Revised June 13, 20192022

Paso Robles Subbasin Groundwater Sustainability Plan

Prepared for:

Paso Robles Subbasin Cooperative Committee and the Groundwater Sustainability Agencies

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ABBREVIATIONS AND ACRONYMS

$/AF	dollar per acre-foot
$/AF-benefit	dollar per acre-foot of basin benefit
Act (or SGMA)	Sustainable Groundwater Management Act
AF	acre-feet
AFY	acre-feet per year
AMWC	Atascadero Mutual Water Company
Basin Plan	Water Quality Control Plan for the Central Coast Basin
BPs	Best Water Use Practices
BMPs	Best Management Practices
C&E	Communications and Engagement
CASGEM	California Statewide Groundwater Elevation Monitoring
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CGPS	Continuous GPS
CIMIS	California Irrigation Management Information System
City	City of Paso Robles
Cooperative Committee	Paso Basin Cooperative Committee
County	San Luis Obispo County
CSA16	Community Service Area 16
CSD	Community Services District
CWWCP	Countywide Water Conservation Program
DAIv2	Data Archive Interface
DDW	Division of Drinking Water
DMS	Paso Robles Subbasin Data Management System
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ET (or ETo)	evapotranspiration
EVI	Enhanced Vegetation Index
ft/day	feet per day
ft^2/day	square feet per day
ft msl	feet above mean sea level
GAMA	Groundwater Ambient Monitoring and Assessment
GDE	Groundwater-Dependent Ecosystem
GMP	Groundwater Management Plan
gpd/ft	gallons per day per foot
gpm	gallons per minute
GSA	Groundwater Sustainability Agency
GSI	GSI Water Solutions, Inc.
GSP (or the Plan)	Groundwater Sustainability Plan

GSSI	Geoscience Support Services, Inc.
hp	horsepower
ILRP	Irrigated Lands Regulatory Program
InSAR	Interferometric Synthetic Aperture Radar
IRWMP	Integrated Regional Water Management Program
JPA	Joint Powers Authority
LID	Low Impact Development
LOS	Level of Severity
LUCE	Land Use and Circulation Element
MCL	Maximum Contaminant Limit (or Maximum Contaminant Levels)
MO	measurable objectives
MOA	Memorandum of Agreement
mg/L	milligram per liter
msl	mean sea level
MT	minimum thresholds
MWR	Master Water Report
NCCAG	Natural Communities Commonly Associated with Groundwater
NDMC	National Drought Mitigation Center
NHD	National Hydrology Dataset
NRCS	USGS National Resources Conservation Service
NWIS	National Water Information System
NWP	Nacimiento Water Project
O&M	operations and maintenance
OSWCR	DWR Online System for Well Completion Reports
pCi/L	picocuries per liter
PLSS	Public Land Survey System
PWIS	CA Water Boards Public Water Information System
RMS	Resource Management System or representative monitoring sites
RSR	Resource Summary Reports
RCS	Resource Capacity Studies
RW	recycled water
SAGBI	Soil Agricultural Groundwater Banking Index
SB	Senate Bill
SEP	Supplemental Environmental Project
SGMA (or Act)	Sustainable Groundwater Management Act
SGMA Regulations	CCR Subchapter 2. Groundwater Sustainability Plans
SLO County	San Luis Obispo County
SLOFCWCD	San Luis Obispo County Flood Control and Water Conservation District
SMC	Sustainable Management Criteria
SMCL	Secondary Maximum Contaminant Limit

SMCSD	San Miguel Community Services District
SNMP	Salt and Nutrient Management Plan
SPI	Standardized Precipitation Index
SSURGO	Soil Survey Geographic Database
Subbasin	Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWRP	San Luis Obispo Stormwater Resource Plan
TDS	total dissolved solids
TMDLs	Total Maximum Daily Load
UNAVCO	University NAVSTAR Consortium
USACE	United States Army Corps of Engineers
USGS	United States Geologic Survey
USDA	United States Department of Agriculture
UWMP	Urban Water Management Plan
Water Board	State Water Resources Control Board
WPA	Water Planning Areas
WRAC	Water Resources Advisory Committee
WY	Water Year

