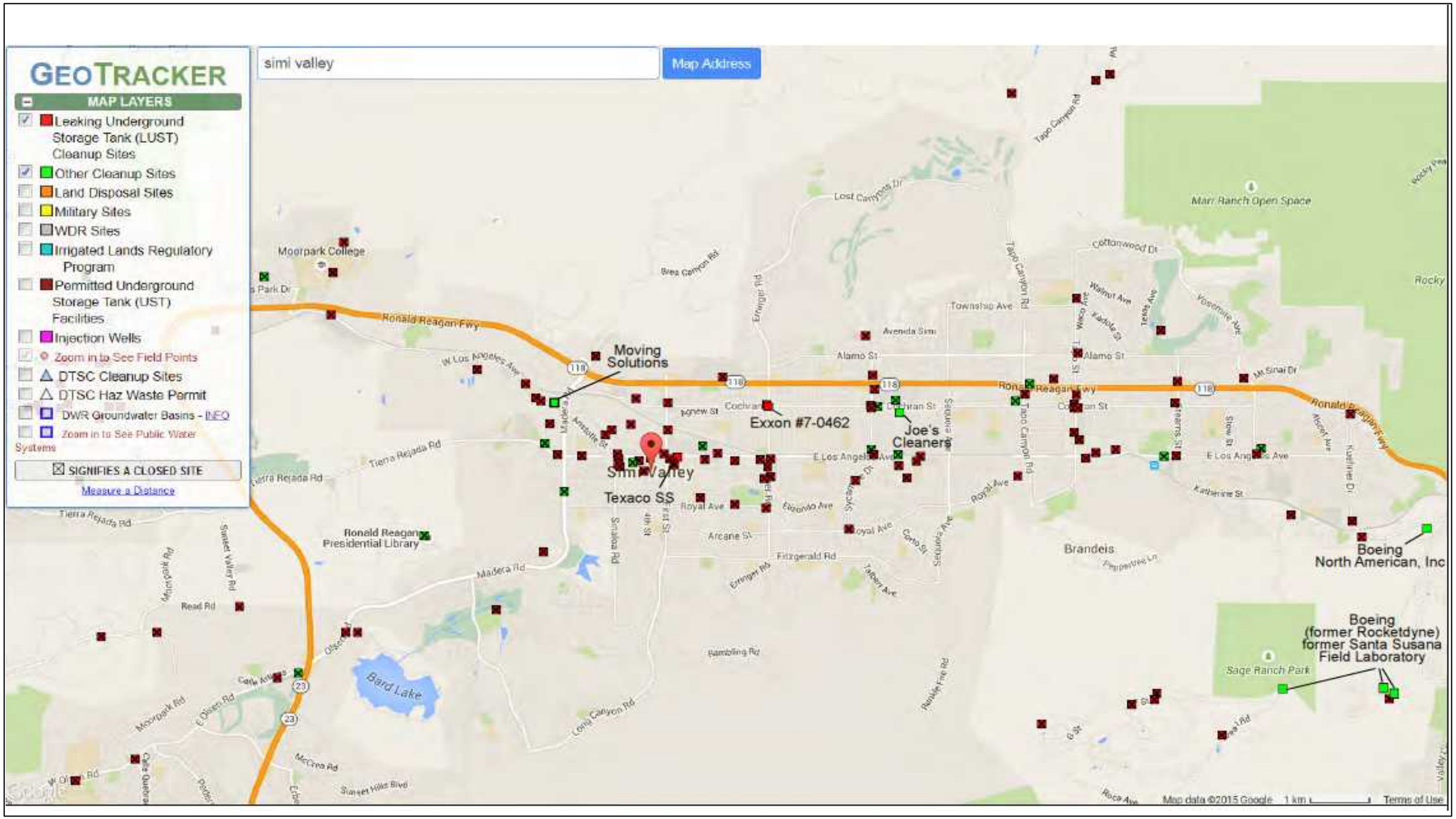
6.1.10 Environmental Contamination Sites

The online GeoTracker site (http://geotracker.waterboards.ca.gov) was accessed to identify environmental release sites that could potentially impact new water supply wells in the valley for the Simi Valley Basin Study. Figure 6-7 shows active and inactive environmental release sites in Simi Valley.

Two active leaking underground storage tank sites were identified on GeoTracker. Both appear to pose low level risks to potential new District production wells. The Texaco SS site has been undergoing remediation and is currently undergoing verification monitoring to assess remedial effectiveness (WaynePerry, 2015). The Exxon #7-0462 site underwent a period of remediation and is currently being monitored (Cardno ERI, 2015).

Two active Spills, Leaks, Investigations and Cleanup (SLIC) sites were identified on GeoTracker as shown on Figure 6-7. An active dry cleaner site (Joe's Cleaners) was identified where perchloroethylene ([PCE], also called tetrachloroethylene) has impacted groundwater to depths of about 100 ft-bgs. The site is undergoing remediation. The site is located in the unconfined portion of the basin. The plume is about 250 feet in length; although, the downgradient extent is not well defined. It is noted that GSWC wells located downgradient from the site have detected trace levels of PCE, which could potentially be related to the site.

The Moving Solutions site, used historically for textile-dying operations, is also an active remedial site. The site overlies a portion of the basin that is confined to semi-confined. Shallow groundwater near the site shows detections of volatile organic compounds including primarily PCE and trichloroethylene (TCE). The site is currently undergoing remediation via groundwater and vapor extraction (Leymaster, 2015). TCE and PCE both have a primary MCL of 5 ug/L. Figure 6-8 shows the extent of total VOCs (about 800 feet in length). However, the downgradient extent is not fully characterized. The reported groundwater flow direction at the site is also shown.

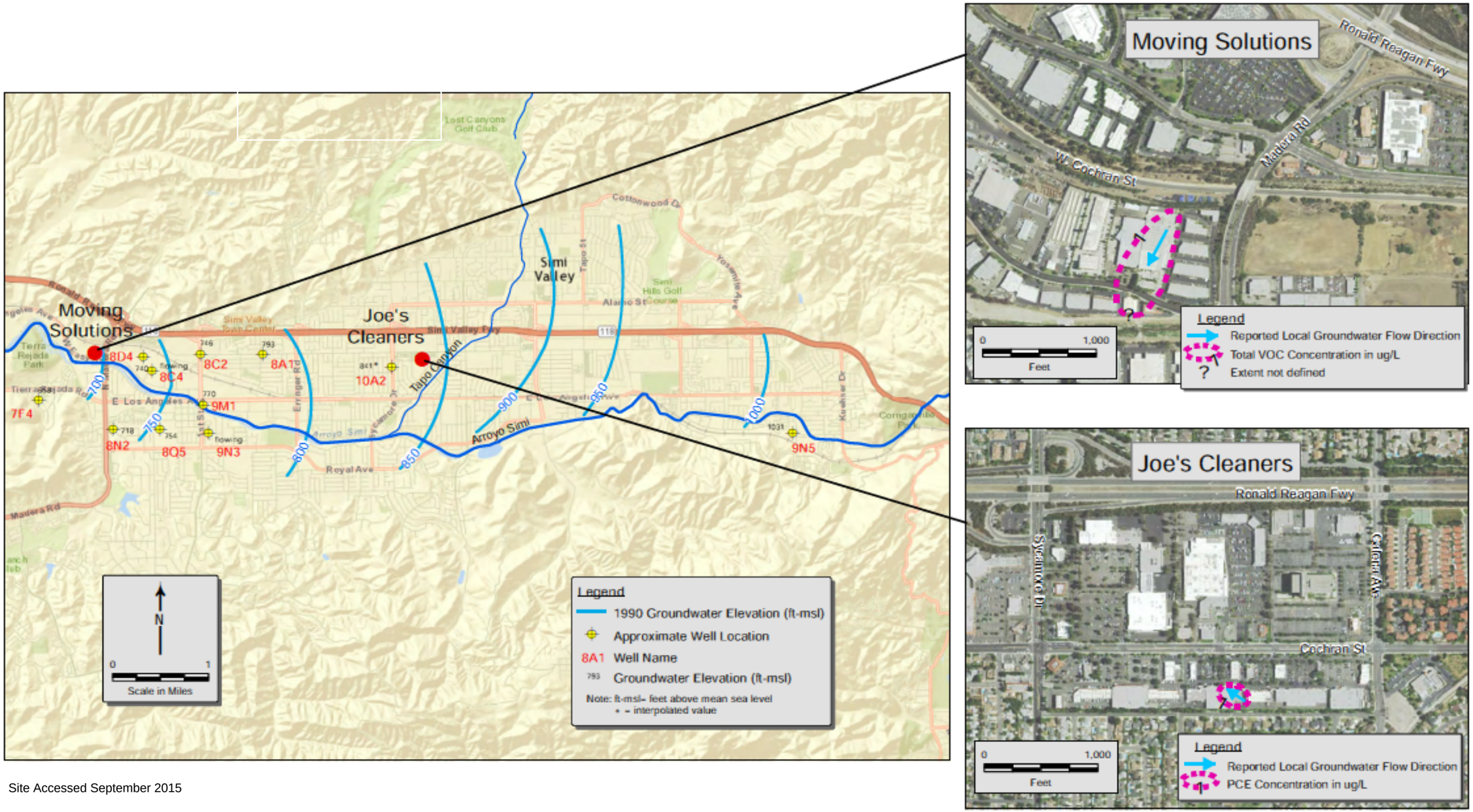


Site Accessed September 2015

Figure 6-7
Geotracker Sites

Hazen TODD GROUNDWATER

Simi Valley Basin
Groundwater Development Feasibility Study



Site Accessed September 2015

Figure 6-8
Extent of VOC's

6.2 Water Treatment Technology

A brackish water source requires treatment through a desalination process, which separates the water into two streams: the larger portion is the treated water, with a low TDS content, whereas the smaller stream is the brine (also known as concentrate), that has a much higher concentration of salts than the feed water. Treatment technologies for desalination are classified broadly as either thermal or membrane processes.

Thermal technologies most commonly used are Multi-Stage Flush Distillation (MSF) and Multi-Effect Distillation (MED). These processes are based on water evaporation and the subsequent condensation of the steam (distillate). They have been utilized since the 1950s in seawater desalination for large treatment plants in Middle East, where the cost of energy is low. Thermal processes are rarely used for brackish water desalination, due to significantly larger capital and operation costs comparing to the other available technologies.

Membrane based desalination technologies involves Electrodialysis Reversal (EDR) and Reverse Osmosis (RO). Nanofiltration (NF) membrane, although very similar to RO, have a low rejection of the monovalent salts such as sodium chloride (NaCl), which is a major constituent to be removed in brackish water treatment. NF applications typically include water softening and organics/color removal. Other membrane based technologies such as ultrafiltration (UF) and microfiltration (MF) are not suitable to remove the salts from a brackish water, due to the large pore size inherent to these membranes. However, UF and MF can be used as pre-treatment for either EDR or RO treatment, for removal of suspended solids and other particulate that would foul the EDR and RO membranes.

EDR technology is based on an electrical potential (voltage) applied to ion-selective membranes. Although originally developed as a seawater destination treatment, currently EDR is a niche technology effective for some brackish water with TDS of 3,000 mg/L or less. When electrodes generate a voltage that is applied to a saline solution, the dissolved ions, such as sodium (Na+) and chloride (Cl-) are driven in opposite directions and pass through the selected membranes. The membranes allows either cations or anions to pass through, but not both. The ions migration towards the electrodes and through the ion selective membranes results in the demineralization of the feed water in between the membranes and concentration of these salts in the channels next to the electrodes. At intervals of typically 15 minutes, the polarity of the electrodes is reversed (thus the term “reversal”), and the ions travel in the opposite direction, which aids breaking up the scale and other surface-fouling mater on the membranes surfaces.

EDR has been employed in a limited number of applications for full scale drinking water facilities, most notable being the 12 MGD groundwater treatment plant in Sarasota, FL built in 1995 and currently the largest in the world. Due to the characteristics of the electrical process in EDR, the constituents in the water that are not ionized will not be removed from the feedwater. Unlike reverse osmosis, EDR will not remove organics and is not a barrier for viruses or other pathogenic microorganisms. The removal of Boron has not been well documented by EDR, and EPA does not list EDR as best available technology (BAT) for radionuclides such as gross alpha.

Due to the limitations of the EDR technologies, RO is selected as the core treatment process for the groundwater at Simi Valley. Presently, RO membranes are the leading technology for new drinking water desalination installations in California and around the world. RO treatment presents additional versatility

in removing some other constituents that could be present in the groundwater at Simi Valley, such as volatile and semi-volatile organics originating from the environmental contamination sites described in Section 6.1.10.

Reverse osmosis (RO) is the most economical option for reducing TDS. However, removal or reduction of iron and manganese, which have been detected at concentrations greater than 6.1 mg/L and 0.35 mg/L respectively, are required prior to the RO. Elevated iron and manganese concentrations will cause colloidal and particulate fouling of the RO membranes, which negatively impacts the operations and maintenance.

Greensand filtration is a cost effective treatment for iron and manganese. A Process Flow Diagram (PFD) of the proposed treatment is presented in Figure 6-9. The treatment systems are planned to be designed with 25 percent turn down increments, and both the greensand and the RO systems are planned to have 4 standalone units.

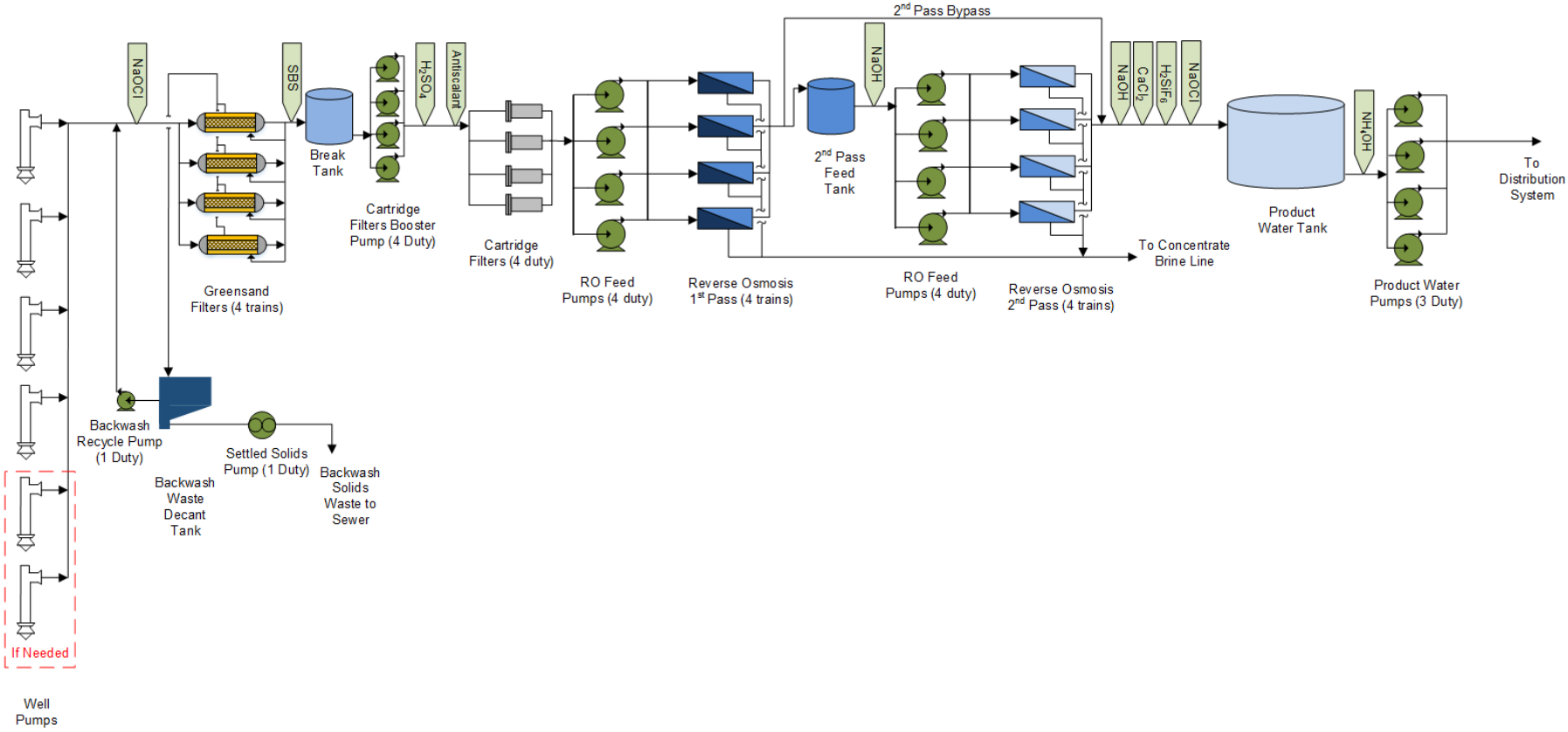


Figure 6-9: Process Flow Diagram for Treatment System

Raw water enters the treatment facility from the well site as indicated at the far left of the PFD. Each of the sub-systems will be described in more detail in the following sections. The first step of the treatment process is the greensand filter system, i.e. filter vessels and backwash and recovery system. From the greensand system, the flow will enter the break tank which provides flow equalization between the greensand system and the two pass RO system. From the break tank, flow enters the RO system, i.e. RO transfer pumps, cartridge filters, high pressure feed pumps, and RO membrane trains. Following the RO system, the post treatment chemicals are dosed before the flow enters the product water storage tank. Finally, the product water pump station pumps the treated water into the distribution system.

6.2.1 Greensand Filtration

Greensand filters are media filters that can be configured in pressure vessels or gravity basins. Greensand filtration is a mature technology used in the United States since the 1950s and very effective in removing iron and manganese. Filtration with greensand requires the addition of an oxidizing agent, such as free chlorine. The process of manganese (Mn) removal by catalytic oxidation/ filtration has been generally regarded as cost effective when compared with conventional oxidation and filtration treatment. The catalytic oxidation/filtration requires lower concentrations of oxidants and shorter oxidant contact time before filtration. The catalytic media accelerates the pre-oxidation of Mn and Fe which are adsorbed on the media through the process of filtration.

The catalytic media can be manganese dioxide coated silica sand, greensand or a number of proprietary media, such as Filtronics media, Mang-OxTM and AD26TM. Each type of media has different properties resulting in differences in hydraulic loading rates and backwash requirements. Proprietary media is more expensive than coated silica sand or greensand, and it limits the procurement process to one manufacturer. For the purposes of estimating the capital costs in this report, generic greensand media has been assumed.

The greensand system evaluated in this study assumes the use of four cell pressure vessels with free chlorine as the oxidizing agent. Such a configuration is very common and it is utilized by a number of agencies in southern California and elsewhere for groundwater treatment and remediation. Figure 6-10 and Figure 6-11 show a four cell greensand filter.

Figure 6-10: Four Cell Greensand Filter

Greensand filters require periodic backwashing to remove the majority of Mn and Fe particles as well as suspended solids that accumulate from the raw water. The conventional backwashing frequency is once every 24 hours of continuous operation. This study assumes 1 backwash every 24 hours for each filter. The backwash mode for a four cell vessel is configured so that the filtrate from three cells will backwash the forth cell (Figure 6-11).

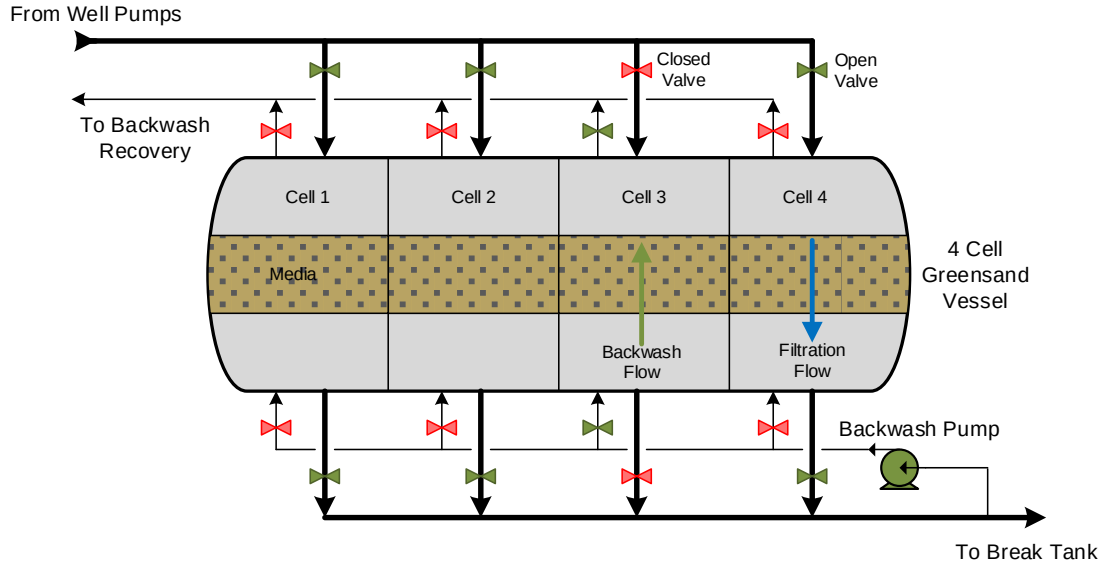


Figure 6-11: Four Cell Greensand Filter Schematic (with Optional Backwash Pump).

A conservative hydraulic loading rate for the conceptual greensand design is 3.5 gallons per minute per square foot (gpm/ft^2). Four pressure vessels will be required, each at 10 ft diameter and 30 ft long and each with four internal cells. Because the RO membranes are not chlorine tolerant, the residual chlorine in the greensand filtrate will be quenched with sodium bisulfite prior to the break tank.

A break tank is proposed between the greensand and the RO system to equalize flow interruptions that occurs during greensand backwash. A conservative estimate for the break tank capacity will consider all 4 greensand filters backwashing sequentially back to back. This would equate to a 25 percent flow reduction to the RO system while each of the respective greensand filters are out of production. Assuming a typical 15 minute backwash time, the required equalization volume is 80,000 gallons to maintain RO operation while the greensand filters are offline. There are means of optimizing this through operations, however, this conservative approach was carried forward in this feasibility study primarily to evaluate the available space on the three alternative treatment plant sites discussed in Section 6.3. The well pumps are assumed to be sized such that they will have sufficient head to drive flow through the greensand system into the break tank.