REGULATIONS CHECKLIST FOR GSP SUBMITTAL

GSP Regulations Section	Requirement	Description	Section Number, or other location as indicated in the GSP
Article 3. Technical and Reporting Standards			
352.2	Monitoring Protocols	Monitoring protocols adopted by the GSA for data collection and management	7.8
		Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin	Chapter 7, including Appendix F
Article 5. Plan Contents, Subarticle 1. Administrative Information			
354.4	General Information	Executive Summary	Executive Summary
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		Existing land use designations	Figure 3-4
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354.8(c) 354.8(d) 354.8(e)	Water Resource Monitoring and Management Programs	Description of water resources monitoring and management programs	3.6, 3.7, 3.8
		Description of how the monitoring networks of those plans will be incorporated into the GSP	3.9.1
		Description of how those plans may limit operational flexibility in the basin	3.9.2
		Description of conjunctive use programs	3.9.3, not applicable
354.8(f)	Land Use Elements or Topic Categories	Summary of general plans and other land use plans	3.10

	of Applicable General Plans	Description of how implementation of the GSP may change water demands or affect achievement of sustainability and how the GSP addresses those effects	3.10.4
		Description of how implementation of the GSP may affect the water supply assumptions of relevant land use plans	10.3, 10.4
		Summary of the process for permitting new or replacement wells in the basin	2.3.1.2 and 3.8.6
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		Replenishment of groundwater extractions	Not applicable
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		Public engagement	Appendix G
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		Map(s) of physical characteristics: topographic information, surficial geology, soil characteristics, surface water bodies, source and point of delivery for imported water supplies	Figures 4-1, 4-2, 4-3, 4-4, 4-19, 3-5
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354.30	Measurable Objectives	Description of establishment of the measurable objectives for each sustainability indicator	8.4.3, 8.5.3, 8.7.3, 8.8.3, 8.9.3
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		Scientific rational (or reason) for site selection	Chapter 7, including 7.2. through 7.6
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		Corresponding sustainability indicator, minimum threshold, measurable objective, and interim milestone	Chapter 7, including 7.2. through 7.6; Chapter 8 Tables 8-1 through 8-10

		Location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used Description of technical standards, data collection methods, and other procedures or protocols to ensure comparable data and methodologies	Chapter 7, including 7.2. through 7.6
354.36	Representative Monitoring	Description of representative sites	7.7
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		Expected benefits and how they will be evaluated	
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		Legal authority required	
		Estimated costs and plans to meet those costs	
		Management of groundwater extractions and recharge	
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Article 8. Interagency Agreements			
357.4	Coordination Agreements - Shall be submitted to the Department together with the GSPs for the basin and, if approved, shall become part of the GSP for each participating Agency.	Coordination Agreements shall describe the following: A point of contact	Not applicable
		Responsibilities of each Agency	
		Procedures for the timely exchange of information between Agencies	
		Procedures for resolving conflicts between Agencies	
		How the Agencies have used the same data and methodologies to coordinate GSPs	
		How the GSPs implemented together satisfy the requirements of SGMA	
		Process for submitting all Plans, Plan amendments, supporting information, all monitoring data and other pertinent information, along with annual reports and periodic evaluations	
		A coordinated data management system for the basin	
		Coordination agreements shall identify adjudicated areas within the basin, and any local agencies that have adopted an Alternative that has been accepted by the Department	

DEFINITIONS

California Water Code

Sec. 10721

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

(a) Adjudication action means an action filed in the superior or federal district court to determine the rights to extract groundwater from a basin or store water within a basin, including, but not limited to, actions to quiet title respecting rights to extract or store groundwater or an action brought to impose a physical solution on a basin.

(b) Basin means a groundwater basin or subbasin identified and defined in Bulletin 118 or as modified pursuant to Chapter 3 (commencing with Section 10722).

(c) Bulletin 118 means the department's report entitled California's Groundwater: Bulletin 118 updated in 2003, as it may be subsequently updated or revised in accordance with Section 12924.

(d) Coordination agreement means a legal agreement adopted between two or more groundwater sustainability agencies that provides the basis for coordinating multiple agencies or groundwater sustainability plans within a basin pursuant to this part.

(e) De minimis extractor means a person who extracts, for domestic purposes, two acre-feet or less per year.

(f) Governing body means the legislative body of a groundwater sustainability agency.

(g) Groundwater means water beneath the surface of the earth within the zone below the water table in which the soil is completely saturated with water, but does not include water that flows in known and definite channels.