The backwash from the greensand system will be sent to a decant tank where the solids will settle out while the majority of the water will be recovered and pumped back into the treatment system. Based on experience operating greensand systems, the total backwash volume per backwash cycle (every 24 hours of operation) is assumed to be 110,000 gallons. The DDW limits the backwash recycle flow to no more than 10 percent of the total treatment plant flow (which is 4,000 gpm), hence the backwash recycle flow is assumed to be 400 gpm. This equates to 4.6 hours to pump the recovered water back into the treatment system. Therefore, in the event of a feed water quality upset, the greensand filter system would accommodate more than 1 backwash cycle in 24 hours. The settled solids are assumed to be trucked off site.

The conceptual design assumes 5 hours settling time for the solids before the decant is pumped back into the head of the treatment facility. Industry experience has shown this should be sufficient time to settle the solids out. No coagulant was assumed for the conceptual design.

6.2.2 Reverse Osmosis

A two pass RO system will be required in order to remove the elevated levels of TDS and Boron in the raw water. The second pass RO treats a portion of the RO permeate from the first pass and is required for Boron removal. At natural pH in the water (7 to 8.5), Boron is not ionized (has no electrical charge) which makes the removal by RO difficult. However, at higher pH (typically higher than 10), the predominant form of Boron in water is borate ion which is well rejected by RO membranes. The pH of the raw water cannot be increased to such high values due to the high concentrations of calcium and high alkalinity, which will result in the precipitation of calcium carbonate and other sparingly soluble constituents. Such water cannot be treated by the RO system since the RO concentrates the water even further into the brine stream, enhancing the precipitation potential even further. The permeate water from the first pass RO has significantly less calcium, alkalinity and TDS, however the Boron concentration is very similar to the raw water, with no significant reduction through the first pass RO treatment. This water quality is suitable for pH increase to values above 10, which will significantly increase the rejection of Boron through the second pass RO.

In order to facilitate flexible operations so the flow can be reduced incrementally down to 25 percent, the RO system is assumed to consist of four independent treatment trains for each of the two passes. Each train in the first pass will be designed for 1,100 gpm feed flow and requires a transfer pump, cartridge filter assembly, high pressure feed pump, and RO rack, i.e. pressure vessels, membrane elements, instruments, and valves. The second pass RO will partly treat the permeate from the first pass in order to

remove the Boron. For an estimated Boron concentration in the raw water of 1.5 mg/L, approximately 75% of the permeate flow from the first pass will be sent to the second pass RO. Figure 6-12 shows a typical 3 million gallon per day (MGD) RO train.

Figure 6-12: Example of Reverse Osmosis Train

RO membrane elements are housed in pressure vessels which are configured in trains, also referred to as racks or units. Typically, RO trains for brackish water are configured in two or three stages (within a pass). A stage is a group of pressure vessels arranged in parallel. High pressure feed water is pumped into the first stage. A percentage, approximately 40 percent, of that water is pushed across the membrane surface and exits the stage as permeate, or RO product water. The remaining water, the concentrate, becomes the feed for the next stage. Because some of the water has exited stage one as product, the next stage will require fewer pressure vessels. Similarly, approximately 30 percent of the water will exit stage two as permeate and the remaining water will be the feed for the third stage. The third stage will recover approximately 10 percent of the water, as permeate. At the tail end of the third stage, the total dissolved solids are concentrated to their limits and must be discharged from the train. This is the concentrate stream, also referred to as the brine, waste, or reject stream and will consist of 15 to 20 percent of the total feed flow. Figure 6-13 shows this schematically. The ratio of the feed flow to the permeate flow is the overall train recovery.

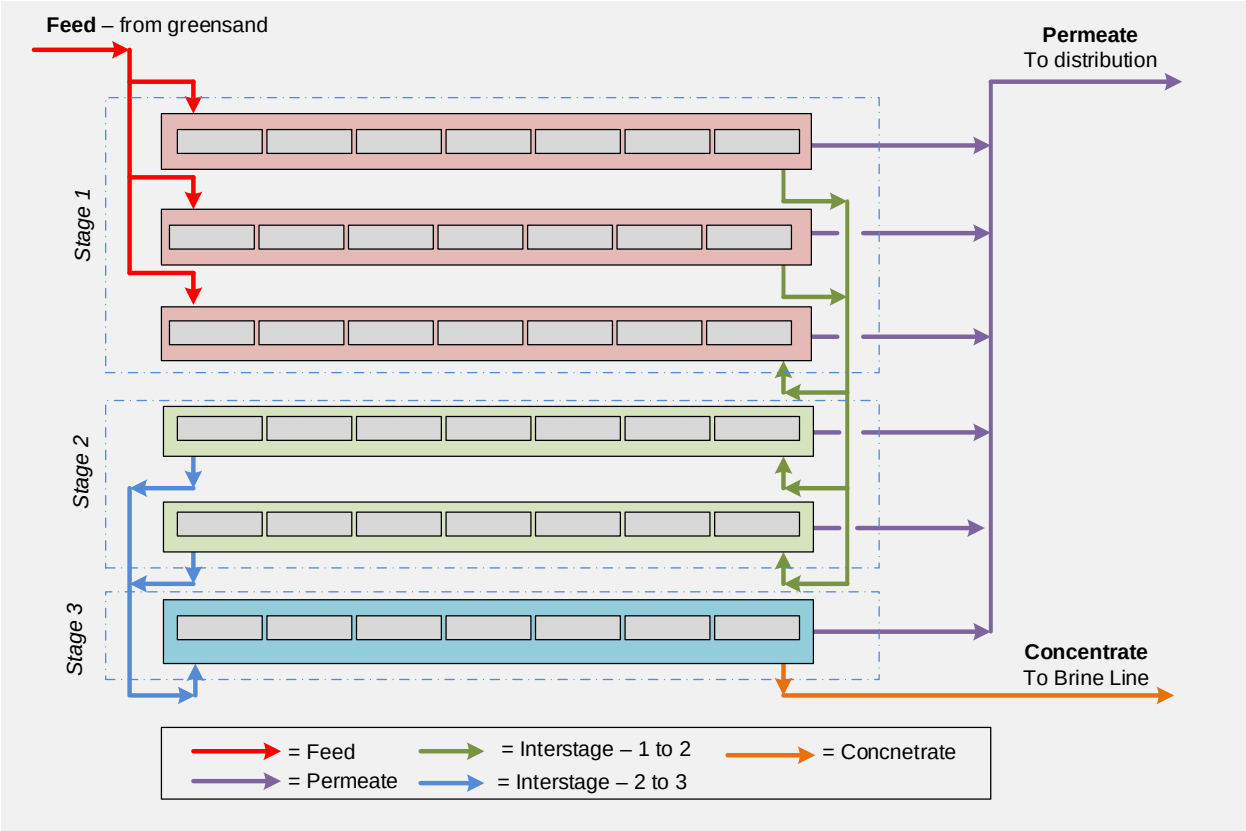


Figure 6-13: Example of Reverse Osmosis Schematic for Single Pass

Each pressure vessel typically contains seven RO membrane elements placed in series. The RO membrane elements will be an eight-inch diameter spiral wound configuration. Figure 6-14 contains a photo of a typical eight-inch RO element. There are several manufacturers of RO membrane elements. Some of the leading manufacturers include Hydranautics, Toray, and Dow – Filmtec.

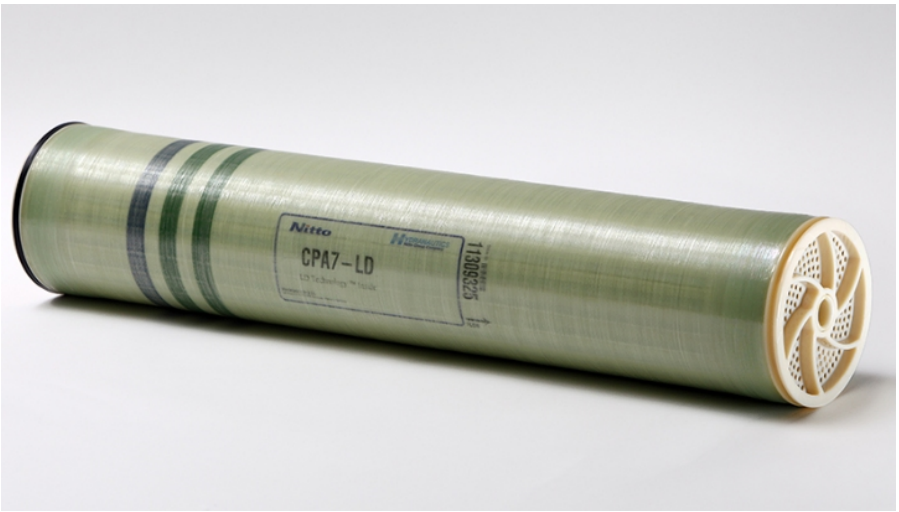


Figure 6-14: Example of 8-inch RO Element

The transfer pumps are required to generate the necessary head to drive the RO feed water from the break tank through the cartridge filters and satisfy the net positive suction head (NPSHR) required by the high pressure RO feed pumps. Downstream of the transfer pumps, sulphuric acid will be dosed for pH control and threshold inhibitor will be dosed for scale control. Both chemicals are required to maximize the RO system recovery and minimize the wasted water (concentrate).

Cartridge filters will be placed between the transfer pumps and the RO units to serve as part of the pretreatment of the RO membranes. Generally, cartridge filters upstream of the RO system ranges from 5 to 20 micron depending on the conditions. Because this RO system is down stream of the greensand filters, this design will likely utilize 10 to 20 micron filters. The conceptual design will incorporate four individual filter vessel housings, one for each RO train. Each cartridge filter vessel will house approximately 50 to 60 filter elements depending on the manufacturer. Figure 6-15 shows a typical horizontally oriented cartridge filter vessel.

Figure 6-15: Example of Cartridge Filter Vessel

High pressure RO feed pumps are required to generate the higher pressure that is needed to drive flow through the RO train. RO membrane projection software, Hydranautics IMSDesign 2016, estimated the required feed pressure to be between 200 and 250 pounds per square inch (psi) for this system. Figure 6-16 contains an image of the projection software interface. One booster pump will be required to feed each second pass RO train to pressure ranging from 120 to 170 psi, depending on the water temperature and the degree of membrane fouling.

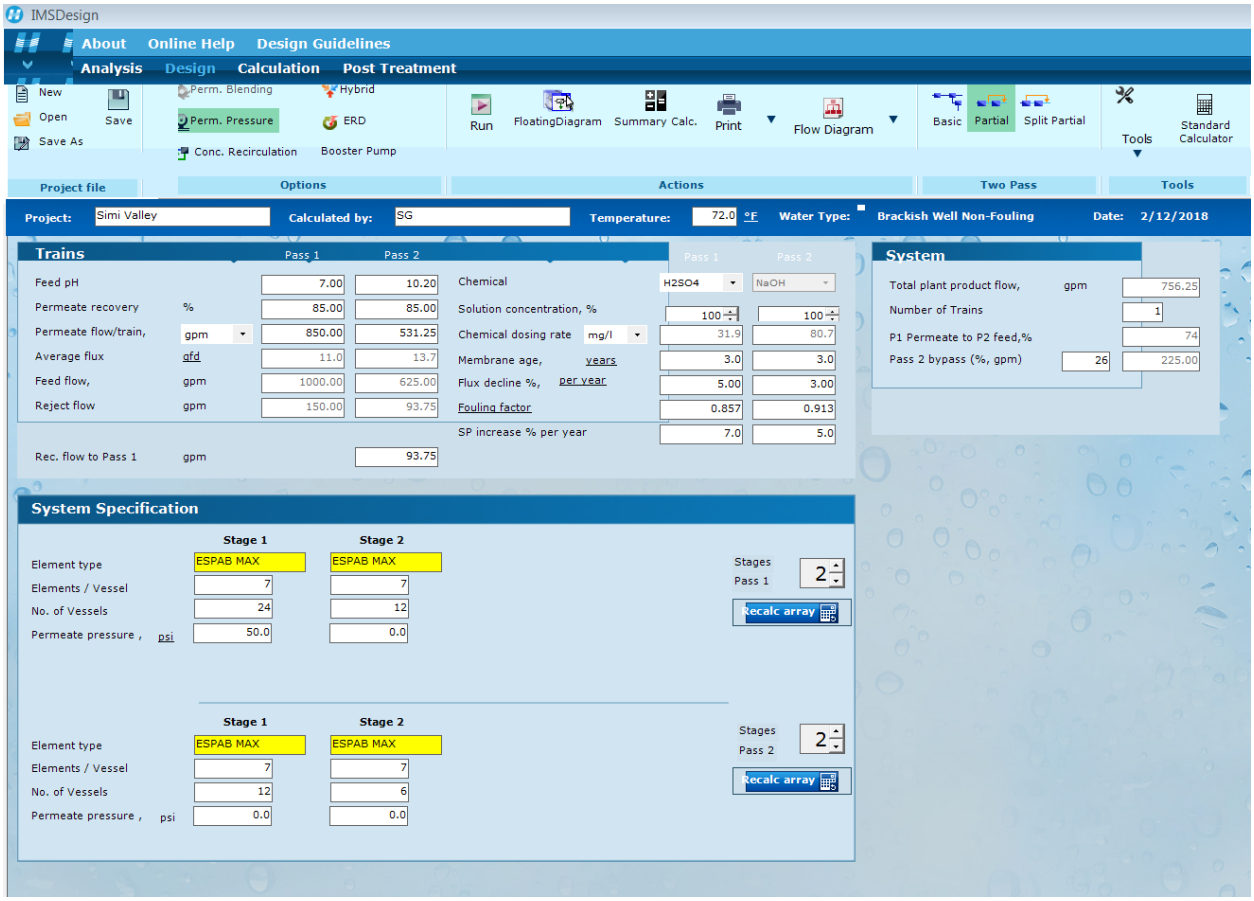


Figure 6-16: Hydranautics IMSDesign RO Projection Software

Each of the four RO units in the first pass are assumed to be a three-stage array with 7 element pressure vessels and will operate at 80 to 85 percent recovery. This is a relatively conservative value for the recovery, as groundwater brackish water systems typically operate at 85% recovery or higher. The lower recovery rate is assumed due to uncertainties in the groundwater quality. The first stage in the first pass will have 19 vessels, the second 10, and the third 5, noted as 19:10:5. An inter-stage booster pump is assumed between stages two and three. This is a supplemental pump situated between the second and third stages that will help balance the overall flow through the train and reduce the overall pressure requirement of the high pressure feed pump. The flux rate is assumed to be 12 gallons per square feet per day (GFD).

Each second pass RO train will have 18 pressure vessels, configured in a two stage arrangement. One booster pump will be required to feed each second pass RO feed to pressure ranging from 120 to 170 psi, depending on the water temperature and the membrane fouling. The flux rate in the second pass was assumed approximately 14 gfd and the recovery rate is 85%.

Under these assumed operating conditions, for 1000 gpm feed flow per train, the product flow will be 710 to 756 gpm (depending on actual recovery of each pass) and the concentrate, or waste stream, will be 244 to 290 gpm per train.

The RO concentrate stream will combine the brine from the two RO passes and is anticipated to not exceed 1,160 gpm. The brine will be piped to the Calleguas SMP. The overall distance to connect to the SMP ranges from approximately 4,800 linear feet (0.6 miles) if the treatment plant will be located in the western part of the Basin to 27,600 linear feet (5.2 miles) if the treatment plant will be located in the eastern part of the Basin. The concentrate will be under high pressure when it exits the RO train, at approximately 150 psi. It was assumed that no additional pumping would be required to get the concentrate to the Calleguas SMP.

The RO system product water quality will be considerably lower than established drinking water standards. A detailed RO system design would incorporate a bypass stream and a blending regime to achieve a tailored product water quality and optimize the overall capital and O&M costs. As a conservative estimate, this study assumes 100 percent of the feed flow is treated through the RO system, with no bypass (there is a 25% bypass for the second pass RO).

Table 6-2 presents a snapshot of the raw water quality assumed together with the expected water quality in the RO permeate, RO concentrate (or brine), RO finished water after postreatment, and Calleguas water quality

6.2.3 Product Water Storage

The CT for 4 log virus removal in accordance with the DDW Groundwater Rule requirements for a water temperature of 10 degrees C (°C) and pH ranging from 6 to 9 is 6 milligram-minute per liter (mg-min/L). For a typical chlorine residual of 2.5 mg/L, the detention time required in the product water storage tank will be 2.4 minutes. It is proposed that the storage tanks will be sized to accommodate for 10 minutes detention time. At a permeate flow of 3,400 gpm, the product water storage is approximately 34,000 gallons. For information on the product water pump station, refer to Section 7.7.

6.2.4 Post Treatment Chemicals

Following the treatment process, several post-treatment chemicals are required. Sodium hydroxide and calcium chloride will be dosed downstream of the RO system to raise the pH and alkalinity, and stabilize the water. RO permeate can be very aggressive to ferrous pipes, concrete lined pipe and basins, and can dissolve existing scale in the distribution pipelines. The Langelier Saturation Index (LSI) is one indication of the stability of a water with respect to its degree of calcium carbonate saturation. LSI is a function of pH, alkalinity, calcium concentration, TDS, and temperature. Another indication of stability is the calcium carbonate precipitation potential (CCPP) of the product water. CCPP is another stability index that provides a quantitative measure of the deficit or excess of calcium carbonate in the water, resulting in a more accurate method of gauging calcium carbonate precipitation. Unstable waters can be adjusted by adding sodium hydroxide and calcium chloride. This conceptual design utilized RTW model to estimate the sodium hydroxide (11 to 13 mg/L) and the calcium chloride (70 mg/L) required for water stabilization.

Chloramines will be formed using sodium hypochlorite and ammonium hydroxide for final disinfection. Chloramines are formed by adding chlorine and ammonia at a 5:1 ratio. These assumptions equate to sodium hypochlorite and ammonium hydroxide dosing rates to be 3.0 mg/L and 0.6 mg/L respectively.

The City of Simi Valley currently doses hexafluorosilicic acid. This conceptual design estimates this dosage rate to be 0.7 mg/L.

Table 6-2 presents a snapshot of the raw water quality assumed together with the expected water quality in the RO permeate, RO concentrate (or brine), RO finished water after postreatment. Calleguas water quality is also presented for comparison.

Table 6-2: Water Quality for Raw Water, RO Permeate, RO Concentrate and Finished Water

Constituent	Units	Raw Water	Feed Water to RO System Pass 1	RO Concentrate Combined	RO Permeate Water	RO Finished Water	Calleguas Water	Raw Water Blend[5)]
Hardness	mg/L as $CaCO_3$	1,456	1,456	5,930	17.3	80.6	148	173
Calcium	mg/L	325	325	1,323	3.9	29.2	35.0	49.0
Magnesium	mg/L	157	157	639	1.9	1.9	15.0	12.3
Sodium	mg/L	530	530	2,204	33.4	40.0	95.0	72.8
Potassium	mg/L	10	10	39	0.71	0.71	4.00	1.33
Ammonia[1)]	mg/L	0.0	0.0	0.0	0.0	0.0	N/A	0.0
Iron	mg/L	4.0	0.0	0.0	0.0	0.0	N/A	0.3
Manganese	ug/L	350	0.0	0.0	0.0	0.0	N/A	23.5
Bicarbonate	mg/L	370	331	1,187	22.6	89.1	107	108
Sulfate	mg/L	1,200	1,231	5,024	11.1	11.1	108	90.8
Chloride	mg/L	800	800	3,196	29.4	29.4	107	81.0
Nitrate	mg/L	82	82	263	23.6	23.6	ND	27.5
Silica[1)]	mg/L	25	25	99	1.0	1.0	N/A	2.6
Boron	mg/L	1.50	1.50	4.9	0.4	0.4	0.3	0.5
Perchlorate[3)]	ug/L	19.0	19.0	>71	<2	<2	N/A	<3
Gross Alpha[4)]	piC/L	10.0	10	>40	<1	<1	ND	<1.6
TDS	mg/L	3,506	3,499	14,261	128	226	447	446
pH	-	7.5	7.10[2)]	8.0	6.44	8.6	8.3	8.31

[1)] Assumed concentrations, no historical information in database

[2)] After acid addition

[3)] At a minimum of 80% rejection

[4)] At a minimum of 95% rejection

[5)] 6.7% blend of raw water with treated water to match Calleguas water quality

N/A = Not Available

ND = Non Detect

6.2.5 Blending of Treated and Raw Water

Based on the raw water quality presented in Table 6-2, up to 6.7% of raw groundwater can be blended with the treated water in order to match the Calleguas water quality. The two limiting factors for the blend are TDS and boron concentrations in raw water, which are both elevated. A refined analysis of the actual blend will be necessary once the actual water quality is known in the next phases of project development. A higher blend with raw water will reduce the size of the treatment plant and the associated capital costs. The O&M costs will also be lowered due to reduced power and chemical consumption.

6.2.6 Treatment Summary

Table 6-3 through 6-5 provides a summary of the greensand system, RO and storage tank conceptual design criteria.

Table 6-3: Greensand Conceptual Design Criteria Summary

Greensand Conceptual Design Criteria	
Number of Greensand Vessels	4
Greensand Vessel Length, ft	30
Greensand Vessel Diameter, ft	10
Hydraulic Loading Rate, gpm/ft^2	3.5
Number of Greensand Backwash Pumps	1 duty, 1 standby
Greensand Backwash Pump, HP	25
Backwash Tank, gal	110,000

Table 6-4: Reverse Osmosis Conceptual Design Criteria

Reverse Osmosis Conceptual Design Criteria	
Number of Transfer Pumps	4
Transfer Pump, HP	50
Number of Cartridge Filter Housings	4
Filter Elements per Housing	50 - 60
Filter Size, micron	10
PASS 1	
Number of RO Trains	4
Number of Stages	3
Total number of Pressure Vessels / Train	34
Total number of RO Membrane Elements/Train	238
Number of High Pressure Feed Pumps	4

Reverse Osmosis Conceptual Design Criteria	
High Pressure Feed Pump, HP	225 - 250
Number of Interstage Boost Pumps	4 (1 per train)
Interstage Boost Pump, HP	20
PASS 2	
Number of RO Trains	4
Number of Stages	2
Total Number of Pressure Vessels/Train	18
Total Number of RO Membrane Elements/Train	126
Number of Second Pass Feed Pumps	4
Second Pass Feed Pumps, HP	80-97

Table 6-5: Storage Tank Conceptual Design Criteria

Storage Tank Conceptual Design Criteria	
Break Tank, gal	80,000
Product Water Storage Tank, gal	34,000

6.2.7 Treatment Layout

Utilizing the conservative conceptual design outlined above, a layout was developed to evaluate the required footprint with respect to the three potential treatment plant sites. Background on the selection of potential treatment plant sites is provided in Section 7.1. Figure 6-17 below shows the plan view of a potential site layout. This layout was developed using the physical equipment dimensions while allowing access to equipment for day to day operations and routine maintenance. The layout assumes a main building housing the operations room, electrical room, and the RO process area. Directly adjacent to the main building is the chemical area shaded with a metal canopy. The greensand equipment, RO transfer pumps, cartridge filters, and product pumps are assumed to be outside and uncovered, typical in southern California due to mild, dry weather.

The site layout was then superimposed over the three treatment plant site alternatives to evaluate the available space compared to the required space and the layouts are shown in Section 6.3. The actual site layout can be further optimized to maximize space usage during final design.

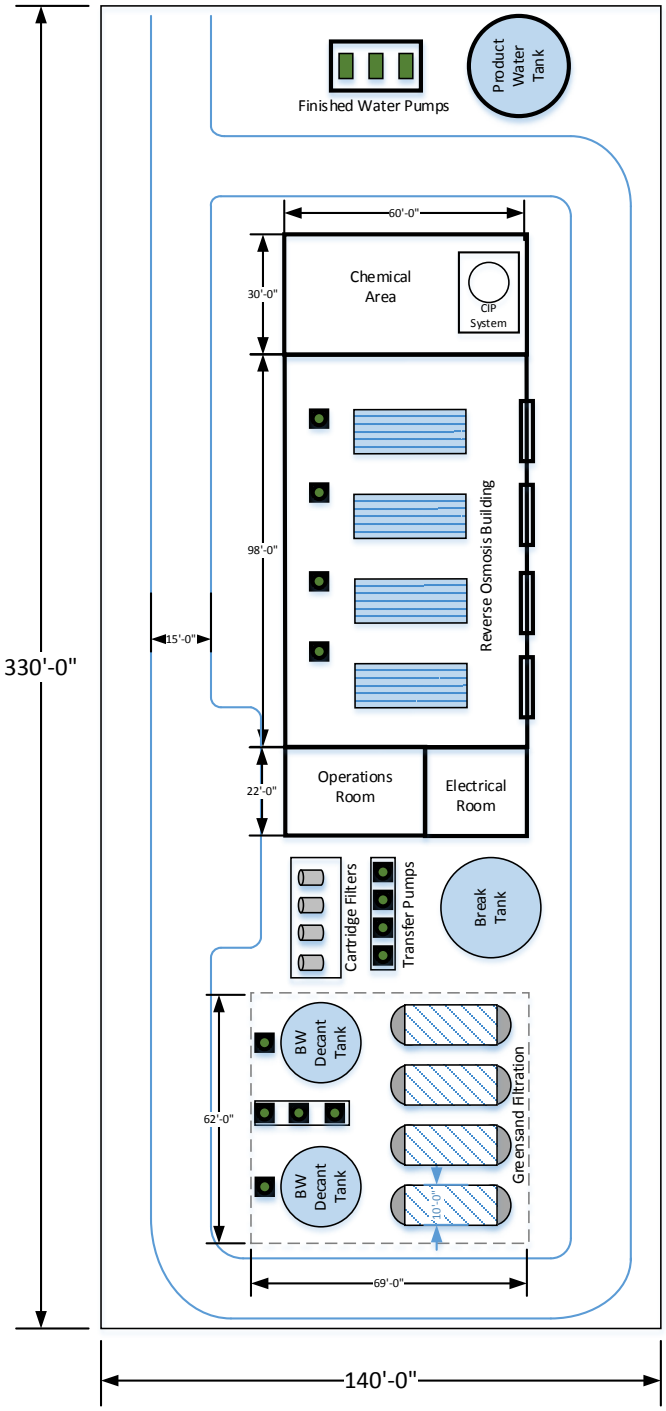


Figure 6-17: Conceptual Site Layout

6.3 Water Treatment Plant Site Alternatives - Equipment Layout

Three potential site locations have been identified for evaluation as discussed in Section 7. The treatment plant site alternatives are referred to as alternatives TP-1 through TP-3.

Treatment plant site alternative 1 (TP-1) is located at the corner of East Los Angeles Avenue and 3rd Street. Figure 6-18 shows a potential site layout. Due to the irregular shape of this site, a one-way dedicated site entrance and separate dedicated site exit may be preferred. This would eliminate the need for chemical delivery and other maintenance trucks to turn around on the site.

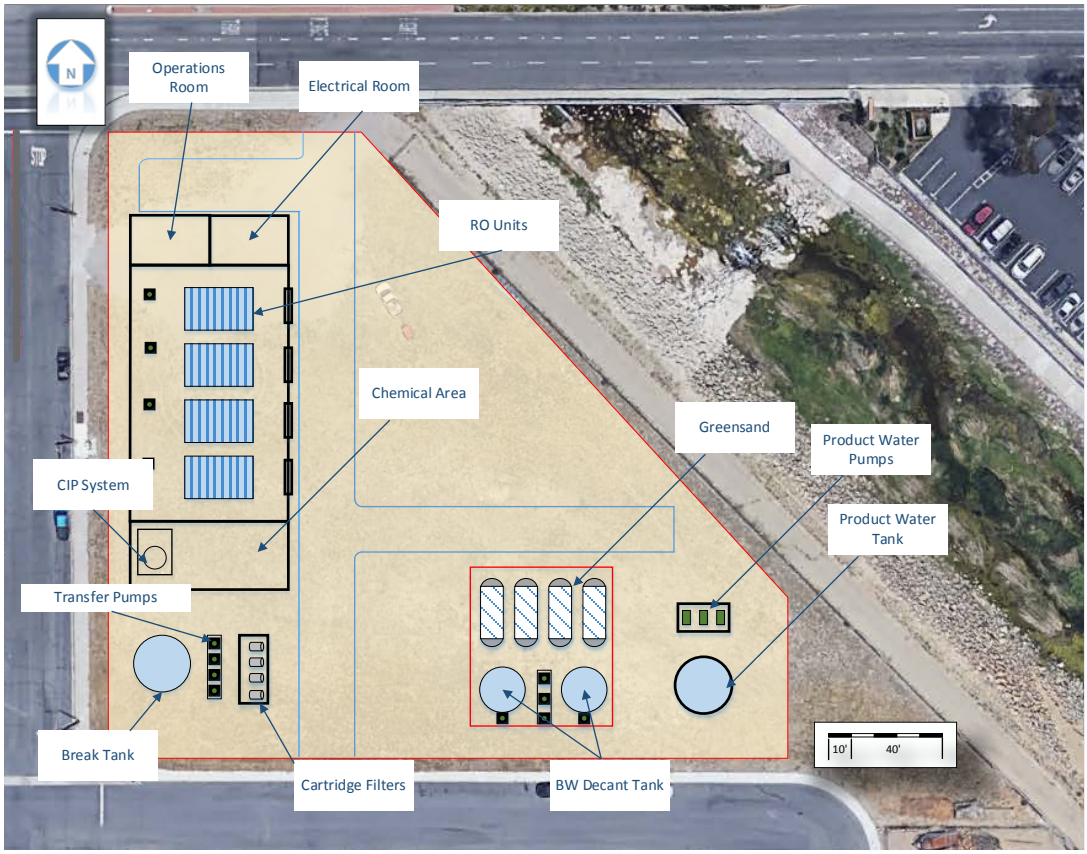


Figure 6-18: Treatment Site Alternative 1

Treatment plant site alternative 2 (TP-2) is located at Callahan Avenue and Alviso Street and is shown in Figure 6-19. This site is long and narrow and a single, common entrance and exit may be more appropriate for this site. Alternative TP-3 is located at the corner of Tapo Canyon Road and the 118 Freeway and is shown in Figure 6-20 Similar to TP-2, a single, common entrance and exit is more appropriate for site access for chemical deliveries and maintenance.

Figure 6-19: Treatment Site Alternative 2

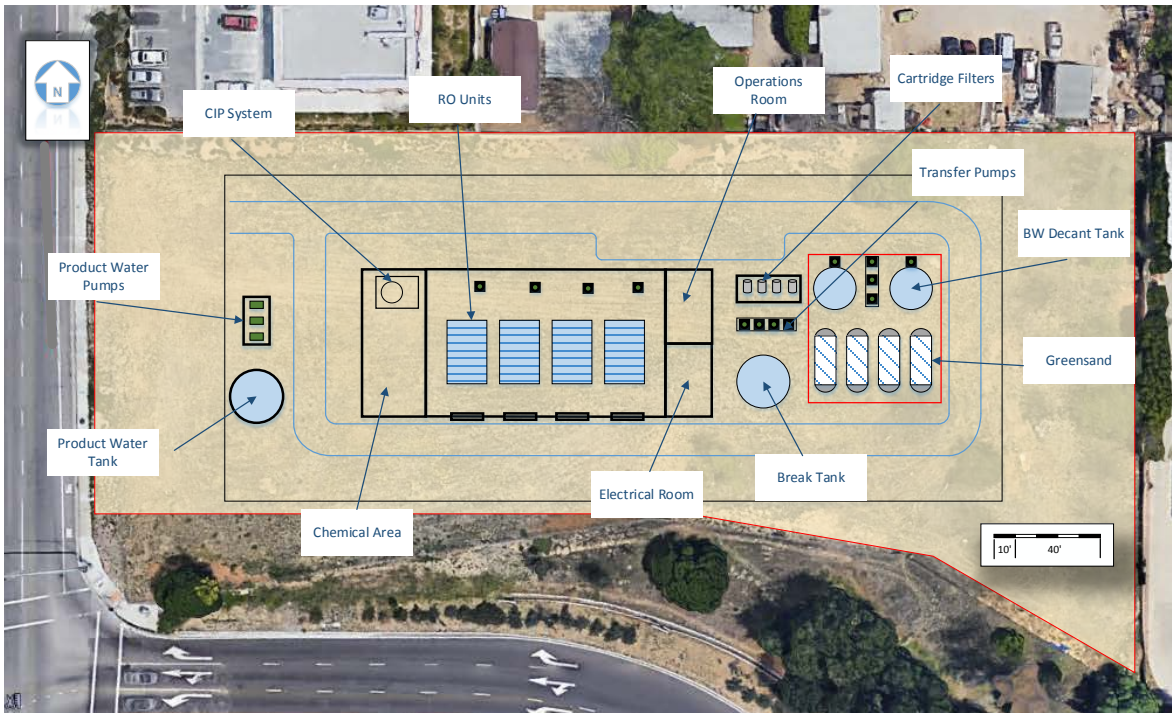


Figure 6-20: Treatment Site Alternative 3

7. Conveyance and Infrastructure

The concept of centralized treatment from a conveyance perspective involves sending the raw water from a grouping of groundwater wells to a centralized treatment plant location where the water can thereby be treated and put into the domestic water distribution system. Infrastructure requirements include the groundwater wells, raw water transmission mains, treatment plant facility and site improvements, brine line, product water transmission mains, and utility infrastructure including electrical and communications. This section describes the criteria and methodology for facility siting, sizing, and routing.

7.1 Treatment Plant Site Alternatives

An initial screening of potential treatment plant sites was performed based on the following criteria:

- Proximity to groundwater wells
- Space allotment for equipment
- Accessibility
- Proximity to existing large diameter water transmission mains
- Utilization of vacant or City-owned parcels, and
- Environmental/Public impacts.

After the initial screening, three treatment plant site alternatives were identified as potentially feasible and are shown in Figure 5-1a and listed in Table 7-1. As previously discussed, six wells are needed (4 active and 2 standby) to deliver the flow required by the treatment plant. Six wells were grouped to deliver water to each of the alternative treatment plant sites based on their proximity and the hydrogeological analyses. TP-1 and TP-2 correspond to wells 2, 3, 4, 5, 6, and 7, and TP-3 corresponds to wells 14, 15, 16, 17, 18, and 19. TP-1 has the smallest footprint of the three sites while TP-3 has the largest.

Table 7-1: Potential Treatment Plant Site Alternatives

Alternative	Wells	Location	Area (Ac)
TP-1	2,3,4,5,6,7	E Los Angeles Ave & 3rd St	1.56
TP-2	2,3,4,5,6,7	Callahan Ave & Alviso St	1.96
TP-3	14,15,16,17, 18,19	Tapo Canyon Rd & 118 Fwy	2.58

These site locations were used as the basis for developing the preliminary treatment plant layouts as presented in Section 6, and determining the conveyance pipeline routing.

7.2 Design Criteria

Facility sizing was developed based upon the criteria set forth in the City of Simi Valley Ventura County Waterworks District No. 8 Water Design and Construction Standards. A summary of the applicable criteria is provided in Table 7-2.

Table 7-2: Design Criteria

Parameter	Criteria
Minimum service pressure	40 psi during maximum day demand (45 preferred)
Maximum service pressure	150 psi (Pressure regulators required when over 80 psi)
Maximum Velocity	5 ft/s
Minimum pipe diameter	8-inch (Dead end mains may be 6-inch)
Casing diameter	No less than 8-inches greater than carrier pipe diameter

7.3 Electrical Requirements

Southern California Edison was contacted as part of this evaluation. However, without an active design project, they would not provide any information with respect to the cost of supplying power to the proposed treatment plant sites. Table 7-3 below summarizes the major equipment electrical loads.

Table 7-3: Electrical Load List

Component	Unit HP	Total Units	HP	kW
Well Pump	75	6	450	336.2
Greensand BW Recycle Pump	20	2	40	29.9
BW Settled Solids Pump	20	2	40	29.9

Component	Unit HP	Total Units	HP	kW
Transfer Pumps	50	4	200	149.4
High Pressure RO Feed Pumps – Pass 1	225	4	900	672.3
Interstage Booster Pumps	20	4	80	59.8
High Pressure RO Feed Pumps – Pass 2	97	4	388	289.3
RO Building HVAC	15	2	30	22.4
RO Building Lighting	27	1	27	20.0
Sodium Bisulfite Pumps	0.5	4	2	1.5
Antiscalant Pumps	0.5	4	2	1.5
Acid Pumps	0.5	4	2	1.5
RO CIP Tank Heater	165	1	165	123.3
RO CIP Pump	50	1	50	37.4
RO Flush Pumps	50	1	50	37.4
High pH Pump	5	1	5	3.7
Low pH Pump	5	1	5	3.7
Detergent Pump	5	1	5	3.7
Chlorine Pumps	0.5	6	3	2.2
Ammonia Pumps	0.5	3	1.5	1.1
Caustic Pumps – RO Second Pass	0.5	4	2	1.5
Caustic Pumps – Post Treatment	0.5	3	1.5	1.1
Calcium Hydroxide Pumps	0.5	3	1.5	1.1
Fluoride Pumps	0.5	3	1.5	1.1
Product Water Pumps	125	4	500	373.5

7.4 Connection to Existing Distribution System

The City's domestic water distribution system is comprised of a series of pressure zones which are geographical areas of the distribution system that operate at a nominal hydraulic grade line (HGL), typically defined by reservoir high water level, turnout or pressure reducing station HGL, or pump station

operating HGL. The product water from the groundwater treatment plant must be able to be delivered into one of the existing pressure zones.

Based on the locations of the treatment plant site alternatives, two pressure zones were identified for potential connections: the 1031 Pressure Zone and the 1248 Pressure Zone. These pressure zones are the two largest in the City's distribution system and have the greatest amount of tank storage that will allow for operational flexibility to accept the groundwater. Both of these pressure zones are ideally suited to accept additional flows due to their existing pipeline capacities, and because they serve as hubs for the transfer of water supply into the City's other pressure zones. Furthermore, these pressure zones have existing turnout facilities with large diameter transmission mains.

TP-1 is located in the 1031 Zone directly adjacent to a 16-inch pipeline that connects to a 20- to 24-inch transmission main from the First Street Turnout, which has a capacity to deliver 6,000 gallons per minute into the system.

While TP-2 could potentially serve either the 1031 or 1248 Zone through the First Street Turnout pipeline or Cochran Street Turnout pipeline respectively, the 1031 Zone is slightly favored since it is a slightly larger pressure zone and has the need for additional supply. This site is also proposed to connect to the 16 to 20-inch pipeline connected to the First Street Turnout similar to TP-1.

TP-3 is located in the 1248 Zone directly adjacent to a 20-inch pipeline from the Tapo Canyon / Cochran Street Turnout, which has a capacity to deliver 8,500 gallons per minute into the system.

Because each existing turnout capacity is greater than that of the proposed treated groundwater supply, it is assumed that, until such time as additional potable water is needed, the imported water will be reduced in accordance with the amount of product water supplied to the system. For purposes of this study, no improvements to the distribution system are anticipated other than the new facilities required to make the necessary connections.

7.5 Pipeline Routing

For each treatment plant site alternative and corresponding wells, optimized pipeline routes were developed for the following facilities:

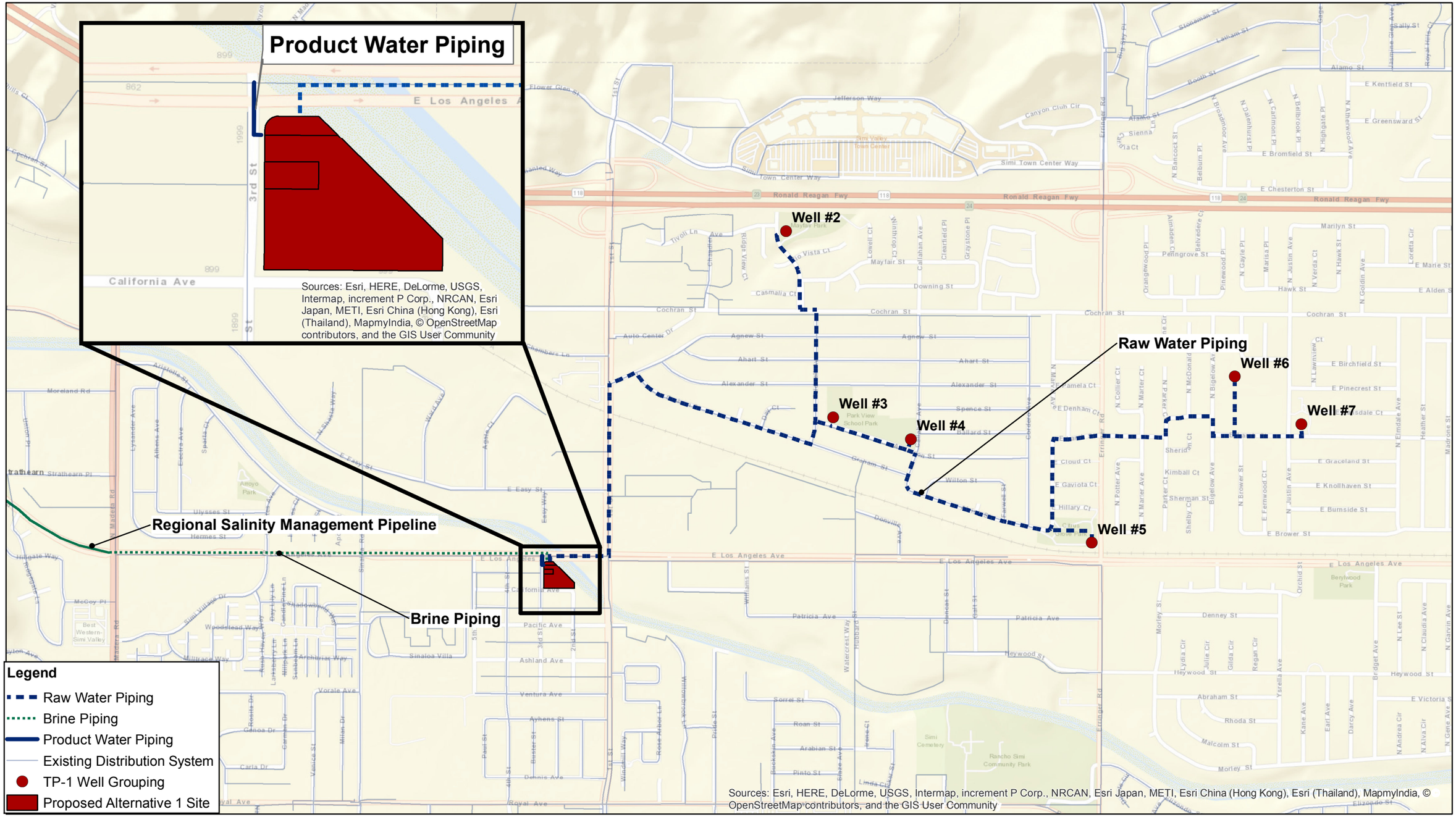
- Raw water piping
- Product water piping
- Brine line piping

The following metrics were considered in the pipeline routing:

- Minimize pipeline lengths
- Minimize alignment in heavily trafficked streets
- Minimize special crossings (e.g., stormwater channels, bridges, railroads, freeways/highways, etc.)

- Minimize easement requirements / alignment through private property
- Group raw water piping where feasible

The results of the pipeline routing analyses are shown on Figures 7-1 through 7-3, and summarized in Table 7-4 and Table 7-5. Note that property and/or easement acquisitions at the well site locations have not been included. While the product water piping for Alternative TP-2 is shown to include an easement through private property to Donville Avenue as a more direct route to the point of connection to the distribution system, there is a lengthier alternative alignment through Graham Street and First Street that would eliminate the need for this private property easement.