(h) Groundwater extraction facility means a device or method for extracting groundwater from within a basin.

(i) Groundwater recharge or recharge means the augmentation of groundwater, by natural or artificial means.

(j) Groundwater sustainability agency means one or more local agencies that implement the provisions of this part. For purposes of imposing fees pursuant to Chapter 8 (commencing with Section 10730) or taking action to enforce a groundwater sustainability plan, groundwater sustainability agency also means each local agency comprising the groundwater sustainability agency if the plan authorizes separate agency action.

(k) Groundwater sustainability plan or plan means a plan of a groundwater sustainability agency proposed or adopted pursuant to this part.

(l) Groundwater sustainability program means a coordinated and ongoing activity undertaken to benefit a basin, pursuant to a groundwater sustainability plan.

(m) In-lieu use means the use of surface water by persons that could otherwise extract groundwater in order to leave groundwater in the basin.

(n) Local agency means a local public agency that has water supply, water management, or land use responsibilities within a groundwater basin.

(o) Operator means a person operating a groundwater extraction facility. The owner of a groundwater extraction facility shall be conclusively presumed to be the operator unless a satisfactory showing is made to the governing body of the groundwater sustainability agency that the groundwater extraction facility actually is operated by some other person.

(p) Owner means a person owning a groundwater extraction facility or an interest in a groundwater extraction facility other than a lien to secure the payment of a debt or other obligation.

(q) Personal information has the same meaning as defined in Section 1798.3 of the Civil Code.

(r) Planning and implementation horizon means a 50-year time period over which a groundwater sustainability agency determines that plans and measures will be implemented in a basin to ensure that the basin is operated within its sustainable yield.

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

(t) Recharge area means the area that supplies water to an aquifer in a groundwater basin.

(u) Sustainability goal means the existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield.

(v) Sustainable groundwater management means the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.

(w) Sustainable yield means the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus that can be withdrawn annually from a groundwater supply without causing an undesirable result.

(x) Undesirable result means one or more of the following effects caused by groundwater conditions occurring throughout the basin:

  (1) Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.

  (2) Significant and unreasonable reduction of groundwater storage.

  (3) Significant and unreasonable seawater intrusion.

  (4) Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.

  (5) Significant and unreasonable land subsidence that substantially interferes with surface land uses.

  (6) Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

(y) Water budget means an accounting of the total groundwater and surface water entering and leaving a basin including the changes in the amount of water stored.

(z) Watermaster means a watermaster appointed by a court or pursuant to other law.

(aa) Water year means the period from October 1 through the following September 30, inclusive.

(ab) Wellhead protection area means the surface and subsurface area surrounding a water well or well field that supplies a public water system through which contaminants are reasonably likely to migrate toward the water well or well field.

Official California Code of Regulations

Title 23. Waters
Division 2. Department of Water Resources
Chapter 1.5. Groundwater Management
Subchapter 2. Groundwater Sustainability Plans
Article 2. Definitions
23 CCR § 351
§ 351. Definitions.

The definitions in the Sustainable Groundwater Management Act, Bulletin 118, and Subchapter 1 of this Chapter, shall apply to these regulations. In the event of conflicting definitions, the definitions in the Act govern the meanings in this Subchapter. In addition, the following terms used in this Subchapter have the following meanings:

(a) "Agency" refers to a groundwater sustainability agency as defined in the Act.

(b) "Agricultural water management plan" refers to a plan adopted pursuant to the Agricultural Water Management Planning Act as described in Part 2.8 of Division 6 of the Water Code, commencing with Section 10800 et seq.

(c) "Alternative" refers to an alternative to a Plan described in Water Code Section 10733.6.

(d) "Annual report" refers to the report required by Water Code Section 10728.

(e) "Baseline" or "baseline conditions" refer to historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin.

(f) "Basin" means a groundwater basin or subbasin identified and defined in Bulletin 118 or as modified pursuant to Water Code 10722 et seq.

(g) "Basin setting" refers to the information about the physical setting, characteristics, and current conditions of the basin as described by the Agency in the hydrogeologic conceptual model, the groundwater conditions, and the water budget, pursuant to Subarticle 2 of Article 5.

(h) “Best available science” refers to the use of sufficient and credible information and data, specific to the decision being made and the time frame available for making that decision, that is consistent with scientific and engineering professional standards of practice.