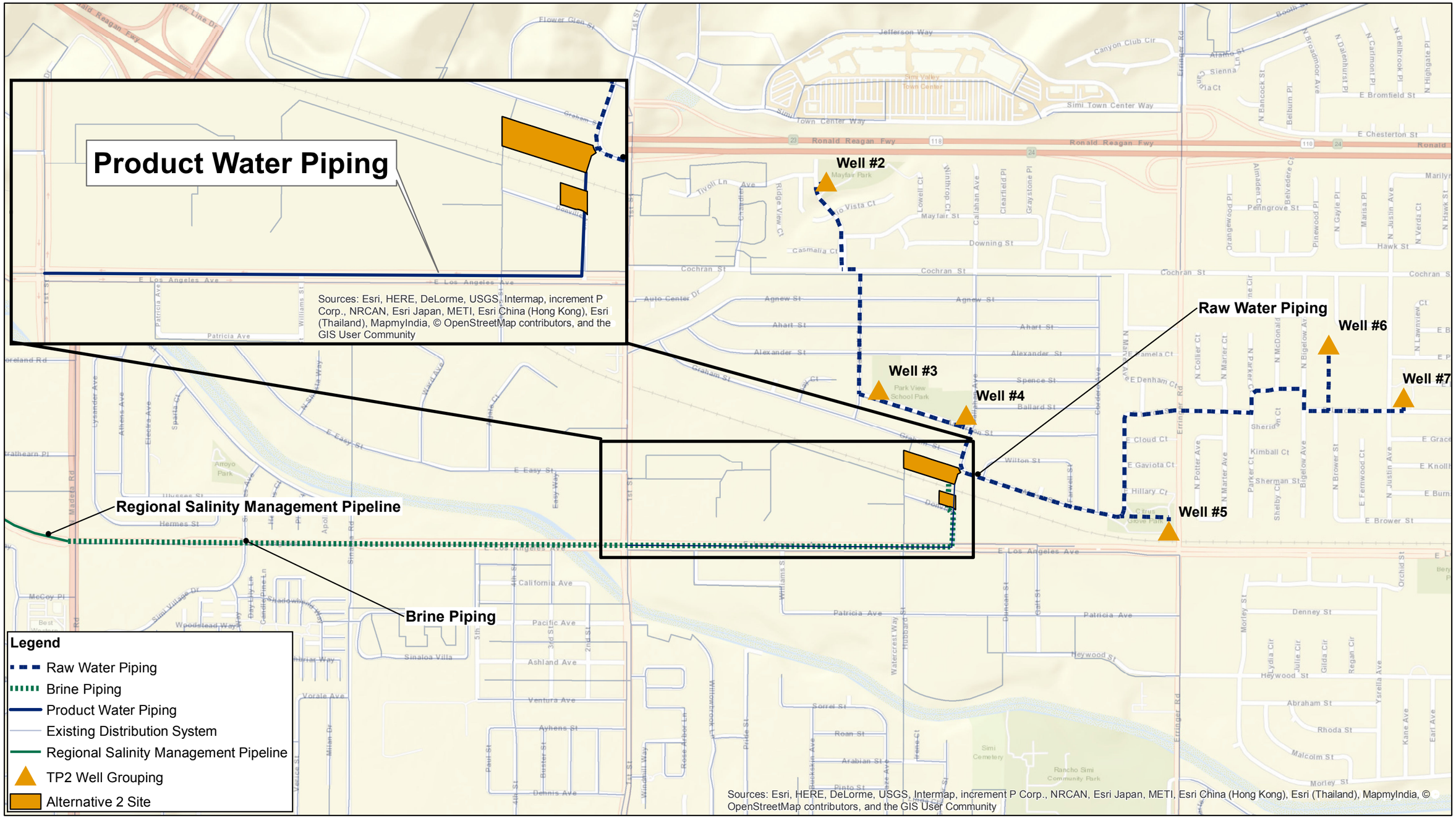


0 0.1 0.2 0.4 Miles

Figure 7-1
Alternative 1 Raw, Brine and Product Water Piping

Hazen TODD GROUNDWATER

Simi Valley Basin
Groundwater Development Feasibility Study

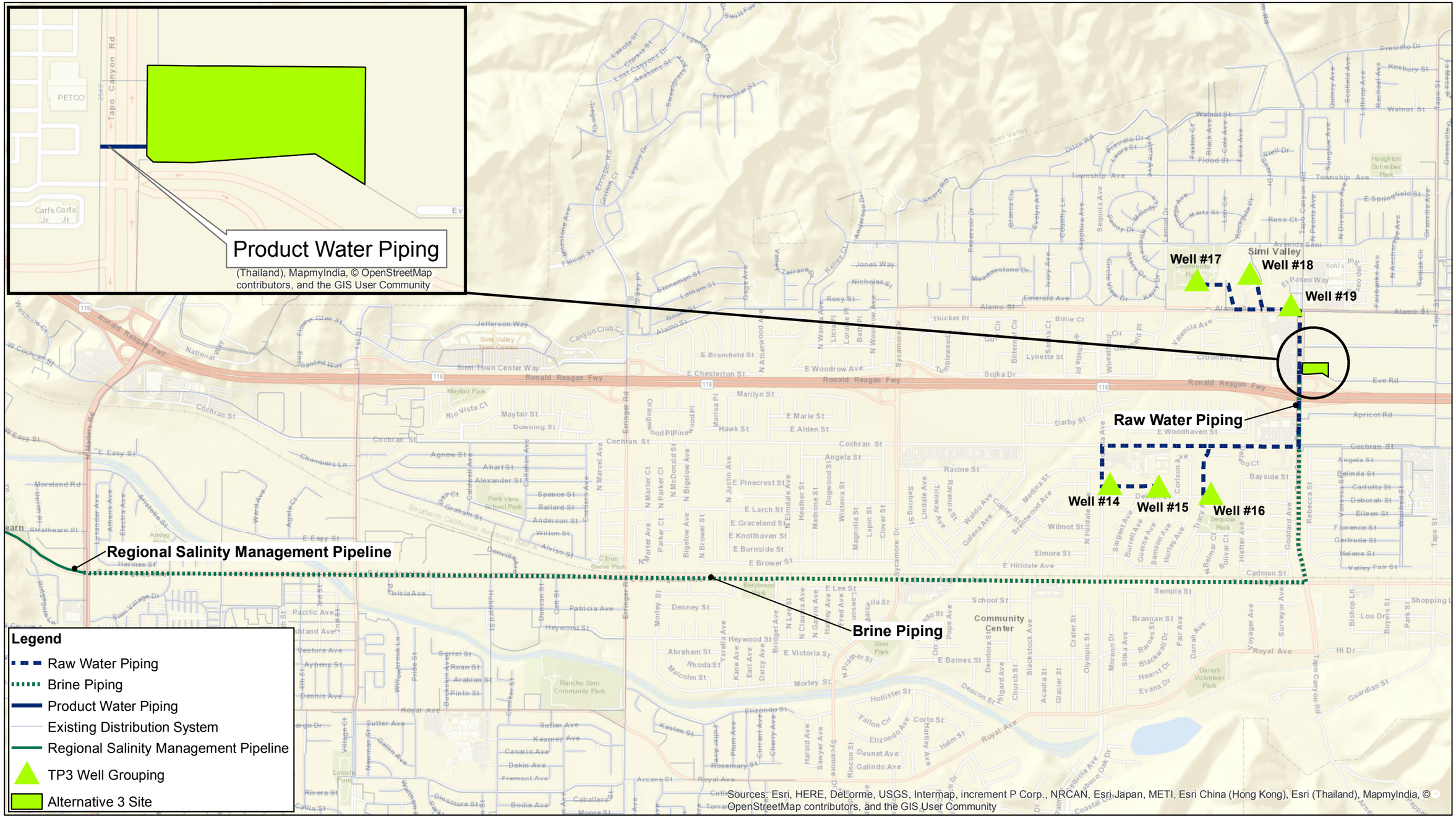


0 0.075 0.15 0.3 Miles

Figure 7-2
Alternative 2 Raw, Brine and Product Water Piping

Hazen TODD GROUNDWATER

Simi Valley Basin
Groundwater Development Feasibility Study



0 0.175 0.35 0.7 Miles

Figure 7-3
Alternative 3 Raw, Brine and Product Water Piping

Hazen TODD GROUNDWATER

Simi Valley Basin
Groundwater Development Feasibility Study

Table 7-4: Pipeline Summary

Alternative 1		Alternative 2		Alternative 3	
Diameter (in)	**Length (ft)**	**Diameter (in)**	**Length (ft)**	**Diameter (in)**	**Length (ft)**
Raw Water Piping		Raw Water Piping		Raw Water Piping	
10	4,700	10	4,900	10	4,700
14	3,400	14	4,700	14	3,600
16	2,200	16	2,200	16	4,700
20	6,200	20	100	20	70
Product Water Piping		Product Water Piping		Product Water Piping	
18	300	18	3,800	18	200
Brine Piping		Brine Piping		Brine Piping	
10	4,800	10	9,200	10	28,300

Table 7-5: Major Crossings and Easement Requirements

Alternative 1	Alternative 2	Alternative 3
• RW Caldwell Ave Channel • RW Railroad in First St • RW E. Los Angeles Ave. Channel Bridge	• RW Caldwell Ave Channel • PW Railroad • PW Donville Ave Private Property Easement • Brine Railroad • Brine E. Los Angeles Ave. Channel Bridge	• RW Channel • Brine Railroad • Brine Channel • Brine Bridge

7.6 Groundwater Well Infrastructure

Groundwater well infrastructure typically consists of the borehole and casing, sanitary seal, pump, pump pedestal, and above grade mechanical piping and equipment. For the purposes of this Study, groundwater well design flows and estimated pump horsepower were established in order to develop preliminary cost estimates and identify electrical requirements.

Treated groundwater well pumps must be able to deliver the design flows to the distribution system while overcoming the static lift required between the groundwater elevation and the product water storage, as well as the headlosses due to treatment, piping, and equipment. System curves were developed for the following three conditions:

1. High head (4 wells running, high friction loss, high product water tank level)
2. Average head (2 wells running, average friction loss, average product water tank level)
3. Low head (1 well running, low friction loss, low product water tank level)

Average groundwater levels from 1999 to 2015 and 1997 to 2015 for the closest existing groundwater wells, Sycamore 3 and Niles 1, respectively, were utilized for total dynamic head (TDH) and horsepower requirements. All wells were found to be subject to roughly the same TDH requirements due to the gradient of the groundwater table; therefore, the parameters for a typical well is listed in Table 7-6

Table 7-6: Typical Well Parameters

Parameter	Value
Design Flow	1,000 gpm
TDH	192.5 ft
Horsepower	75 HP

7.7 Product Water Pump Station

The product water pump station will take supply from the product water storage tank and pump it into the distribution system. A proposed product water transmission main (PWTM) will connect the PWPS to an existing large diameter transmission main at a location where the capacity can be accepted into the system. The PWPS requires a maximum capacity of 3,400 gpm (4.9 MGD) based on 85 percent of the flow of four wells at 1,000 gallons per minute each. This assumes that the RO second pass is not required and it is a conservative assumption with regards to the maximum RO permeate water produced.

The horsepower requirements for the product water pump station were estimated by calculating the total dynamic head (TDH) required at the design flow for the maximum head condition. Total dynamic head was estimated assuming a low water level for the product water storage tank and a high water level for the distribution system reservoir, including minor losses for valves and fittings, and friction losses for piping. For a total design flow of 3,400 gallons per minute, it is assumed that the product water pump station will

consist of three duty pumps, each with a nominal capacity of 1,200 gallons per minute. The pump station will also include one stand-by pump to allow for maintenance that does not count towards the firm capacity of the pump station. For a 1,200 gpm pump with a TDH requirement of up to approximately 287 feet, and an assumed overall efficiency of 70 percent, the corresponding estimated horsepower required for each pump is 125.

The total dynamic head required of the PWPS depends on the PWTM length, pressure zone served, and actual connection point to the distribution system. As listed in Table 7-7, all three alternatives require generally the same order of TDH, although Alternative 3 required the least amount of head due to its lower static lift required and short PWTM. On a per-pump basis, the TDHs required were similar enough such that the same horsepower motor would be able to serve any of the three alternatives.

Table 7-7: Product Water Pump Station Parameters

Alternative	Total Design Flow (gpm)	TDH (ft)	No. Duty Pumps	No. Standby Pumps	Capacity Per Pump (gpm)	HP per Pump
TP1	3,400	267	3	1	1,200	125
TP2	3,400	287	3	1	1,200	125
TP3	3,400	258	3	1	1,200	125

7.8 Brine Discharge Station

At the point of connection to the SMP, a discharge station will be required to monitor the flow and water quality of the brine being discharged into the SMP. Information obtained from Calleguas indicates that if the District decides to move forward with this project, Calleguas will require a deposit to design and construct the discharge station. An example of a typical discharge station is shown in Appendix C. The costs to design and construct the discharge stations is approximately $200,000 to $500,000 depending on the size and location of the station and this will need to be discussed further with Calleguas. However, for purposes of our study, we have assumed the larger cost will be required. In addition to the cost to design and construct the discharge station, Calleguas charges a monthly fee for replacement of the discharge station. This fee is 0.33 percent of the actual costs to design and construct the discharge station. In addition, it is estimated that Calleguas will charge an annual O&M cost of $45,000 which includes water quality sampling and $519.60 per AF for brine discharge. All of these costs have been included in the capital and O&M cost estimates presented in Section 8. A copy of the Calleguas SMP Information for Potential Dischargers dated January 2016 that includes the water quality requirements for the brine discharge is included in Appendix C.

8. Project Costs

8.1 Engineer's Estimate of Probable Costs

An engineer's estimate of probable costs was prepared for each of the alternatives and they are summarized in Table 8-1. These costs include equipment costs, cost to design and build the brine discharge station, engineering design and construction, environmental, permitting, construction management, legal and administrative costs. Note that these costs are an AACEI Class 4 level cost estimate and they include a number of conservative assumptions and contingencies typical of a feasibility level study. The estimate includes a 25 percent contingency to account for unknowns such as changes in the groundwater treatment equipment that may be necessary due to the lack of current water quality data. In addition, well construction costs are less when constructing multiple wells consecutively by sharing costs among multiple wells and reducing the per-well cost. For this cost estimate, it has been assumed that each well will be drilled as a stand-alone project, so costs for items that could potentially be shared may be lower on a per-well basis.

Costs for disposal of drilling fluids and cuttings can vary widely, and actual costs represent a significant unknown. In some cases, it is possible to dispose of drilling fluids and cuttings on or near a well site, which limits the costs associated with this item. However, in many urban environments, there is not sufficient unused open space to allow land application of fluids and cuttings and they must be containerized and transported to legal disposal facilities. Because the potential for land application in Simi Valley is unknown at this time, the costs for this item assumes that fluids and cuttings will have to be containerized and hauled to legal disposal facilities.

These costs are for comparison purposes to assist the District in selecting an alternative as well as providing a measure of magnitude to utilize the Simi Valley Basin as a groundwater supply. As additional water quality data is collected and 30, 60, 90 and 100 percent designs are completed, the contingencies will be decreased and the project costs will be adjusted to be reflective of the information that is available. The detailed itemized estimates are included in Appendix A.

Table 8-1: Summary of Probable Project Costs

Alternative	Total Project Cost ($M)
TP1	$87.1
TP2	$89.5
TP3	$99.8

An estimate of annual operations and maintenance costs have also been prepared. These costs include power and chemical costs, well maintenance, water quality testing and monitoring at the drinking water

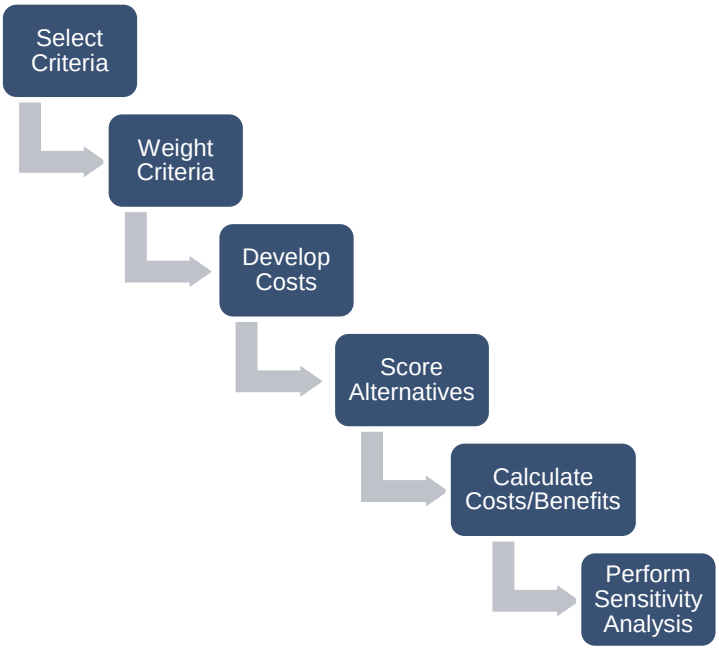
and monitoring wells, and the annual cost charged by Calleguas for brine disposal, water quality sampling and replacement of the discharge station. There are also costs that will be incurred to prepare a Salt and Nutrient Management Plan, Sustainability Groundwater Management Plan and the Drinking Water Sources Assessment and Protection Reports and these costs have not been included. The summary of the annual O&M costs is presented in Table 8-2.

Table 8-2: Summary of Probable Annual O&M Costs

Item	Annual Cost ($M)	Assumptions
Greensand Replacement and Maintenance	$0.15	Includes media replacement every 5 years
Cartridge Filters Replacement	$0.05	Cartridge filters are replaced every 1.5 months
RO Membrane Replacement	$0.36	Membranes are replaced every 3 years
RO Replacement and Maintenance	$0.04	-
Power	$1.56	$0.11/kW-hr and 24 hour operation at full capacity
Chemicals	$2.30	Based on current chemical costs. Not adjusted for inflation
Calleguas Discharge Station[1] Replacement Charge	$0.02	0.33% of actual design and construction
Discharge Station O&M[1]	$0.05	$45,000 annually; includes water quality
Brine Disposal Charge[1]	$0.97	1,6868 AFY disposed at $519.60/AF
Water Quality Testing, Monitoring and Reporting[2]	$0.25	Assumes water quality testing at 6 drinking water wells, water quality monitoring at 1 well and annual maintenance on 3 wells
Labor	$0.42	One plant superintendent, one shift supervisor, 1.5 Operator III and 2 Operator I
Total Probable Annual O&M Costs	**$6.16**[3]	

[1] Information obtained from Salinity Management and Water Supply in Ventura County (Calleguas, 2016)
[2] Includes annual water quality testing, reporting, annual well maintenance, and preparation of DWSAPs Program.
[3] Does not include cost of Sustainability Groundwater Management Plan or preparation of a Salt and Nutrient Management Plan as discussed in Section 10.

9. Alternatives Evaluation



A decision model was created to evaluate the costs and non-monetary benefits of each alternative. The objective is to identify the preferred approach that meets the goals and objectives of the feasibility study. The evaluation process included engagement with the project team and the District consisting of correspondence and review to define and select the alternatives, determine selection criteria, assign weightings of the criteria, review scoring methodologies and scores for each criterion of each alternative, and review the costs and decision model results. The decision process included the following steps:

1. Select decision criteria representing important non-monetary benefits or attributes of an alternative that are independent, provide differentiation, and are measurable.
2. Weight the decision criteria to prioritize importance of the individual criterion to the decision process.
3. Develop cost estimates (capital, O&M, and life cycle) for each alternative.
4. Develop a quantitative or qualitative score for each alternative with respect to each decision criterion.
5. Calculate the cumulative scores of each alternative based on the product of the weighting assigned to the criterion and the score/costs.
6. Perform sensitivity analyses to evaluate the impact of criteria weighting relative to the scores for each alternative.

9.1 Selection Criteria

Selection criteria were initially established by the Hazen team and the District to represent factors of importance to provide differentiation among alternatives, and avoid redundancy in definition that could lead to double counting of benefits.

Once selection criteria were set, the District was asked to complete weighting sheets separately to distribute points relative to the primary criteria's importance. These weightings were used for the decision analysis. Table 9-1 provides the weightings established based on the numbers provided by the District.

Table 9-1: Criteria Weightings

Criteria	District
Costs	15%
Proximity to Public Facilities/Public Acceptance	10%
Proximity to Contaminated Sites	5%
Constructability/Schedule	10%
Difficulties Crossing Existing Land Features	15%
Ease of Land Acquisition	5%
Waste Disposal, Proximity to Brine Connection	10%
Permitting	10%
Future Regulatory Compliance	10%
Accessibility to the Site (Chemical Deliveries, etc.)	5%
Availability of Electrical Service (unknown)	5%
TOTAL	**100%**

9.2 Alternatives Scoring

A benefit score was generated for each alternative relative to the primary selection criteria. Criteria for each alternative were scored in a similar manner. Scores were generated using engineering analysis and judgment and, when possible, quantifiable scoring methodologies were used to impart objectivity to the analysis. Alternatives were scored based on a scale from 1 to 3 with 1 being the worst and 3 being the best. Higher scores are considered more favorable. Table 9-2 presents a summary of the scoring results. TP-1 ranked as the most favorable alternative.

Table 9-2: Alternatives Scoring Results

Criteria	Weight	TP1	TP2	TP3
Costs	15%	2.75	2	1.5
Proximity to Public Facilities/Public Acceptance	10%	2	1.75	1.75
Proximity to Contaminated Sites	5%	2.25	2	2.75
Constructability/Schedule	10%	2.75	2	1.75
Difficulties Crossing Existing Land Features	15%	2.25	2.25	2.25
Ease of Land Acquisition	5%	2.5	2.25	1.5
Waste Disposal, Proximity to Brine Connection	10%	2.5	1.75	1.25
Permitting	10%	1.75	2.25	1.5
Future Regulatory Compliance	10%	1.5	1.75	2.25
Accessibility to the Site (Chemical Deliveries, etc.)	5%	1.75	1.75	2.5
Availability of Electrical Service (unknown)	5%	2	2	2
TOTAL	**100%**	**74.17**	**66.25**	**61.67**

10. Simi Valley Groundwater Management

Currently, various divisions, districts and sections of Ventura County (County) collect (by County staff and from local agencies and water purveyors) and prepare annual reports on groundwater conditions in the County (Ventura County Water Protection District, undated). The County monitors and collects both groundwater level and quality data and reports the water level data to DWR under the California Statewide Groundwater Elevation Monitoring Program (CASGEM) Program and the water quality data to the SWRCB under the GeoTracker Groundwater Ambient Monitoring and Assessment Program (GAMA) program.