(i) “Best management practice” refers to a practice, or combination of practices, that are designed to achieve sustainable groundwater management and have been determined to be technologically and economically effective, practicable, and based on best available science.

(j) “Board” refers to the State Water Resources Control Board.

(k) “CASGEM” refers to the California Statewide Groundwater Elevation Monitoring Program developed by the Department pursuant to Water Code Section 10920 et seq., or as amended.

(l) “Data gap” refers to a lack of information that significantly affects the understanding of the basin setting or evaluation of the efficacy of Plan implementation, and could limit the ability to assess whether a basin is being sustainably managed.

(m) “Groundwater dependent ecosystem” refers to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface.

(n) “Groundwater flow” refers to the volume and direction of groundwater movement into, out of, or throughout a basin.

(o) “Interconnected surface water” refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted.

(p) “Interested parties” refers to persons and entities on the list of interested persons established by the Agency pursuant to Water Code Section 10723.4.

(q) “Interim milestone” refers to a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan.

(r) “Management area” refers to an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors.

(s) “Measurable objectives” refer to specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin.

(t) “Minimum threshold” refers to a numeric value for each sustainability indicator used to define undesirable results.

(u) “NAD83” refers to the North American Datum of 1983 computed by the National Geodetic Survey, or as modified.

(v) “NAVD88” refers to the North American Vertical Datum of 1988 computed by the National Geodetic Survey, or as modified.

(w) “Plain language” means language that the intended audience can readily understand and use because that language is concise, well-organized, uses simple vocabulary, avoids excessive acronyms and technical language, and follows other best practices of plain language writing.

(x) “Plan” refers to a groundwater sustainability plan as defined in the Act.

(y) “Plan implementation” refers to an Agency's exercise of the powers and authorities described in the Act, which commences after an Agency adopts and submits a Plan or Alternative to the Department and begins exercising such powers and authorities.

(z) “Plan manager” is an employee or authorized representative of an Agency, or Agencies, appointed through a coordination agreement or other agreement, who has been delegated management authority for submitting the Plan and serving as the point of contact between the Agency and the Department.

(aa) “Principal aquifers” refer to aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems.

(ab) “Reference point” refers to a permanent, stationary and readily identifiable mark or point on a well, such as the top of casing, from which groundwater level measurements are taken, or other monitoring site.

(ac) “Representative monitoring” refers to a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin.

(ad) “Seasonal high” refers to the highest annual static groundwater elevation that is typically measured in the Spring and associated with stable aquifer conditions following a period of lowest annual groundwater demand.

(ae) “Seasonal low” refers to the lowest annual static groundwater elevation that is typically measured in the Summer or Fall, and associated with a period of stable aquifer conditions following a period of highest annual groundwater demand.

(af) “Seawater intrusion” refers to the advancement of seawater into a groundwater supply that results in degradation of water quality in the basin, and includes seawater from any source.

(ag) “Statutory deadline” refers to the date by which an Agency must be managing a basin pursuant to an adopted Plan, as described in Water Code Sections 10720.7 or 10722.4.

(ah) “Sustainability indicator” refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results, as described in Water Code Section 10721(x).

(ai) “Uncertainty” refers to a lack of understanding of the basin setting that significantly affects an Agency's ability to develop sustainable management criteria and appropriate projects and management actions in a Plan, or to evaluate the efficacy of Plan implementation, and therefore may limit the ability to assess whether a basin is being sustainably managed.

(aj) “Urban water management plan” refers to a plan adopted pursuant to the Urban Water Management Planning Act as described in Part 2.6 of Division 6 of the Water Code, commencing with Section 10610 et seq.

(ak) “Water source type” represents the source from which water is derived to meet the applied beneficial uses, including groundwater, recycled water, reused water, and surface water sources identified as Central Valley Project, the State Water Project, the Colorado River Project, local supplies, and local imported supplies.

(al) “Water use sector” refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.

(am) “Water year” refers to the period from October 1 through the following September 30, inclusive, as defined in the Act.

(an) “Water year type” refers to the classification provided by the Department to assess the amount of annual precipitation in a basin.

ES EXECUTIVE SUMMARY

This Groundwater Sustainability Plan (GSP) fulfills the requirements of the Sustainable Groundwater Management Act (SGMA) for the Paso Robles Subbasin of the Salinas Valley Basin. The sustainability goal of this GSP is to sustainably manage the groundwater resources of the Paso Robles Subbasin for long-term community, financial, and environmental benefit of Subbasin users. This GSP outlines the approach to achieve a sustainable groundwater resource free of undesirable results within 20 years, while maintaining the unique cultural, community, and business aspects of the Subbasin. In adopting this GSP, it is the express goal of the GSAs to balance the needs of all groundwater users in the Subbasin, within the sustainable limits of the Subbasin's resources. The GSP describes the Paso Robles Subbasin, develops quantifiable management objectives that consider the interests of the Subbasin's beneficial groundwater uses and users, and identifies management actions and conceptual projects that will allow the Subbasin to achieve sustainability by 2040. This GSP covers the entire Paso Robles Subbasin. The Paso Robles Subbasin GSP has been jointly developed by four Groundwater Sustainability Agencies (GSAs):

- City of Paso Robles GSA
- Paso Basin - County of San Luis Obispo GSA
- San Miguel Community Services District (CSD) GSA
- Shandon - San Juan GSA

Submitted to the California Department of Water Resources (DWR) in January 2021, the first version of this GSP was reviewed by DWR in January 2022 and determined to be incomplete (DWR, 2022). Corrective actions were provided by DWR for two identified deficiencies; these corrective actions are incorporated into this June 13, 2022 GSP for resubmittal to DWR.

ES-1 Plan Area

The Paso Robles Subbasin lies completely within San Luis Obispo County. The Subbasin is bounded by two groundwater basins and two subbasins, as shown on Figure ES-1~~Figure ES-1~~. The Subbasin includes the incorporated City of Paso Robles. The Subbasin additionally includes the unincorporated census-designated places of Shandon, San Miguel, Creston, Cholame, and Whitley Gardens.

The Subbasin is drained by the Salinas River. Primary tributaries to the Salinas River include the Estrella River, Huer Huero Creek, and San Juan Creek. Highway 101 is the most significant north-south highway in the Subbasin, with Highways 41 and 46 running east-west across the Subbasin.

The Subbasin currently has two water source types: groundwater and imported surface water. Until 2015, all water demands in the Subbasin were met with groundwater. Water demands in the Basin are organized into the six water use sectors identified in the SGMA Regulations. Agriculture is the largest water use sector as measured by water use. Native vegetation is the largest water use sector as measured by land area.