The County also regulates groundwater well construction and destruction through its Well Ordinances, but does not regulate groundwater extraction. The Simi Valley Basin is not adjudicated and normally unrestricted groundwater development can occur by individual property owners and water purveyors. However, in light of the recent drought and declining groundwater levels in many basins in the County, Ventura County recently enacted a prohibition on new well drilling. The District will need to request an exemption from the County to install wells in the basin.

The monitoring, data collection and reporting conducted by the County (as well as studies conducted by other state and federal agencies) were helpful in establishing the hydrogeologic setting for the Simi Valley Basin Study. Nonetheless, additional development of groundwater resources should be accompanied by additional studies, monitoring, and management of groundwater resources. In some cases, additional monitoring and management are required by State regulations. The following sections describe recommended actions to further groundwater management in Simi Valley.

10.1 Sustainable Groundwater Management

On September 16, 2014, Governor Edmund G. Brown Jr. signed a three-bill package known as the Sustainable Groundwater Management Act (SGMA). SGMA creates a framework for sustainable, local groundwater management and is the first legislation in California to comprehensively regulate groundwater. Building on the recognition that groundwater management in California is best accomplished locally, it provides local water agencies with considerable new powers, most notably the power to regulate pumping. Nonetheless, SGMA also imposes substantial responsibility to find solutions for overdraft and to achieve long-term sustainability of groundwater supply. If local agencies fail to achieve sustainability, it establishes the power of the State to manage a groundwater basin and regulate groundwater use.

SGMA provides a priority list of groundwater basins, defines Groundwater Sustainability Agencies (GSAs), outlines the contents of Groundwater Sustainability Plans (GSPs), establishes the roles of State agencies, and sets a timeline with deadlines for high and medium priority basins. While the Simi Valley Basin has been designated as a low priority basin, SGMA provides guidance on basin management moving forward as additional groundwater development in Simi Valley is planned and implemented.

In short, SGMA:

- Enhances local management of groundwater consistent with rights to use or store groundwater
- Establishes minimum standards for effective, continuous management of groundwater
- Provides local groundwater agencies with the authority, technical, and financial assistance needed to maintain groundwater supplies
- Avoids or minimizes impacts for land subsidence
- Improves data collection and understanding of groundwater resources and management
- Increases groundwater storage and removes impediments to recharge
- Empowers local agencies to manage groundwater basins, while minimizing state intervention.

SGMA recognizes that groundwater is best managed at the local or regional level. It also recognizes that there are geographic, geologic, and hydrologic differences and various levels of readiness experienced by local and regional agencies across the state. SGMA requires local agencies to establish a new governance structure, known as GSAs, prior to developing groundwater sustainability plans for groundwater basins or subbasins that are designated as medium or high priority. Even though the Simi Valley Basin is a low priority basin now, as additional groundwater resources are developed, it is likely to move up in priority ranking. A benefit of moving up in basin ranking is that medium and high priority basins qualify for state grant funding for basin management activities. Accordingly, it is recommended that the District engage with stakeholders such as the County and Golden State Water Company to discuss issues associated with SGMA and future establishment of a GSA for the Simi Valley Basin. It is also recommended that the District begin working toward development of a Groundwater Sustainability Plan in compliance with the Water Code.

There are many components to a Groundwater Sustainability Plan. While some plan components are required, plans are intended to be flexible to address basin-specific issues. Recommended components include the following:

- Local and Regional Water Management
- Stakeholder Outreach
    - Hydrogeologic Setting and Groundwater Conditions
    - Geographic Setting
    - Surface Water Conditions
    - Geology and Aquifers
    - Groundwater Levels and Flow
    - Surface Water Groundwater Interaction
    - Groundwater Production
    - Water Balance
    - Recharge Areas
    - Groundwater Quality

- Basin Management Objectives
    - Establish Perennial Yield
    - Avoid Subsidence
    - Protect Groundwater Quality
    - Encourage Conjunctive Use
    - Improve Understanding of Groundwater System
- Groundwater Management Actions
    - Stakeholder Outreach
    - Monitoring Programs (levels and quality)
    - Groundwater Sustainability
    - Groundwater Protection
    - Coordinated Planning and Management
- Implementation Plan
    - Strategy and Schedule

Once a GSP is developed, SGMA requires annual reports and five-year updates on the status of basin management. It is estimated that the GSP would take two years to prepare and cost approximately $500,000 or $250,000 per year. The annual reports and five-year update are estimated to cost $100,000 per year. These costs have not been included in the annual O&M cost estimate.

10.1.1 Salt and Nutrient Management Plan

Recognizing that some groundwater basins contain salts and nutrients that exceed or threaten to exceed water quality objectives, the SWRCB Recycled Water Policy requires local water and wastewater entities, together with local salt and nutrient contributing stakeholders to develop a Salt and Nutrient Management Plan (SNMP) for each groundwater basin and subbasin in California. As stated in the Recycled Water Policy, the goal of the SNMP is to manage salt and nutrients (S/Ns) from all sources on a basin-wide basis in a manner that facilitates attainment of Water Quality Objectives and preserves beneficial uses.

Accordingly, it is recommended that the District develop a SNMP or include the required SNMP requirements in its GSP. The cost to develop the SNMP is estimated to be $100,000 and has not been included in the annual O&M cost estimate.

10.1.2 Groundwater Level Monitoring Program

DWR has developed requirements for CASGEM submittals to maintain consistency throughout the state (DWR, 2010). Groundwater level monitoring plans are required to describe the basin, provide information about and justification for the wells that will be part of the monitoring program, define the monitoring frequency, document field methods for data collection, and identify any data gaps.

The DWR guidelines (2010) include a lengthy discussion of monitoring well density. The resulting recommendations for monitoring well density in CASGEM monitoring plans is between 2 and 20 per 100

square miles, depending on geologic complexity, relative volume of groundwater use, slope of the groundwater gradient, and the availability of wells.

The guidelines also provide recommendations for frequency of groundwater elevation data collection for CASGEM programs. The goal of the CASGEM program is to track seasonal and long-term trends in groundwater elevations in all the designated basins in the state. The guidelines discuss the importance of higher frequency monitoring to accurately characterize these trends. At a minimum, the frequency must be semiannual to coincide with the high and low groundwater elevations in a specific basin.

It is recommended that a formal groundwater level monitoring program be developed for the basin and included in the GSP. The existing County groundwater level monitoring network is relatively sparse (only 2 wells are included). The Simi Valley Basin Study presented preliminary recommendations for the water level monitoring program. While the plan can be incorporated in the GSP, the costs for the program are provided here. Any appropriately sited existing supply wells that could be monitored through agreement with the well owners should be identified. A network of 12 existing wells was identified in the Simi Valley Basin Study. In addition, a program of new multi-completion monitoring wells should be installed over time to augment both the water level and water quality monitoring program. These depth-discrete wells will allow characterization of vertical and horizontal hydraulic gradients and monitoring of the water level impacts of increased District pumping. It is recommended that 3 multi-completion monitoring wells with 3 discrete screened intervals be installed. The wells should be completed with water level transducers so relatively continuous water level readings can be attained. The well installations can be staggered over multiple years to defer some costs. The cost to monitor water levels in the wells is relatively small and might include downloading the data logger data once per quarter. Existing wells identified for the program would be monitored for water levels manually. These include the District's dewatering monitoring wells and one of the Golden State Water Company wells.

10.1.3 Groundwater Quality Monitoring Program

The Simi Valley Basin Study presented preliminary recommendations for a groundwater quality monitoring plan. The County groundwater quality monitoring network is sparse and currently focused on the western end of the basin.

It is recommended that a formal water quality monitoring plan be included in the GSP. The multi-completion monitoring wells installed for the water level monitoring plan, would also provide points for water quality monitoring as would the new City production wells and the Golden State Water Company wells. The 3 multi-completion monitoring wells will include 3 sampling intervals per well for a total of 9 samples. Assuming that 4 other existing wells can be identified, this would result in 13 water quality samples at a proposed frequency of once per year. The initial constituents to be monitored would be defined in the groundwater quality monitoring plan. Since the program is voluntary, the number of constituents can be considerably smaller and some less frequently monitored than others. Assuming $500 per well for analytical costs and $50 per well for sampling, this yields $7,150 per year for the program.

11. References

- Boeing, 2015, Report on Annual Groundwater Monitoring, 2014, Santa Susana Field Laboratory, Ventura County, California, report to Department of Toxic Substances Control.
- City of Simi Valley Ventura County Waterworks District No. 8 Water Design and Construction Standards
- California Environmental Protection Agency, Department of Toxic Substances Control (DTSC), 2003. Update on Perchlorate Investigation in Simi Valley, September. Accessed: https://www.dtsc.ca.gov/SiteCleanup/Projects/upload/SSFL_FS_Perc-Update.pdf
- California Environmental Protection Agency, Regional Water Quality Control Board, Los Angeles Region (LARWQCB), 1994. Water Quality Control Plan, Los Angeles Region (Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties), adopted on June 13, 1994 and amendments dated October 28, 2011. Accessed at http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/basin_plan_documentation.shtml.
- California Department of Water Resources (DWR), 2010. Groundwater Elevation Monitoring Guidelines, December. Accessed at: http://www.water.ca.gov/groundwater/casgem/pdfs/CASGEM%20DWR%20GW%20Guidelines%20Final%20121510.pdf
- California Office of Environmental Health Hazard Assessment (OEHHA), 2008. Public Notice, Initiation of Risk Assessments for Chemicals in Drinking Water, July 2008. Accessed at: http://oehha.ca.gov/water/phg/pdf/PHGinitiation073008.pdf
- Calleguas Municipal Water District (Calleguas), 2016. Salinity Management Pipeline: Information for Potential Dischargers, January.
- Cardno ERI, 2015. First Quarter 2015 Groundwater Monitoring and Status Report, Former Exxon/Mobil Station 70462, 2395 Ettinger Road, Simi Valley, California, report to Los Angeles Regional Water Quality Control Board, April 14. Accessed at: http://geotracker.waterboards.ca.gov/esi/uploads/geo_report/1271187961/T0611100221.PDF
- CH2MHILL, 2007. Reconnaissance Study Report, Simi Valley Perchlorate Study, Ventura County, California, prepared for United States Army Corps of Engineers, Los Angeles District, August 2007. Accessed at: http://www.dtscssfl.com/files/lib_offsite_investig%5Cperchlorate/65782_7510_USACEFinal-ReconRptSimi-drd2081.pdf
- Driscoll, F.G., 1986. Groundwater and Wells, Johnson Division, Signal Environmental Systems, St. Paul, MN.
- Hem, John D., 1989, Study and Interpretation of the Chemical Characteristics of Natural Water, USGS Water Supply Paper 2254, Third Edition.

- Kennedy/Jenks Consultants (Kennedy/Jenks), 2017. Amended Final 2015 Urban Water Management Plan for Ventura County Waterworks, District No. 8, City of Simi Valley, April.
- Leighton and Associates (Leighton), 1988. Ground Water Dewatering Program Implementation West End of Simi Valley Groundwater Basin, prepared for Simi Valley County Sanitation District, September.
- Leymaster Environmental Consulting, LLC (Leymaster), 2015a. Semi-Annual Groundwater and Vapor System Monitoring Report, 1st Quarter 2015, 45 West Easy Street, Simi Valley, California, report to Los Angeles Regional Water Quality Control Board, April 16. Accessed at: http://geotracker.waterboards.ca.gov/esi/uploads/geo_report/4137520968/SLT4L3711811.PDF
- Leymaster Environmental Consulting, LLC (Leymaster), 2015b. Quarterly Groundwater and Vapor System Monitoring Report, 1st Quarter 2015, 45 West Easy Street, Simi Valley, California, report to Los Angeles Regional Water Quality Control Board, April 16. Accessed at: http://geotracker.waterboards.ca.gov/esi/uploads/geo_report/1946825146/SLT4L3711811.PDF
- Metropolitan Water District of Southern California (MWD) and U.S. Department of Interior, Bureau of Reclamation (USBOR), 1999. Salinity Management Study, Final Report: Long-term Strategy and Recommended Action Plan, prepared by Bookman-Edmonston, June. Accessed at: http://www.socalsalinity.org/pdfs/1999salinityreport.pdf
- Motzer, William, E, 2001. Perchlorate: Problems, Detection, and Solutions, Environmental Forensics, vol. 2, no. 4, December.
- National Research Council (NRC), 2005. Health Implications of Perchlorate Ingestion, National Academies Press, Washington, DC.
- Nzengung, V.A., C. Wang, and G. Harvey, 1999. Plant-mediated Transformation of Perchlorate into Chloride, Environ. Sci. Technol. 33.
- Padre Associates, Inc. (Padre), 2014. Draft Environmental Impact Report for the Calleguas Regional Salinity Management Project Phase 2 (Upper Reach), Lead Agency: Calleguas Municipal Water District, January. Accessed at: http://www.calleguas.com/images/docs-documents-reports/deirsmpphase2ur.pdf
- State Water Resources Control Board (SWRCB), 2010. Groundwater Information Sheet Boron, revised July 13, 2010. Accessed at: http://www.waterboards.ca.gov/gama/docs/coc_boron.pdf
- State Water Resources Control Board (SWRCB), 2010. Groundwater Information Sheet Nitrate, revised August 2010. Accessed at: http://www.waterboards.ca.gov/gama/docs/coc_nitrate.pdf
- State Water Resources Control Board (SWRCB), 2012. Low-Threat Closure Policy, effective August 17, 2012. Accessed at: http://www.swrcb.ca.gov/ust/lt_cls_plcy.shtml#policy081712
- Todd, D.K. and L.W. Mays, 2005, Groundwater Hydrology, John Wiley & Sons, Inc.
- Todd Groundwater (Todd), 2016, Characterization and Groundwater Supply Assessment for Simi Valley Basin, March.

- United States Environmental Protection Agency (USEPA), 2008. Interim Drinking Water Health Advisory for Perchlorate, USEPA 822-R-08-025, December 2008. Accessed at: http://nepis.epa.gov/Exe/ZyNET.exe/P1004X7Q.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&

- United States Geological Survey (USGS), CA. Burton, J. Montrella, M.K. Landon, and K. Belitz, 2011. Status and Understanding of Groundwater Quality in the Santa Clara River Valley, 2007: California GAMA Priority Basin Project, Scientific Investigation Report 2011-5052, prepared in cooperation with the California State Water Resources Control Board. Accessed at: http://pubs.usgs.gov/sir/2011/5052/pdf/sir20115052.pdf

- Ventura County Watershed Protection District, Water & Environment Resources Division, undated, 2013 Groundwater Section Annual Report. Accessed at: http://obgma.com/wp-content/uploads/2015/05/WPD_Grndwtr_Annual_Rpt_2013.pdf

- Wayne Perry, Inc., 2015. Quarterly Status and Groundwater Monitoring Report, First Quarter2015, Former Shell Service Station, 1196 East Los Angeles Ave., Simi Valley, California, report to Los Angeles Regional Water Quality Control Board, April 20. Accessed at: http://geotracker.waterboards.ca.gov/esi/uploads/geo_report/1254049718/T0611100120.PDF

Appendix A: Detailed Cost Estimates

City of Simi Valley

Simi Valley, CA

Groundwater Feasibility Study

Alternative 1 - E Los Angeles Avenue & 3rd Street Site

AACEI Class 4

Estimator:	*CP*	*Date:*	*6/29/2018*
Reviewer:	*TSS/SG*	*Date:*	*6/29/2018*

#	Description	QTY	UNIT	UNIT COST	TOTAL COST	NOTES
	Well Drilling 16-inch Casing, 600 ft Depth	*6*	*EA*	*$ 988,400*	*$ 5,930,400*	
	Well Pump, Vertical Turbine, 75 HP, 200 ft Column Piping	*6*	*EA*	*$ 145,000*	*$ 870,000*	
	Well site generator (kW TBD by Electrical)	*6*	*EA*	*$ -*	*$ -*	*Included in electrical contingency below*
	10" RW Pipeline, DIP, PC-350, 42" Cover	*4500*	*LF*	*$ 185*	*$ 832,500*	
	20" Steel Casing Jack and Bore Channel Crossing	*200*	*LF*	*$ 3,000*	*$ 600,000*	
	14" RW Pipeline, DIP, PC-250, 42" Cover	*3400*	*LF*	*$ 225*	*$ 765,000*	
	16" RW Pipeline, DIP, PC-250, 42" Cover	*2200*	*LF*	*$ 250*	*$ 550,000*	
	20" RW Pipeline, DIP, PC-250, 42" Cover	*5700*	*LF*	*$ 310*	*$ 1,767,000*	
	36" Steel Casing Jack and Bore RR Crossing	*200*	*LF*	*$ 3,500*	*$ 700,000*	
	Bridge Crossing	*300*	*LF*	*$ 800*	*$ 240,000*	
	18" FW Pipeline, DIP, PC-250, 42" Cover	*300*	*LF*	*$ 275*	*$ 82,500*	
	10" Brine Pipeline, PVC C-900, 42" Cover	*4800*	*LF*	*$ 145*	*$ 696,000*	
	Brine Discharge Station	*1*	*EA*	*$ 500,000*	*$ 500,000*	*Estimate from Calleguas Jan 2016 Report. Cost to design and build varies from $200,000 - $500,000*
	4.9 MGD Finished Water Pump Station (3 duty, 1 stand-by 1,200 gpm 125 HP pumps)	*1*	*EA*	*$ 1,984,000*	*$ 1,984,000*	
	Treatment Plant Generator (kW TBD by Electrical)	*1*	*EA*	*$ -*	*$ -*	*Included in electrical contingency below*
	Pavement Removal/Replacement	*15920*	*SY*	*$ 92*	*$ 1,466,151*	
	Greensand Filter	*1*	*LS*	*$ 2,470,000*	*$ 2,470,000*	
	Backwash Tank	*1*	*EA*	*$ 260,000*	*$ 260,000*	*120,000 gallons*
	Backwash Recycle Pump	*2*	*EA*	*$ 29,900*	*$ 59,800*	*20hp centrifugal*
	Solids Pump	*2*	*EA*	*$ 39,849*	*$ 79,698*	*20hp non-clog*
	RO System	*1*	*LS*	*$ 7,875,000*	*$ 7,875,000*	
	Break Tank	*1*	*EA*	*$ 135,000*	*$ 135,000*	*75,000 gallon, Steel*
	Break Tank btwn 1st and 2nd Pass RO	*1*	*EA*	*$ 112,500*	*$ 112,500*	*25,000 gallon, Steel*
	NaOH Dosing Pumps	*4*	*EA*	*$ 12,500*	*$ 50,000*	*1 per train*
	NaOH Storage Tank	*1*	*EA*	*$ 7,500*	*$ 7,500*	*Allow at 2,000 gallon, HDPE*
	Product Water Tank	*1*	*EA*	*$ 97,500*	*$ 97,500*	*34,000 gallon, Steel*
	Finished Water Pump	*3*	*EA*	*$ 71,500*	*$ 214,500*	*65hp centrifugal*
	Building	*8946*	*sf*	*$ 250*	*$ 2,236,500*	*Masonry, including mechanical, HVAC, electrical appurtenances*
	Metal Canopy	*1800*	*sf*	*$ 180*	*$ 324,000*	*Metal columns, metal framing, metal decking*
					$ -	
		Subtotal:			**$ 30,905,548**	

City of Simi Valley

Simi Valley, CA

Groundwater Feasibility Study

Alternative 1 - E Los Angeles Avenue & 3rd Street Site

AACEI Class 4

Estimator:	*CP*	*Date:*	*6/29/2018*
Reviewer:	*TSS/SG*	*Date:*	*6/29/2018*

#	Description	QTY	UNIT	UNIT COST	TOTAL COST	NOTES
	Well Drilling 16-inch Casing, 600 ft Depth	*6*	*EA*	*$ 988,400*	*$ 5,930,400*	
	Well Pump, Vertical Turbine, 75 HP, 200 ft Column Piping	*6*	*EA*	*$ 145,000*	*$ 870,000*	
	Well site generator (kW TBD by Electrical)	*6*	*EA*	*$ -*	*$ -*	*Included in electrical contingency below*
	10" RW Pipeline, DIP, PC-350, 42" Cover	*4500*	*LF*	*$ 185*	*$ 832,500*	
	20" Steel Casing Jack and Bore Channel Crossing	*200*	*LF*	*$ 3,000*	*$ 600,000*	
	14" RW Pipeline, DIP, PC-250, 42" Cover	*3400*	*LF*	*$ 225*	*$ 765,000*	
	16" RW Pipeline, DIP, PC-250, 42" Cover	*2200*	*LF*	*$ 250*	*$ 550,000*	
	20" RW Pipeline, DIP, PC-250, 42" Cover	*5700*	*LF*	*$ 310*	*$ 1,767,000*	
	36" Steel Casing Jack and Bore RR Crossing	*200*	*LF*	*$ 3,500*	*$ 700,000*	
	Bridge Crossing	*300*	*LF*	*$ 800*	*$ 240,000*	
	18" FW Pipeline, DIP, PC-250, 42" Cover	*300*	*LF*	*$ 275*	*$ 82,500*	
	10" Brine Pipeline, PVC C-900, 42" Cover	*4800*	*LF*	*$ 145*	*$ 696,000*	
	Brine Discharge Station	*1*	*EA*	*$ 500,000*	*$ 500,000*	*Estimate from Calleguas Jan 2016 Report. Cost to design and build varies from $200,000 - $500,000*
	4.9 MGD Finished Water Pump Station (3 duty, 1 stand-by 1,200 gpm 125 HP pumps)	*1*	*EA*	*$ 1,984,000*	*$ 1,984,000*	
	Treatment Plant Generator (kW TBD by Electrical)	*1*	*EA*	*$ -*	*$ -*	*Included in electrical contingency below*
	Pavement Removal/Replacement	*15920*	*SY*	*$ 92*	*$ 1,466,151*	
	Greensand Filter	*1*	*LS*	*$ 2,470,000*	*$ 2,470,000*	
	Backwash Tank	*1*	*EA*	*$ 260,000*	*$ 260,000*	*120,000 gallons*
	Backwash Recycle Pump	*2*	*EA*	*$ 29,900*	*$ 59,800*	*20hp centrifugal*
	Solids Pump	*2*	*EA*	*$ 39,849*	*$ 79,698*	*20hp non-clog*
	RO System	*1*	*LS*	*$ 7,875,000*	*$ 7,875,000*	
	Break Tank	*1*	*EA*	*$ 135,000*	*$ 135,000*	*75,000 gallon, Steel*
	Break Tank btwn 1st and 2nd Pass RO	*1*	*EA*	*$ 112,500*	*$ 112,500*	*25,000 gallon, Steel*
	NaOH Dosing Pumps	*4*	*EA*	*$ 12,500*	*$ 50,000*	*1 per train*
	NaOH Storage Tank	*1*	*EA*	*$ 7,500*	*$ 7,500*	*Allow at 2,000 gallon, HDPE*
	Product Water Tank	*1*	*EA*	*$ 97,500*	*$ 97,500*	*34,000 gallon, Steel*
	Finished Water Pump	*3*	*EA*	*$ 71,500*	*$ 214,500*	*65hp centrifugal*
	Building	*8946*	*sf*	*$ 250*	*$ 2,236,500*	*Masonry, including mechanical, HVAC, electrical appurtenances*
	Metal Canopy	*1800*	*sf*	*$ 180*	*$ 324,000*	*Metal columns, metal framing, metal decking*
					$ -	
		Subtotal:			**$ 30,905,548**	

City of Simi Valley

Simi Valley, CA

Groundwater Feasibility Study

Alternative 1 - E Los Angeles Avenue & 3rd Street Site

AACEI Class 4

Estimator:	*CP*	*Date:*	*6/29/2018*
Reviewer:	*TSS/SG*	*Date:*	*6/29/2018*

#	Description	QTY	UNIT	UNIT COST	TOTAL COST	NOTES
	Other Indirect Factors:					
	Equipment Installation Cost	*0%*			*$ -*	*Included above*
	Process Mechanical (Piping, Valves, Appurtenances, etc)	*3%*			*$ 1,004,430*	*Large piping between treatment processes*
	Site Civil	*5%*			*$ 1,545,277*	*Allow for site preparation, restoration, mass excavation, small yard piping*
	Structural	*0%*			*$ -*	*Included above*
	HVAC/Plumbing	*0%*			*$ -*	*Included above*
	Electrical	*10%*			*$ 3,090,555*	*As percent of total cost for electrical heavy equipment, conduit/wire, small equipment*
	Instrumentation and Controls	*3%*			*$ 927,166*	*As percent of total cost for instruments, controls, integration, programming*
	General Conditions (Div01)	*10%*			*$ 3,747,298*	
		Subtotal:			***$ 41,220,275***	
	Escalation at 2.5% annually	*5%*			*$ 2,086,776*	*Assumes 24 months for construction*
	Contractor Overhead	*10%*			*$ 4,122,027*	
	Contractor Profit	*10%*			*$ 4,122,027*	
	Contract Allowances/Unit Price Items	*0%*			*$ -*	
	Bond and Insurance	*3%*			*$ 1,236,608*	
	Design Contingency	*25%*			*$ 10,305,069*	*Allows for unknowns in water quality if treatment equipment needs to be modified*
		Subtotal:			**$ 63,092,783**	
	TOTAL PROBABLE CONSTRUCTION COST:				**$ 63,093,000**	
	PROJECT COSTS:					
	Engineering	*10%*			*$ 6,309,300*	
	Environmental	*3%*			*$ 1,892,790*	
	Permitting	*1%*			*$ 630,930*	
	Construction Management	*10%*			*$ 6,309,300*	
	Change Order Reserve	*10%*			*$ 6,309,300*	
	Legal	*2%*			*$ 1,261,860*	
	Administration	*2%*			*$ 1,261,860*	
	TOTAL PROBABLE PROJECT COST:				**$ 87,069,000**	

Notes:
Reuse of Backfill
No hazardous materials
No cost for piles are provided for any structures or pipelines
No cost for dewatering is provided for any subsurface work
Does not include cost to purchase well site properties or treatment plant property

Hazen

City of Simi Valley

Simi Valley, CA

Groundwater Feasibility Study

Alternative 2 - Callahan Ave & Alviso St Site

AACEI Class 4

Estimator:	*CP*	*Date:*	*6/29/2018*
Reviewer:	*TSS/SG*	*Date:*	*6/29/2018*

#	Description	QTY	UNIT	UNIT COST	TOTAL COST	NOTES
	Well Drilling 16-inch Casing, 600 ft Depth	*6*	*EA*	*$ 988,400*	*$ 5,930,400*	
	Well Pump, Vertical Turbine, 75 HP, 200 ft Column Piping	*6*	*EA*	*$ 145,000*	*$ 870,000*	
	Well site generator (kW TBD by Electrical)	*6*	*EA*	*$ -*	*$ -*	*Included in electrical contingency below*
	10" RW Pipeline, DIP, PC-350, 42" Cover	*4700*	*LF*	*$ 185*	*$ 869,500*	
	20" Steel Casing Jack and Bore Channel Crossing	*200*	*LF*	*$ 3,000*	*$ 600,000*	
	14" RW Pipeline, DIP, PC-250, 42" Cover	*4700*	*LF*	*$ 225*	*$ 1,057,500*	
	16" RW Pipeline, DIP, PC-250, 42" Cover	*2200*	*LF*	*$ 250*	*$ 550,000*	
	20" RW Pipeline, DIP, PC-250, 42" Cover	*100*	*LF*	*$ 310*	*$ 31,000*	
	18" FW Pipeline, DIP, PC-250, 42" Cover	*3600*	*LF*	*$ 275*	*$ 990,000*	
	36" Steel Casing Jack and Bore RR Crossing	*200*	*LF*	*$ 3,500*	*$ 700,000*	
	10" Brine Pipeline, PVC C-900, 42" Cover	*8700*	*LF*	*$ 145*	*$ 1,261,500*	
	20" Steel Casing Jack and Bore RR Crossing	*200*	*LF*	*$ 3,000*	*$ 600,000*	
	Bridge Crossing	*300*	*LF*	*$ 800*	*$ 240,000*	
	Brine Discharge Station	*1*	*EA*	*$ 500,000*	*$ 500,000*	*Estimate from Calleguas Jan 2016 Report. Cost to design and build varies from $200,000 - $500,000*
	4.9 MGD Finished Water Pump Station (3 duty, 1 stand-by 1,200 gpm 125 HP pumps)	*1*	*EA*	*$ 1,984,000*	*$ 1,984,000*	
	Treatment Plant Generator (kW TBD by Electrical)	*1*	*EA*	*$ -*	*$ -*	*Included in electrical contingency below*
	Pavement Removal/Replacement	*20130*	*SY*	*$ 92*	*$ 1,853,870*	
	Greensand Filter	*1*	*LS*	*$ 2,470,000*	*$ 2,470,000*	
	Backwash Tank	*1*	*EA*	*$ 260,000*	*$ 260,000*	*120,000 gallons*
	Backwash Recycle Pump	*2*	*EA*	*$ 29,900*	*$ 59,800*	*20hp centrifugal*
	Solids Pump	*2*	*EA*	*$ 39,849*	*$ 79,698*	*20hp non-clog*
	RO System	*1*	*LS*	*$ 7,875,000*	*$ 7,875,000*	
	Break Tank	*1*	*EA*	*$ 135,000*	*$ 135,000*	*75,000 gallon, Steel*
	Break Tank btwn 1st and 2nd Pass RO	*1*	*EA*	*$ 112,500*	*$ 112,500*	*25,000 gallon, Steel*
	NaOH Dosing Pumps	*4*	*EA*	*$ 12,500*	*$ 50,000*	*1 per train*
	NaOH Storage Tank	*1*	*EA*	*$ 7,500*	*$ 7,500*	*Allow at 2,000 gallon, HDPE*
	Product Water Tank	*1*	*EA*	*$ 97,500*	*$ 97,500*	*34,000 gallon, Steel*
	Fnished Water Pump	*3*	*EA*	*$ 71,500*	*$ 214,500*	*65hp centrifugal*
	Building	*8946*	*sf*	*$ 250*	*$ 2,236,500*	*Masonry, including mechanical, HVAC, electrical appurtenances*
	Metal Canopy	*1800*	*sf*	*$ 80*	*$ 144,000*	
					$ -	
		Subtotal:			**$ 31,779,768**	

Hazen

City of Simi Valley

Simi Valley, CA

Groundwater Feasibility Study

Alternative 2 - Callahan Ave & Alviso St Site

AACEI Class 4

Estimator:	*CP*	*Date:*	*6/29/2018*
Reviewer:	*TSS/SG*	*Date:*	*6/29/2018*

#	Description	QTY	UNIT	UNIT COST	TOTAL COST	NOTES
	Other Indirect Factors:					
	Equipment Installation Cost	*0%*			*$ -*	*Included above*
	Process Mechanical (Piping, Valves, Appurtenances, etc)	*3%*			*$ 1,032,842*	*Large piping between treatment processes*
	Site Civil	*5%*			*$ 1,588,988*	*Allow for site preparation, restoration, mass excavation, small yard piping*
	Structural	*0%*			*$ -*	*Included above*
	HVAC/Plumbing	*0%*			*$ -*	*Included above*
	Electrical	*10%*			*$ 3,177,977*	*As percent of total cost for electrical heavy equipment, cnoduit/wire, small equipment*
	Instrumentation and Controls	*3%*			*$ 953,393*	*As percent of total cost for instruments, controls, integration, programming*
	General Conditions (Div01)	*10%*			*$ 3,853,297*	
		Subtotal:			**$ 42,386,265**	
	Escalation at 2.5% annually	*5%*			*$ 2,145,805*	*Assumes 24 months for construction*
	Contractor Overhead	*10%*			*$ 4,238,627*	
	Contractor Profit	*10%*			*$ 4,238,627*	
	Contract Allowances/Unit Price Items	*0%*			*$ -*	
	Bond and Insurance	*3%*			*$ 1,271,588*	
	Design Contingency	*25%*			*$ 10,596,566*	*Allows for unknowns in water quality if treatment equipment needs to be modified*
					$ -	
		Subtotal:			**$ 64,877,477**	
	TOTAL PROBABLE CONSTRUCTION COST:				**$ 64,878,000**	
	PROJECT COSTS:					
	Engineering	*10%*			*$ 6,487,800*	
	Environmental	*3%*			*$ 1,946,340*	
	Permitting	*1%*			*$ 648,780*	
	Construction Management	*10%*			*$ 6,487,800*	
	Change Order Reserve	*10%*			*$ 6,487,800*	
	Legal	*2%*			*$ 1,297,560*	
	Administration	*2%*			*$ 1,297,560*	
	TOTAL PROBABLE PROJECT COST:				**$ 89,532,000**	

Notes:
Reuse of Backfill
No hazardous materials
No cost for piles are provided for any structures or pipelines
No cost for dewatering is provided for any subsurface work
Does not include cost to purchase well site properties or treatment plant property

City of Simi Valley

Simi Valley, CA

Groundwater Feasibility Study

Alternative 3 - Tapo Canyon Road & 118 Freeway Site

AACEI Class 4

Estimator:	*CP*	*Date:*	*2/16/2018*
Reviewer:	*TSS/SG*	*Date:*	*2/21/2018*

#	Description	QTY	UNIT	UNIT COST	TOTAL COST	NOTES
	Well Drilling 16-inch Casing, 600 ft Depth	*6*	*EA*	*$ 988,400*	*$ 5,930,400*	
	Well Pump, Vertical Turbine, 75 HP, 200 ft Column Piping	*6*	*EA*	*$ 145,000*	*$ 870,000*	
	Well site generator (kW TBD by Electrical)	*6*	*EA*	*$ -*	*$ -*	*Included in electrical contingency below*
	10" RW Pipeline, DIP, PC-350, 42" Cover	*4500*	*LF*	*$ 185*	*$ 832,500*	
	20" Steel Casing Jack and Bore Channel Crossing	*200*	*LF*	*$ 3,000*	*$ 600,000*	
	14" RW Pipeline, DIP, PC-250, 42" Cover	*3600*	*LF*	*$ 225*	*$ 810,000*	
	16" RW Pipeline, DIP, PC-250, 42" Cover	*5800*	*LF*	*$ 250*	*$ 1,450,000*	
	20" RW Pipeline, DIP, PC-250, 42" Cover	*100*	*LF*	*$ 310*	*$ 31,000*	
	18" FW Pipeline, DIP, PC-250, 42" Cover	*200*	*LF*	*$ 275*	*$ 55,000*	
	10" Brine Pipeline, PVC C-900, 42" Cover	*27600*	*LF*	*$ 145*	*$ 4,002,000*	
	20" Steel Casing Jack and Bore RR Crossing	*200*	*LF*	*$ 3,000*	*$ 600,000*	
	20" Steel Casing Jack and Bore Channel Crossing	*200*	*LF*	*$ 3,000*	*$ 600,000*	
	Bridge Crossing	*300*	*LF*	*$ 800*	*$ 240,000*	
	Brine Discharge Station	*1*	*EA*	*$ 500,000*	*$ 500,000*	*Estimate from Calleguas Jan 2016 Report. Cost to design and build varies from $200,000 - $500,000*
	4.9 MGD Finished Water Pump Station (3 duty, 1 stand-by 1,200 gpm 125 HP pumps)	*1*	*EA*	*$ 1,984,000*	*$ 1,984,000*	
	Treatment Plant Generator (kW TBD by Electrical)	*1*	*EA*	*$ -*	*$ -*	*Included in electrical contingency below*
	Pavement Removal/Replacement	*34540*	*SY*	*$ 92*	*$ 3,180,957*	
	Greensand Filter	*1*	*LS*	*$ 2,470,000*	*$ 2,470,000*	
	Backwash Tank	*1*	*EA*	*$ 260,000*	*$ 260,000*	*120,000 gallons*
	Backwash Recycle Pump	*2*	*EA*	*$ 29,900*	*$ 59,800*	*20hp centrifugal*
	Solids Pump	*2*	*EA*	*$ 39,849*	*$ 79,698*	*20hp non-clog*
	RO System	*1*	*LS*	*$ 7,875,000*	*$ 7,875,000*	
	Break Tank	*1*	*EA*	*$ 135,000*	*$ 135,000*	*75,000 gallon, Steel*
	Break Tank btwn 1st and 2nd Pass RO	*1*	*EA*	*$ 112,500*	*$ 112,500*	*25,000 gallon, Steel*
	NaOH Dosing Pumps	*4*	*EA*	*$ 12,500*	*$ 50,000*	*1 per train*
	NaOH Storage Tank	*1*	*EA*	*$ 7,500*	*$ 7,500*	*Allow at 2,000 gallon, HDPE*
	Product Water Tank	*1*	*EA*	*$ 97,500*	*$ 97,500*	*34,000 gallon, Steel*
	Fnished Water Pump	*3*	*EA*	*$ 71,500*	*$ 214,500*	*65hp centrifugal*
	Building	*8946*	*sf*	*$ 250*	*$ 2,236,500*	*Masonry, including mechanical, HVAC, electrical appurtenances*
	Metal Canopy	*1800*	*sf*	*$ 80*	*$ 144,000*	
					$ -	
		Subtotal:			**$ 35,427,855**	

Hazen

City of Simi Valley

Simi Valley, CA

Groundwater Feasibility Study

Alternative 3 - Tapo Canyon Road & 118 Freeway Site

AACEI Class 4

Estimator:	*CP*	*Date:*	*2/16/2018*
Reviewer:	*TSS/SG*	*Date:*	*2/21/2018*

#	Description	QTY	UNIT	UNIT COST	TOTAL COST	NOTES
	Other Indirect Factors:					
	Equipment Installation Cost	*0%*			*$ -*	*Included above*
	Process Mechanical (Piping, Valves, Appurtenances, etc)	*3%*			*$ 1,151,405*	*Large piping between treatment processes*
	Site Civil	*5%*			*$ 1,771,393*	*Allow for site preparation, restoration, mass excavation, small yard piping*
	Structural	*0%*			*$ -*	*Included above*
	HVAC/Plumbing	*0%*			*$ -*	*Included above*
	Electrical	*10%*			*$ 3,542,785*	*As percent of total cost for electrical heavy equipment, cnoduit/wire, small equipment*
	Instrumentation and Controls	*3%*			*$ 1,062,836*	*As percent of total cost for instruments, controls, integration, programming*
	General Conditions (Div01)	*10%*			*$ 4,295,627*	
		Subtotal:			***$ 47,251,902***	
	Escalation at 2.5% annually	*5%*			*$ 2,392,128*	
	Contractor Overhead	*10%*			*$ 4,725,190*	
	Contractor Profit	*10%*			*$ 4,725,190*	
	Contract Allowances/Unit Price Items	*0%*			*$ -*	
	Bond and Insurance	*3%*			*$ 1,417,557*	
	Design Contingency	*25%*			*$ 11,812,975*	*Allows for unknowns in water quality if treatment equipment needs to be modified*
		Subtotal:			**$ 72,324,942**	
	TOTAL PROBABLE CONSTRUCTION COST:				**$ 72,325,000**	
	PROJECT COSTS:					
	Engineering	*10%*			*$ 7,232,500*	
	Environmental	*3%*			*$ 2,169,750*	
	Permitting	*1%*			*$ 723,250*	
	Construction Management	*10%*			*$ 7,232,500*	
	Change Order Reserve	*10%*			*$ 7,232,500*	
	Legal	*2%*			*$ 1,446,500*	
	Administration	*2%*			*$ 1,446,500*	
	TOTAL PROBABLE PROJECT COST:				**$ 99,809,000**	

Notes:
Reuse of Backfill
No hazardous materials
No cost for piles are provided for any structures or pipelines
No cost for dewatering is provided for any subsurface work
Does not include cost to purchase well site properties or treatment plant property

Appendix B: California Code of Regulations

California Code of Regulations, Title 22 Drinking Water Well Monitoring

Program Origin	Title 22 of the California Code of Regulations: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Lawbook.aspx
Responsible Agency	Drinking water well owners
Number of Monitoring Points	Assume six (6) production wells
Constituents and Frequency	Drinking water wells are sampled for many parameters, including coliform bacteria/E-coli, volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, and other general physical constituents The constituents monitored and the frequency of monitoring varies based on the well location, size of the water system, and history of water quality results. The number of constituents and sampling frequency can be reduced if constituents are not detected. Drinking water wells must be sampled in accordance with monitoring schedules (http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Monitoring.aspx) enforced by DDW
Other Media Monitored/ Monitoring Locations	Water samples may be collected at various locations throughout the distribution system, including: • Well head • Designated sampling points along the distribution piping • Effluent of treatment plants • Effluent of water storage tanks and blending tanks • Service connections to imported water system
Reporting/ Databases	• Analytical results are submitted directly to DDW database as Electronic Database Files: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDT.aspx • Title 22 monitoring data can be downloaded from DDW website: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx
Quality Assurance / Quality Control (QA/QC) Program	• Must use California certified laboratories with established QA/QC programs • Utilize U.S. Environmental Protection Agency method acceptance criteria and laboratory internal controls for QC parameters, including preparation blanks, surrogates, spikes, duplicates and laboratory control samples
Compliance Oversight	Data are reviewed for compliance and any necessary corrective actions by groundwater pumpers (i.e., the District) and DDW

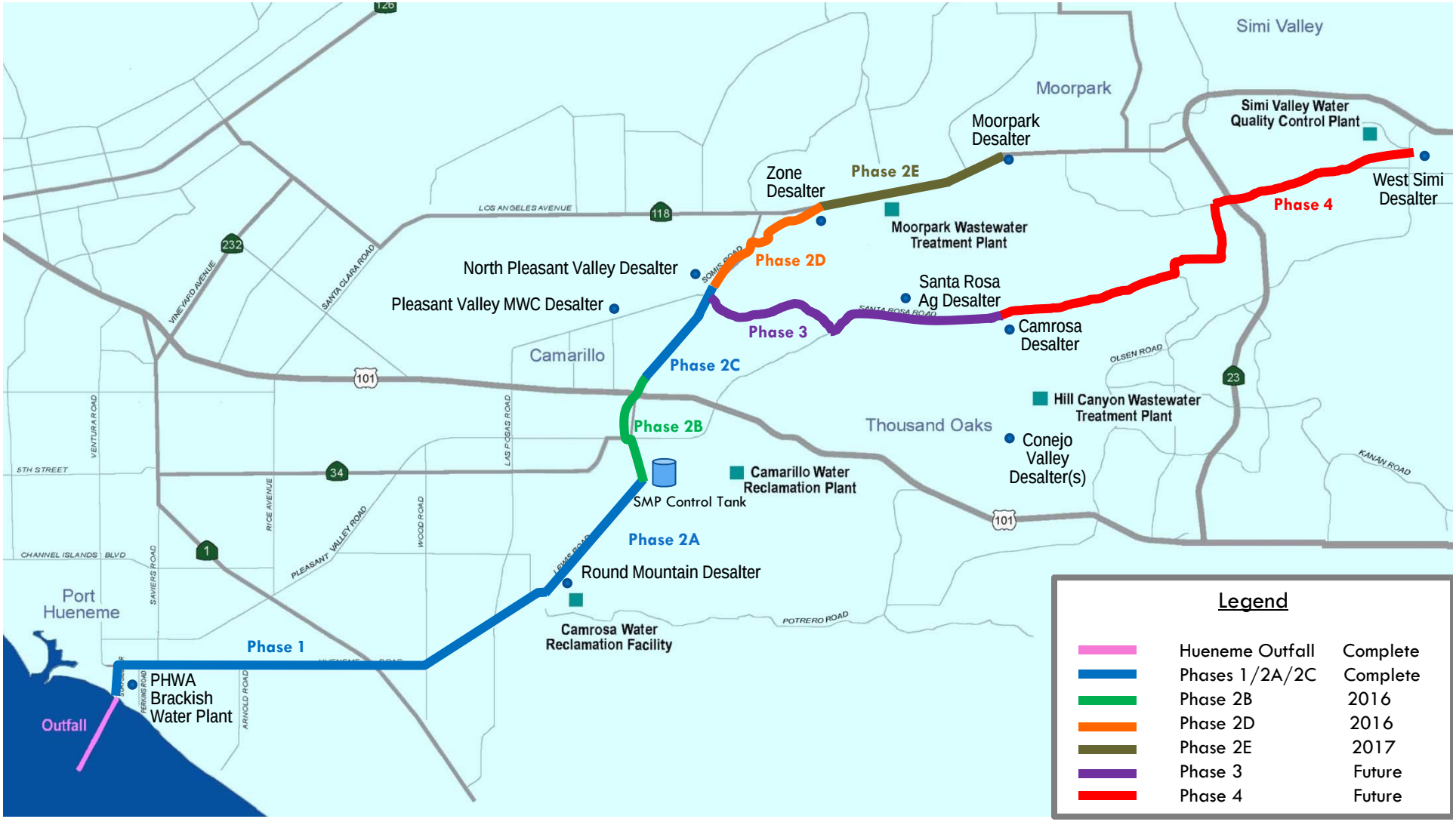
Appendix C: Calleguas Salinity Management Pipeline

Salinity Management Pipeline

Information for Potential Dischargers

Updated January 2016

Salinity Management Pipeline (SMP) Alignment and Estimated Schedule

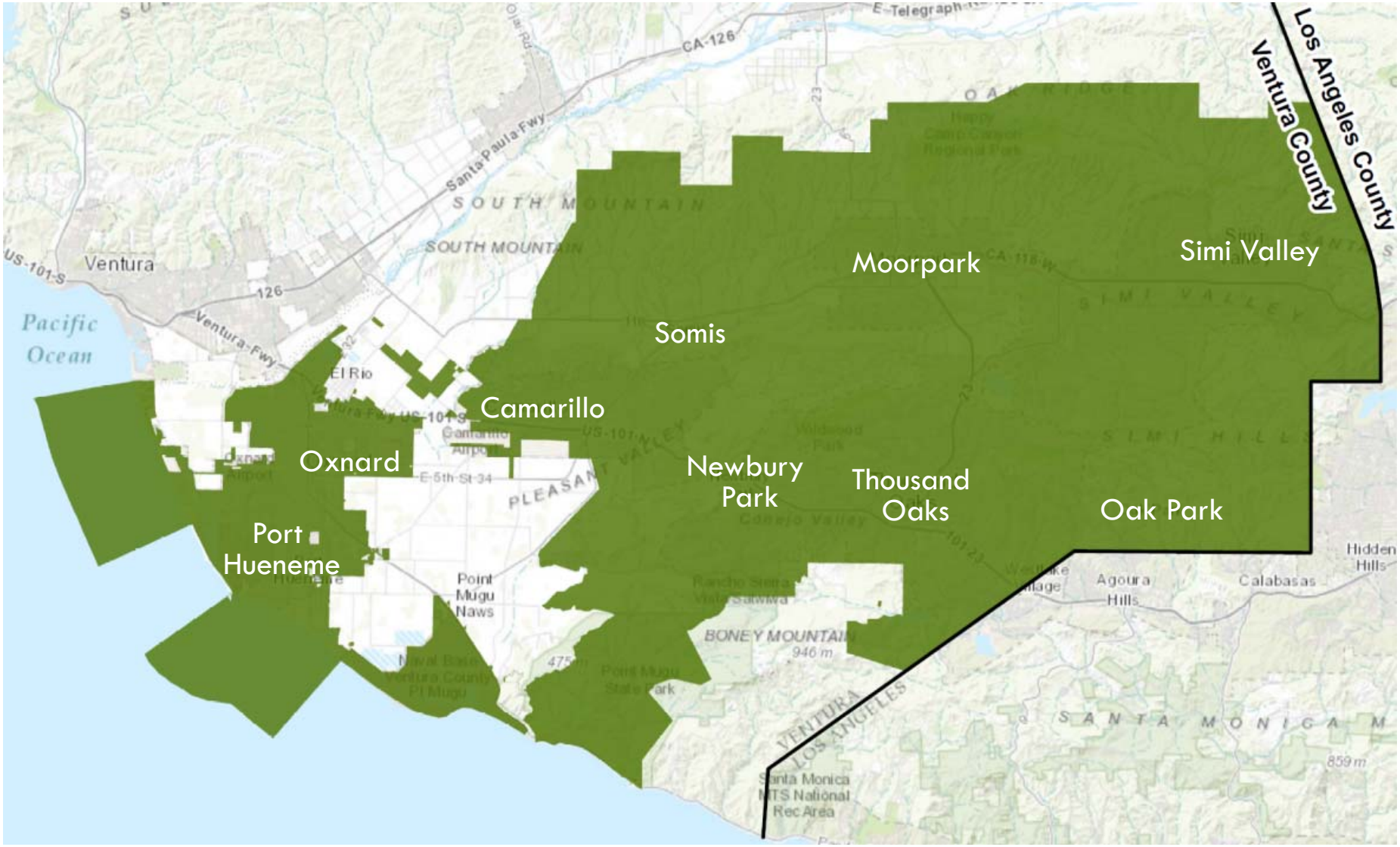


January 2016

Rate Components for Direct Dischargers to the SMP

- Actual costs to design and build discharge stations (approx. $200,000 - $500,000, depending on size and location)
- 0.33% of actual costs to design and build discharge station monthly (replacement charge)
- O&M on each discharge station (estimated $45,000 per year, includes water quality sampling)
- Within the service area, Calendar Year 2016 discharge rates are:
  - $519.60 per AF for brine
  - $41.60 per AF for recycled water (interruptible discharge)
- Dischargers outside the service area pay 50% surcharge ($779.40/AF and $62.40/AF) because the SMP is subsidized by potable water rates.

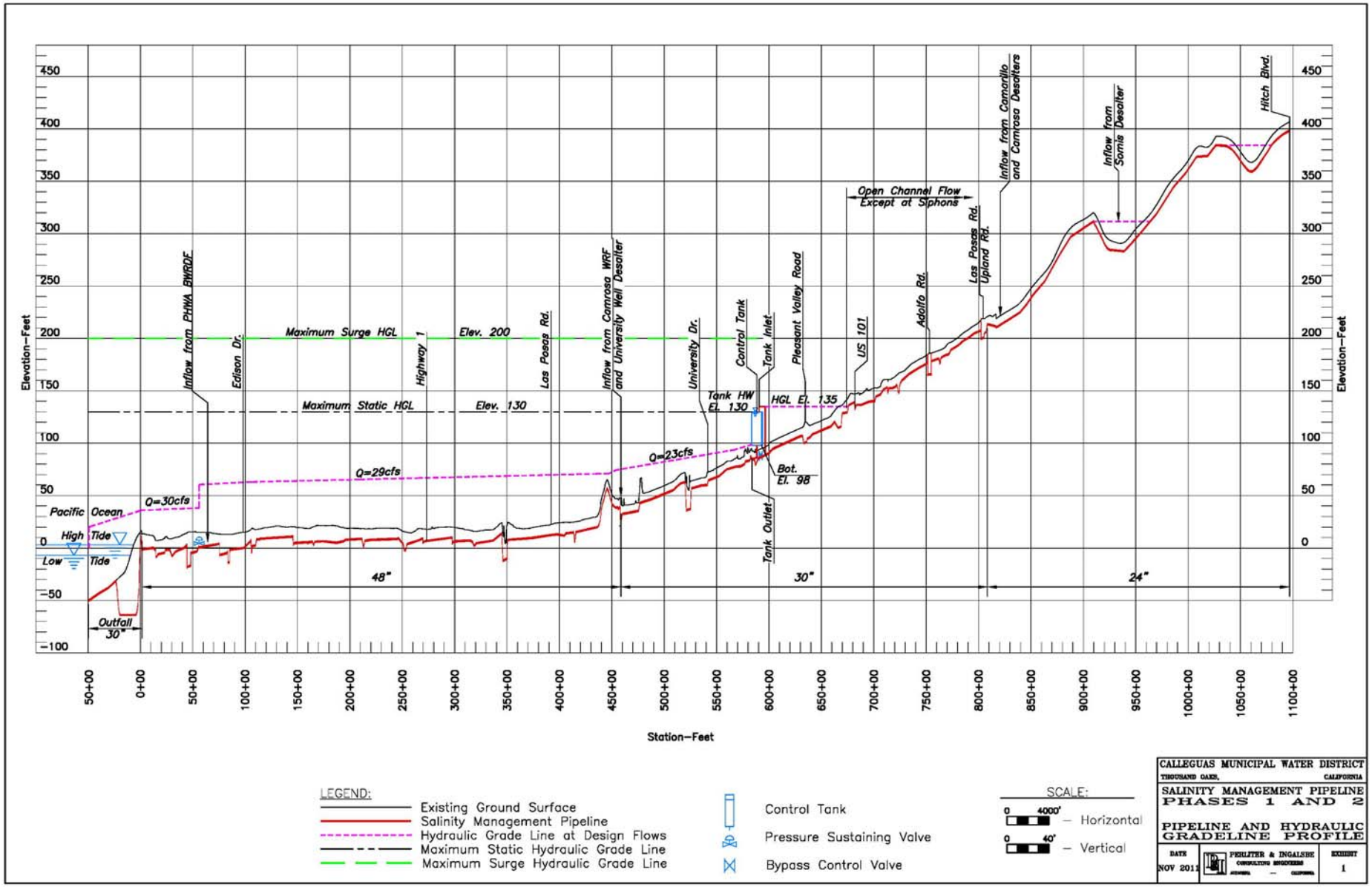
Calleguas Service Area



Pipe Hydraulics

- Pipe is under pressure south of Pleasant Valley Road
  - hydraulic grade line 100' to 130' above sea level
  - discharges must overcome pressure in the pipe
- Pipe flows by gravity north of Pleasant Valley Road
  - typically no pressure
  - some reaches have low pressure due to topographic high points

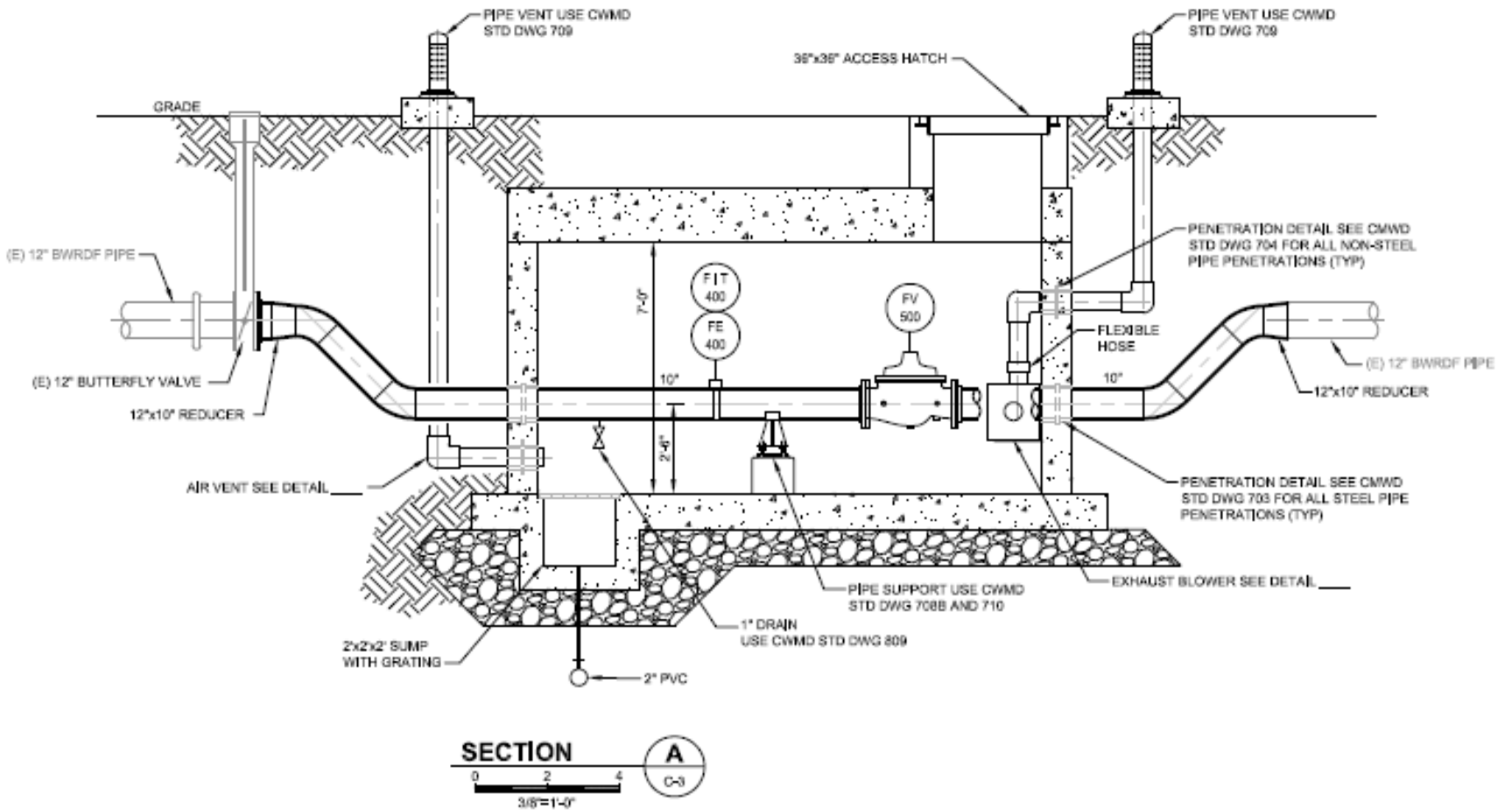
Salinity Management Pipeline Hydraulic Grade Line



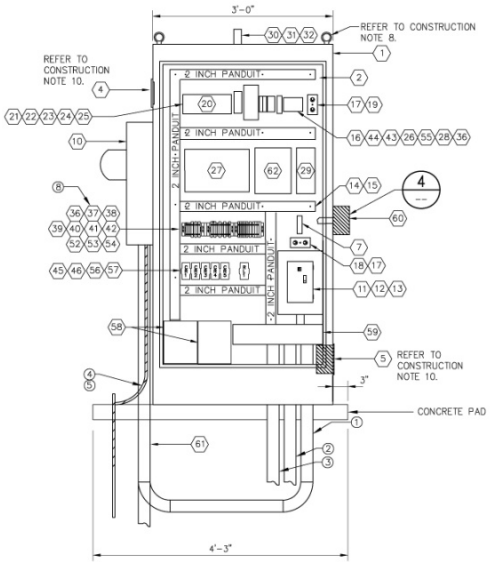
Discharge Station Construction

- Calleguas to design and build discharge stations
- Discharger to pay deposit for design and construction prior to commencement of each of those activities

Typical Discharge Station Section

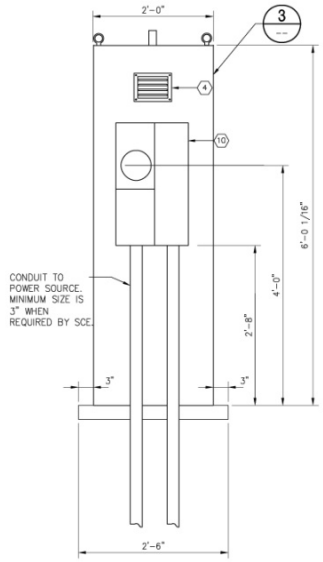


Typical Discharge Station Control Panel



CONTROL CABINET DETAIL
(FRONT DOOR NOT SHOWN)

DETAIL 1
SCALE: 1"=1'



POWER METER DETAIL

DETAIL 2
1"=1'

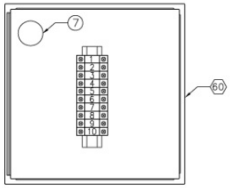
CONSTRUCTION NOTES:

1. CABINET TO BE ANCHORED TO THE CONCRETE PAD PER DRAWING O-S-5.
2. CONTROL WIRING SHALL BE MARKED WITH RAYCHEM, T&B, OR EQUAL HEAT-SHRINK WIRE MARKERS AT BOTH ENDS.
3. ALL WIRING ENTERING CONTROL CABINET TO BE RUN IN NEC APPROVED, UL RATED CONDUIT PER SPECIFICATION 16110. WIRING FOR INTRUSION SWITCH, LIGHT AND FAN SHALL BE RUN IN WATERPROOF, FLEXIBLE, METALLIC CONDUIT.
4. FIELD PENETRATIONS TO THE CONTROL CABINET SHALL BE DE-BURRED, TREATED WITH COLD GALVANIZED PRIMER AND FINISH RESTORED TO FACTORY SPECIFICATION.
5. LIGHT KIT TO BE CENTER MOUNTED ON THE INSIDE FRONT OF CABINET, ABOVE THE DOOR. LIGHT KIT SWITCH SHALL DIRECTLY CONTROL LIGHT.
6. MAINS ENCLOSURE AND PURVEYOR BOX TO BE ATTACHED TO THE CABINET AND THE PENETRATIONS SEALED TO PREVENT ENTRY OF DIRECTED WATER. IN SOME LOCATIONS, THE LOCATION OF THE MAINS ENCLOSURE AND PURVEYOR BOX ARE REVERSED FROM THAT SHOWN. SEE ELECTRICAL SITE PLANS FOR DETAILS.
7. PANEL SHALL BE FACTORY PAINTED. FIELD TOUCH UP AS REQUIRED PER SPECIFICATION 17510.
8. CONTRACTOR TO REMOVE LIFTING BOLTS AND PLUG WITH SS BOLTS.
9. ALL ITEMS IN THE BILL OF MATERIALS SHALL BE CONSIDERED AS MARKED "OR EQUAL", WITH THE EXCEPTION OF THE AGM MODULES AND THE PLC AND ITS ASSOCIATED PARTS.
10. REFER TO DETAIL 6 ON DRAWING O-E-5 FOR DETAILS OF LOUVER, FAN, AND FILTER ASSEMBLY.
11. CABLES, CONNECTORS, TERMINALS AND FUSES ARE NOT SHOWN FOR CLARITY.
12. SOME SITES REQUIRE NEMA 4X STAINLESS STEEL CABINETS. REFER TO ELECTRICAL SITE PLANS FOR LOCATIONS AND SPECIFICATION 17510 FOR CONSTRUCTION REQUIREMENTS.
13. NOT ALL MAINS ENCLOSURES REQUIRE A SCE METER, AND SOME SITES DO NOT REQUIRE A MAINS ENCLOSURE. SEE ELECTRICAL SITE PLANS FOR DETAILS.

SINGLE CABINET CONTROL PANEL BILL OF MATERIALS

ITEM	QTY	MANUFACTURER	PART NUMBER	DESCRIPTION
1	1	HOFFMAN	A-72H3724FS3PT	FREE STANDING NEMA 4 ENCLOSURE. NOTE 12
2	1	HOFFMAN		BACK PANEL 72" H x 36" W
3				NOT USED
4	1	HOFFMAN	TEP6 WITH AVK66SS AND T10S3R	EXHAUST GRILLE PACKAGE WITH LOUVER PLATE KIT, FILTER. SEE CONSTRUCTION NOTE 10.
5	1	HOFFMAN	TFP61 WITH AVK66SS AND T10S3R	COOLING FAN PACKAGE WITH LOUVER PLATE KIT, FILTER. SEE CONSTRUCTION NOTE 10.
6	1	HOFFMAN	A-LTDB1	LIGHT FIXTURE
7	1	HOFFMAN	A-TEMNO	TEMPERATURE CONTROL SWITCH
8				3-POINT LATCH KIT (INCLUDED IN ITEM 1)
9	1	HONEYWELL	1LS3	INTRUSION SWITCH
10	1	COOPER	U214MTBL	MAINS ENCLOSURE WITH 100A MAIN BREAKER, LOAD CENTER. SEE NOTES 6 AND 13.
11	1	SQUARE D	Q01-6L100GDS	LOAD CENTER – 6 CIRCUITS
12	2	SQUARE D	Q0115	15A CIRCUIT BREAKER FOR LOAD CENTER (SPARES)
13	4	SQUARE D	Q0120	20A CIRCUIT BREAKER FOR LOAD CENTER
14	AS REQ'D	PANDUIT	F2X2LG	2" WIRING DUCT
15	AS REQ'D	PANDUIT	C2LG	2" WIRING DUCT COVER
16	1	AGM	PTA4000-13	SIGNAL ISOLATOR (4-20 mA)
17	1	LEVITON	STANDARD	ALUMINUM BOX 2" x 4"
18	1	LEVITON	7899-GY	DUPLEX RECEPTACLE 20A WITH GFCI AND ALUMINUM PLATE
19	1	LEVITON	5262-I	DUPLEX RECEPTACLE 15A WITH ALUMINUM PLATE
20	1	SCHNEIDER	BMX-P34-2020	M340 PROGRAMMABLE LOGIC CONTROLLER
21	1	SCHNEIDER	BMX-CPS-2010	M340 POWER SUPPLY
22	1	SCHNEIDER	BMX-XBP-0400	M340 CHASSIS – 4 SLOT
23	1	SCHNEIDER	BMX-AMM-0600	AI/AO MODULE – 4 INPUTS, 2 OUTPUTS
24	1	SCHNEIDER	BMX-DDM-16025	DI/DO MODULE – 8 INPUTS, 8 OUTPUTS
25	2	SCHNEIDER	BMX-FTB-2010	I/O MODULE TERMINAL CONNECTOR
26	1	AGM	PTA4000-13	BATTERY VOLTS MONITOR
27	1		PER SPEC 17510	INDUSTRIAL BOX PC
28	1	SPECTRUM	WEBPORT 2005	4-PORT VPN ROUTER
29	1	AIRLINK	PER SPEC 17510	CELLULAR MODEM
30	1	AIRLINK	RF15NSMA	RF CABLE (LENGTH AS REQ'D)
31	1	AIRLINK	120-110-2107	CELLULAR ANTENNA (PANEL TOP MOUNT)
32	1	AIRLINK	(NO PART NUMBER)	SMA CONNECTOR
33	1	BELDEN		CAT-6 CABLE PC TO ROUTER WITH RJ45 CONNECTORS
34	1	BELDEN		CAT-6 CABLE ROUTER TO MODEM WITH RJ45 CONNECTORS
35	1	BELDEN		CAT-6 CABLE PLC TO ROUTER WITH RJ45 CONNECTORS
36	AS REQ'D	WEIDMULLER	0330800000	DIN RAIL
37	AS REQ'D	WEIDMULLER	0380560000	TERMINALS FOR DIN RAIL
38	AS REQ'D	WEIDMULLER	0117960000	TERMINALS END PLATE
39	AS REQ'D	WEIDMULLER	0474560000	FUSED TERMINALS
40	AS REQ'D	WEIDMULLER	0380360000	FUSED TERMINALS END PLATE
41	AS REQ'D	WEIDMULLER	0383560000	TERMINALS END BRACKET
42	AS REQ'D	WEIDMULLER	4734600I/ 4734600S1	TERMINALS MARKING TAGS
43	1		PER SPEC 17510	120VAC/24 VDC BATTERY BACKUP UNIT
44	1		PER SPEC 17510	24 VDC POWER SUPPLY
45	5	IDEC	RR2P-UL-DC24V	RELAY – CR1, CR2, CR3, CR4, CR5
46	5	IDEC	SR2P-06	RELAY BASE
47	AS REQ'D	BELDEN		CONTROL CABLE, 16 AWG, MTW
48	AS REQ'D	BELDEN		CONTROL CABLE, 14 AWG, MTW
49	AS REQ'D	BELDEN		CABLE, 18 AWG, TWISTED SHIELDED PAIR
50	AS REQ'D	BUSSMAN	GMA500MA	FUSE, 500 mA
51	AS REQ'D	BUSSMAN	GMA2A	FUSE, 2 A
52	AS REQ'D	WEIDMULLER		MINIATURE CB, 1 A
53	AS REQ'D	WEIDMULLER		MINIATURE CB, 3 A
54	AS REQ'D	WEIDMULLER		MINIATURE CB, 5 A
55	1	WELAND	WB.700.120	SURGE PROTECTOR
56	1	P&B	KRP-14AG-120	RELAY – RL1
57	1	P&B	27E892	RELAY BASE – RL1
58	2		PER SPEC 17510	UPS BATTERY
59	1	COOPER	4418FNK	4" x 4" x 18" WIREWAY WITH END CAPS
60	1	HOFFMAN AND WEIDMULLER	A-6R64, PADLOCKABLE	NEMA 4 BOX, 6"x6"x4", TERMINAL BLOCKS WITH END PLATES. SEE DETAIL 4 THIS SHEET.
61	AS REQ'D			1" CONDUIT AND FITTINGS FROM METER ENCLOSURE
62	1		PER SPEC 17510	INVERTER

The discharger may request a single or double cabinet. The double cabinet will allow the discharger to place communications or other equipment in one side. No equipment may be mounted on the Calleguas cabinet.



PURVEYOR BOX DETAIL

DETAIL 4
SCALE: NONE

If a single cabinet is installed, then this connection will be mounted to the outside of the cabinet. If the discharger requests a double cabinet, then it will be mounted inside the discharger half of the cabinet.

Discharge Limits
Important Considerations

- Each individual discharge must always be at or below the limitations in the NPDES permit.
- When testing a potential discharge for compliance with the discharge limits, please note the very low concentrations.
  - Special lab methods are needed.
  - Seek advice from a water quality expert.

Discharge Limits
Important Considerations

- Please note that the frequency of monitoring often **<u>does not</u>** correlate with the time intervals of the discharge limits. For example, many constituents have instantaneous and daily maxima, but the most frequent monitoring is performed monthly.
- The discharge must meet the standard for the time interval actually monitored. In many cases, that means the discharge must meet the more stringent monthly or 6-month discharge limit rather than the less stringent weekly, daily, or instantaneous limit.

Discharge Limits
Important Considerations

- The concentration-based limits contained in the permit are on the following pages. (There are also mass-based limitations.)
- Constituents with asterisks are defined in the Monitoring Requirements section.

Discharge Limits

Constituent	Units	Instantaneous Maximum	Median of 1 Tidal Cycle
Temperature	°F	Receiving Water + 20°	Receiving Water + 4°

Constituent	Units	Minimum	Maximum
pH	pH units	6.0	9.0

Discharge Limits

Constituent	Units	Average Monthly	Average Weekly	Daily Maximum	Instantaneous Maximum	6-Month Median
BOD (5-day @ 20° C)	mg/L	30	45	--	--	--
Oil and Grease	mg/L	25	40	--	75	--
Settleable Solids	mL/L	1.0	1.5	--	3.0	--
Total Suspended Solids	mg/L	60	--	--	--	--
Turbidity	NTU	75	100	--	225	--
Total Residual Chlorine	µg/L	--	--	580	4,400	150
Ammonia (as N)	µg/L	--	--	180,000	440,000	44,000
Chronic Toxicity	P/F % Effect	Pass	--	Pass or % Effect < 50	--	--

Discharge Limits

Constituent	Units	Geometric Mean	Single Sample Maximum
Total coliform	MPN / 100 mL	1,000	10,000; 1,000 if fecal/total ratio exceeds 0.1
Fecal coliform	MPN / 100 mL	200	400
Enterococcus	MPN / 100 mL	35	104

Discharge Limits

Constituent	Units	Average Monthly	Average Weekly	Daily Maximum	Instantaneous Maximum	6-Month Median
Antimony (Total Recoverable)	µg/L	88,000	--	--	--	--
Arsenic (Total Recoverable)	µg/L	--	--	2,100	5,600	370
Beryllium (Total Recoverable)	µg/L	2.4	--	--	--	--
Cadmium (Total Recoverable)	µg/L	--	--	290	730	73
Chromium III (Total Recoverable)	µg/L	1.4E+07	--	--	--	--
Chromium VI (Total Recoverable)	µg/L	--	--	580	1,500	150
Copper (Total Recoverable)	µg/L	--	--	730	2,000	75
Lead (Total Recoverable)	µg/L	--	--	580	1,500	150
Mercury (Total Recoverable)	µg/L	--	--	12	29	2.9
Nickel (Total Recoverable)	µg/L	--	--	1,500	3,700	370
Selenium (Total Recoverable)	µg/L	--	--	4,400	11,000	1,100

Discharge Limits

Constituent	Units	Average Monthly	Average Weekly	Daily Maximum	Instantaneous Maximum	6-Month Median
Silver (Total Recoverable)	µg/L	--	--	190	500	40
Thallium (Total Recoverable)	µg/L	150	--	--	--	--
Zinc (Total Recoverable)	µg/L	--	--	5,300	14,000	880
Cyanide	µg/L	--	--	290	730	73
Non-chlorinated Phenolic Compounds*	µg/L	--	--	8,800	22,000	2,200
Chlorinated Phenolics*	µg/L	--	--	290	730	73
TCDD Equivalents*	µg/L	2.8E-07	--	--	--	--
Acrolein	µg/L	16,000	--	--	--	--
Acrylonitrile	µg/L	7.3	--	--	--	--
Benzene	µg/L	430	--	--	--	--
Carbon Tetrachloride	µg/L	66	--	--	--	--

Discharge Limits

Constituent	Units	Average Monthly	Average Weekly	Daily Maximum	Instantaneous Maximum	6-Month Median
Chlorobenzene	µg/L	42,000	--	--	--	--
Chlorodibromomethane	µg/L	630	--	--	--	--
Chloroform	µg/L	9,500	--	--	--	--
Dichlorobromomethane	µg/L	450	--	--	--	--
1,2-Dichloroethane	µg/L	2,000	--	--	--	--
1,1-Dichloroethylene	µg/L	66	--	--	--	--
1,3-Dichloropropylene	µg/L	650	--	--	--	--
Ethylbenzene	µg/L	3.0E+5	--	--	--	--
Halomethanes*	µg/L	9,500	--	--	--	--
Dichloromethane	µg/L	33,000	--	--	--	--
1,1,2,2-Tetrachloroethane	µg/L	170	--	--	--	--

Discharge Limits

Constituent	Units	Average Monthly	Average Weekly	Daily Maximum	Instantaneous Maximum	6-Month Median
Tetrachloroethylene	µg/L	150	--	--	--	--
Toluene	µg/L	6.2E+06	--	--	--	--
1,1,1-Trichloroethane	µg/L	3.9E+07	--	--	--	--
1,1,2-Trichloroethane	µg/L	690	--	--	--	--
Trichloroethylene	µg/L	2,000	--	--	--	--
Vinyl Chloride	µg/L	2,600	--	--	--	--
4,6-dinitro-2-methylphenol	µg/L	16,000	--	--	--	--
2,4-Dinitrophenol	µg/L	290	--	--	--	--
2,4,6-Trichlorophenol	µg/L	21	--	--	--	--
Benzidine	µg/L	0.0050	--	--	--	--
PAH*	µg/L	0.64	--	--	--	--
Bis(2-Chloroethoxy)Methane	µg/L	320	--	--	--	--

Discharge Limits

Constituent	Units	Average Monthly	Average Weekly	Daily Maximum	Instantaneous Maximum	6-Month Median
Bis(2-Chloroethyl)Ether	µg/L	3.3	--	--	--	--
Bis(2-chloroisopropyl)Ether	µg/L	88,000	--	--	--	--
Bis(2-Ethylhexyl)Phthalate	µg/L	260	--	--	--	--
Dichlorobenzenes	µg/L	3.7E+05	--	--	--	--
1,4-Dichlorobenzene	µg/L	1,300	--	--	--	--
3,3'-Dichlorobenzidine	µg/L	0.59	--	--	--	--
Diethyl Phthalate	µg/L	2.4E+06	--	--	--	--
Dimethyl Phthalate	µg/L	6.0E+07	--	--	--	--
Di-n-Butyl Phthalate	µg/L	2.6E+05	--	--	--	--
2,4-Dinitrotoluene	µg/L	190	--	--	--	--
1,2-Diphenylhydrazine	µg/L	12	--	--	--	--
Fluoranthene	µg/L	1,100	--	--	--	--

Discharge Limits

Constituent	Units	Average Monthly	Average Weekly	Daily Maximum	Instantaneous Maximum	6-Month Median
Hexachlorobenzene	µg/L	0.015	--	--	--	--
Hexachlorobutadiene	µg/L	1,000	--	--	--	--
Hexachlorocyclopentadiene	µg/L	4,200	--	--	--	--
Hexachloroethane	µg/L	180	--	--	--	--
Isophorone	µg/L	53,000	--	--	--	--
Nitrobenzene	µg/L	360	--	--	--	--
N-Nitrosodimethylamine	µg/L	530	--	--	--	--
N-Nitrosodi-N-Propylamine	µg/L	28	--	--	--	--
N-Nitrosodiphenylamine	µg/L	180	--	--	--	--
Aldrin	µg/L	0.0016	--	--	--	--
HCH*	µg/L	--	--	0.58	0.88	0.29
Chlordane	µg/L	0.0017	--	--	--	--

Discharge Limits

Constituent	Units	Average Monthly	Average Weekly	Daily Maximum	Instantaneous Maximum	6-Month Median
DDT*	µg/L	0.012	--	--	--	--
Dieldrin	µg/L	0.0029	--	--	--	--
Endosulfan	µg/L	--	--	1.3	2.0	0.66
Endrin	µg/L	--	--	0.29	0.44	0.15
Heptachlor	µg/L	0.0037	--	--	--	--
Heptachlor Epoxide	µg/L	0.0015	--	--	--	--
PCBs*	µg/L	0.0014	--	--	--	--
Toxaphene	µg/L	0.015	--	--	--	--
Tributyltin	µg/L	0.10	--	--	--	--

Triggers

Constituent	Units	Average Monthly	Average Weekly	Daily Maximum	Instantaneous Maximum	6-Month Median
Gross alpha	pCi/L	--	--	15	--	--
Gross beta	pCi/L	--	--	50	--	--
Combined Radium-226 & Radium-228	pCi/L	--	--	5.0	--	--
Tritium	pCi/L	--	--	20,000	--	--
Strontium-90	pCi/L	--	--	8.0	--	--
Uranium	pCi/L	--	--	20	--	--

Note that these are not limits. They are triggers for additional monitoring.

Monitoring Requirements Important Considerations

- Note that there are constituents that must be monitored that do not have a discharge limit.
- The method listed is the most common method used to meet the required minimum levels. Other methods that are approved under 40 CFR 136.3, 136.4, and 136.5 may be used.
- Note that high concentration brines can have interference issues and the analytical laboratory must ensure the method is appropriate for the discharge characteristics.

Monitoring Requirements Important Considerations

- All samples are grab samples.
- The Minimum Level represents the most stringent minimum level for the constituent. The analytical method chosen should be able to achieve this minimum level. If the constituent does not have a minimum level listed, the selected analysis method minimum level should be lower than the discharge limit.

Monitoring Requirements Monthly

Constituent	Units	Method	Min. Level
Temperature	°F	Field probe	N/A
pH	pH units	Field probe	N/A
Total coliform	MPN/100 mL	SM 9221B	N/A
Fecal coliform	MPN/100 mL	SM 9221E	N/A
Enterococcus	MPN/100 mL	SM 9230B	N/A
Dissolved Oxygen	mg/L	Field probe	N/A
Ammonia (as N)	µg/L	SM 4500-NH3 F	N/A
Total Residual Chlorine	µg/L	Field probe	N/A

Monitoring Requirements Monthly

Constituent	Units	Method	Min. Level
Chronic Toxicity	P/F or % Effect	TST	N/A
Antimony (Total Recoverable)	µg/L	EPA 1640 or 200.8	0.5
Arsenic (Total Recoverable)	µg/L	EPA 1640 or 200.8	1
Beryllium (Total Recoverable)	µg/L	EPA 1640 or 200.8	0.5
Cadmium (Total Recoverable)	µg/L	EPA 1640 or 200.8	0.2
Chromium III (Total Recoverable)	µg/L	Calculated	N/A
Chromium VI (Total Recoverable)	µg/L	EPA 218.6	5
Copper (Total Recoverable)	µg/L	EPA 1640 or 200.8	0.5
Lead (Total Recoverable)	µg/L	EPA 1640 or 200.8	0.5
Mercury (Total Recoverable)	µg/L	EPA 245.1	0.2
Nickel (Total Recoverable)	µg/L	EPA 1640 or 200.8	1
Selenium (Total Recoverable)	µg/L	EPA 1640 or 200.8	1

Monitoring Requirements Monthly

Constituent	Units	EPA Method	Min. Level
Silver (Total Recoverable)	µg/L	EPA 1640 or 200.8	0.2
Thallium (Total Recoverable)	µg/L	EPA 1640 or 200.8	1
Zinc (Total Recoverable)	µg/L	EPA 1640 or 200.8	1
Cyanide	µg/L	SM 4500 CN-E	5
Non-Chlorinated Phenolic Compounds[1]	µg/L	EPA 625	varies
Chlorinated Phenolics[2]	µg/L	EPA 625	varies
TCDD Equivalents[3]	µg/L	EPA 1613B	varies

[1] Non-Chlorinated phenolic compounds represent the sum of 2-nitrophenol; phenol; 2,4-dimethylphenol; 2,4-dinitrophenol; 2-methyl-4,6-dinitrophenol; and 4-nitrophenol.

[2] Chlorinated phenolic compounds represent the sum of 2-chlorophenol; 2,4-dichlorophenol; 2,4,6-trichlorophenol; 4-chloro-3-methylphenol; and pentachlorophenol.

[3] TCDD Equivalents are the sum of 2,3,7,8-tetra CDD; 2,3,7,8-penta CDD; 2,3,7,8-hexa CDDs; 2,3,7,8-hepta CDD; octa CDD, 2,3,7,8 tetra CDF; 1,2,3,7,8 penta CDF; 2,3,4,7,8 penta CDF; 2,3,7,8 hexa CDFs; 2,3,7,8 hepta CDFs; and octa CDF weighted by their toxicity equivalence factors in Attachment A to the permit.

Monitoring Requirements Monthly

Constituent	Units	Method	Min. Level
Acrolein	µg/L	EPA 624	2
Acrylonitrile	µg/L	EPA 624	2
Benzene	µg/L	EPA 624	0.5
Carbon Tetrachloride	µg/L	EPA 624	0.5
Chlorobenzene	µg/L	EPA 624	0.5
Chlorodibromomethane	µg/L	EPA 624	0.5
Chloroform	µg/L	EPA 624	0.5
Dichlorobromomethane	µg/L		
1,2-Dichloroethane	µg/L	EPA 624	0.5
1,1-Dichloroethylene	µg/L	EPA 624	0.5
1,3-Dichloropropylene	µg/L		
Ethylbenzene	µg/L	EPA 624	0.5

Monitoring Requirements Monthly

Constituent	Units	Method	Min. Level
Halomethanes[1]	µg/L	EPA 624	0.5
Dichloromethane	µg/L	EPA 624	0.5
1,1,2,2-Tetrachloroethane	µg/L	EPA 624	0.5
Tetrachloroethylene	µg/L	EPA 624	0.5
Toluene	µg/L	EPA 624	0.5
1,1,1-Trichloroethane	µg/L	EPA 625	0.5
1,1,2-Trichloroethane	µg/L	EPA 624	0.5
Trichloroethylene	µg/L	EPA 624	0.5
Vinyl Chloride	µg/L	EPA 624	0.5
4,6-Dinitro-2-Methylphenol	µg/L	EPA 625	5
2,4-Dinitrophenol	µg/L	EPA 625	5

[1] **Halomethanes** is sum of bromoform, bromomethane (methyl bromide), and chloromethane (methyl chloride).

Monitoring Requirements Monthly

Constituent	Units	Method	Min. Level
2,4,6-Trichlorophenol	µg/L	EPA 625	10
Benzidine	µg/L	EPA 625	5
PAH[1]	µg/L	EPA 625	2
Bis(2-Chloroethoxy)Methane	µg/L	EPA 625	5
Bis(2-Chloroethyl)Ether	µg/L	EPA 625	1
Bis(2-Chloroisopropyl)Ether	µg/L	EPA 625	2
Bis(2-Ethylhexyl)Phthalate	µg/L	EPA 625	5
Dichlorobenzenes	µg/L	EPA 624	1

[1] PAH is sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo(k)fluoranthene, 1,12-benzonperylene, benzo(a)pyrene, chrysene, dibenzo(ah)anthracene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene and pyrene.

Monitoring Requirements Monthly

Constituent	Units	EPA Method	Min. Level
1,4-Dichlorobenzene	µg/L	EPA 625	1
3,3'-Dichlorobenzidine	µg/L	EPA 625	5
Diethyl Phthalate	µg/L	EPA 625	2
Dimethyl Phthalate	µg/L	EPA 625	2
Di-n-butyl Phthalate	µg/L	EPA 625	10
2,4-Dinitrotoluene	µg/L	EPA 625	5
1,2-Diphenylhydrazine	µg/L	EPA 625	1
Fluoranthene	µg/L	EPA 625	0.05
Hexachlorobenzene	µg/L	EPA 625	1
Hexachlorobutadiene	µg/L	EPA 625	1
Hexachlorocyclopentadiene	µg/L	EPA 625	5
Hexachloroethane	µg/L	EPA 625	1

Monitoring Requirements
Monthly

Constituent	Units	Method	Min. Level
Isophorone	µg/L	EPA 624	1
Nitrobenzene	µg/L	EPA 625	1
N-Nitrosodimethylamine	µg/L	EPA 625	5
N-Nitrosodi-N-Propylamine	µg/L	EPA 625	5
N-Nitrosodiphenylamine	µg/L	EPA 625	1
Aldrin	µg/L	EPA 625 / 8270	0.005
HCH[1]	µg/L	EPA 608	0.005
Chlordane	µg/L	EPA 625 / 8270	0.1
DDT[2]	µg/L	EPA 625 / 8270	0.01

[1] HCH is sum of alpha, beta, gamma (lindane) and delta-HCH.

[2] DDT is the sum of 4,4'DDT; 2,4'DDT; 4,4'DDE; 2,4'DDE; 4,4'DDD; and 2,4',DDD.

Monitoring Requirements Monthly

Constituent	Units	EPA Method	Min. Level
Dieldrin	µg/L	EPA 625 / 8270	0.01
Endosulfan a	µg/L	EPA 625 / 8270	0.01
Endosulfan b	µg/L	EPA 625 / 8270	0.02
Endrin	µg/L	EPA 625 / 8270	0.01
Heptachlor	µg/L	EPA 625 / 8270	0.01
Heptachlor Epoxide	µg/L	EPA 625 / 8270	0.01
PCBs[1]	µg/L	EPA 608	0.5
Toxaphene	µg/L	EPA 608	0.5
Tributyltin	µg/L	EPA 282.3	N/A

[1] PCBs is sum of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, aroclor-1248, Aroclor-1254, and Aroclor-1260.

Monitoring Requirements Quarterly

Constituent	Units	Method	Min. Level
BOD (5-day @ 20° C)	mg/L	SM 5210B	N/A
Oil and Grease	mg/L	1664	N/A
Settleable Solids	mL/L	SM 2540F	N/A
Total Suspended Solids	mg/L	SM 2540D	N/A
Turbidity	NTU	180.1	N/A

Monitoring Requirements Semi-Annually

Constituent	Units	Method	Min. Level
Gross alpha	pCi/L	EPA 900.0	N/A
Gross beta	pCi/L	EPA 900.0	N/A
Combined Radium-226 & Radium-228	pCi/L	EPA 903.0/903.1 EPA 904.0	N/A
Tritium	pCi/L	EPA 906.0	N/A
Strontium-90	pCi/L	EPA 905.0	N/A
Uranium	pCi/L	EPA 908.0	N/A

Note: If the gross alpha and/or gross beta exceed the triggers, combined radium-226 and radium-228 will be analyzed. If the combined radium results are exceed the triggers, then tritium, strontium-90 and uranium analyses will be conducted.

For Additional Information

- Visit http://smp.calleguas.com for:
  - Ordinance 19 - An Ordinance of Calleguas Municipal Water District Covering the Rules and Regulations for Use of the Salinity Management Pipeline
  - NPDES Permit for the SMP Outfall
  - Example Discharge Agreement
  - Discharge Service Information Request Form

Questions?

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City of Simi Valley
Waterworks District No. 8

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