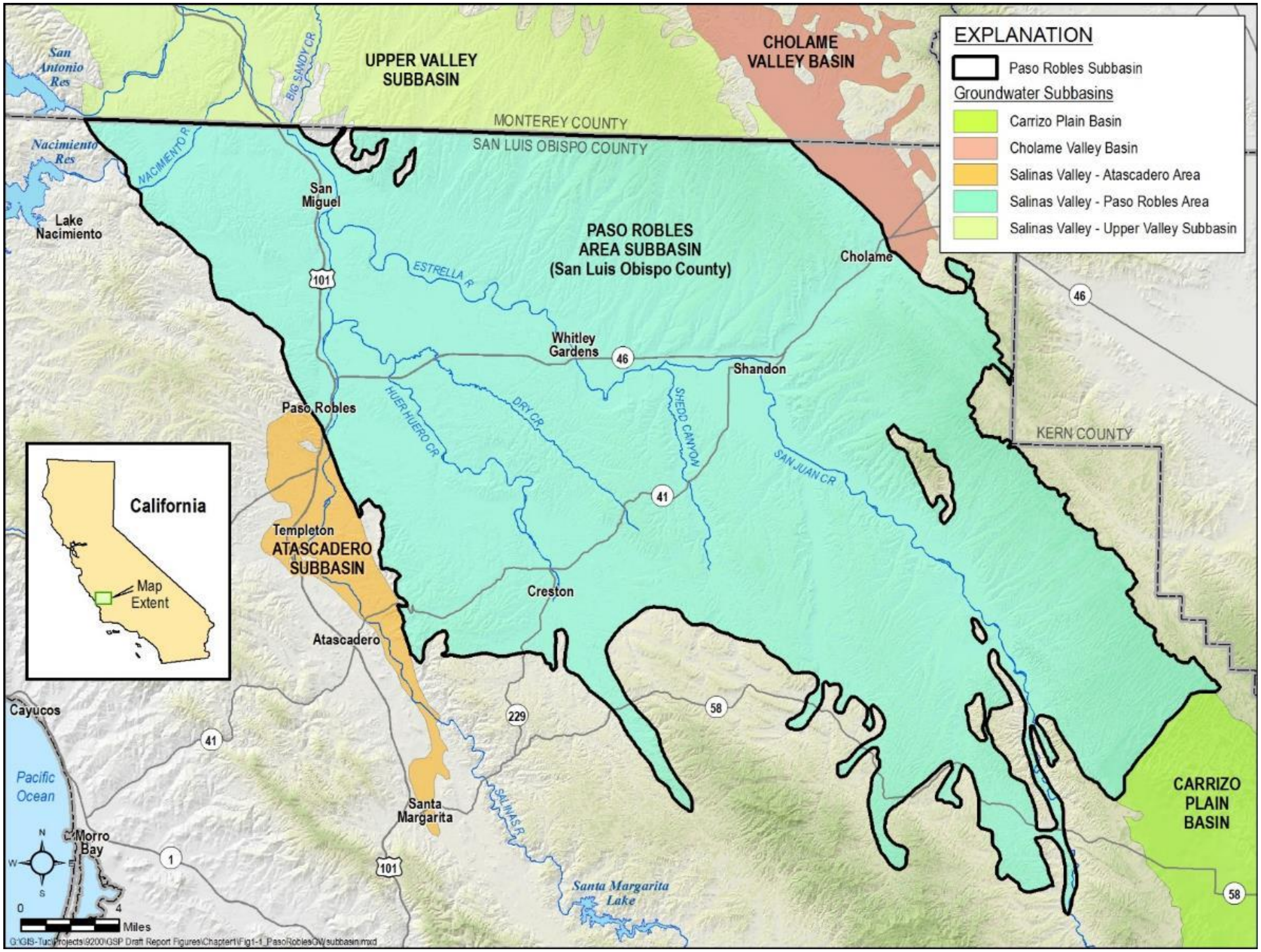


Figure ES-1: Paso Robles Subbasin Location

ES-2 Stakeholder Outreach

A stakeholder outreach and engagement strategy was developed to consider the concerns and ideas of a broad cross-section of stakeholders in the Subbasin. The stakeholder outreach strategy is detailed in Chapter 11 – Notice and Communication and Appendix F – Communications and Engagement (C&E) Plan.

Outreach and communication throughout GSP development included regular presentations at Cooperative Committee meetings, meetings with community groups, meetings with individual stakeholders, and community meetings. Comments from stakeholders were collected with a computerized system, and each GSA reviewed and considered the comments from their stakeholders. ~~To date~~As of November 2019, over 190 comments ~~have been~~were received and reviewed by the GSAs.

ES-3 Subbasin Geology and Hydrogeology

Two mapped geologic formations constitute the primary water bearing formations in the Subbasin: the Quaternary Alluvium bordering streams and rivers, and the Plio-Pleistocene Paso Robles Formation. The Alluvium is typically no more than 100 feet thick and comprises coarse sand and gravel with some fine-grained deposits. The Alluvium is generally coarser than the Paso Robles Formation, with higher permeability. Well production capacities often exceed 1,000 gallons per minute (gpm) from the Alluvium. The Paso Robles Formation constitutes most of the Subbasin, with depths up to 3,000 feet thick in some places. This formation comprises relatively thin, often discontinuous sand and gravel layers interbedded with thicker layers of silt and clay. The formation is typically unconsolidated and generally poorly sorted. The sand and gravel beds in the Paso Robles Formation have lower permeability compared to the overlying Alluvium. These two geologic formations constitute the two principal aquifers in the Subbasin. Underlying and surrounding the Subbasin are various geologic formations including Tertiary-age or older consolidated sedimentary beds, Cretaceous-age metamorphic rocks, and granitic rock.

ES-4 Existing Groundwater Conditions

Groundwater elevations in some portions of the Subbasin have been declining for many years, while groundwater elevations in other areas of the Subbasin have remained relatively stable.

ES- 4.1 Groundwater Flow Conditions

Groundwater elevations in the Alluvial Aquifer range from an elevation of approximately 1,400 feet above mean sea level (NAVD88) in the southeastern portion of the Subbasin to an elevation of approximately 600 feet above mean sea level near San Miguel. Groundwater flow generally follows the alignment of the creeks and rivers. The average horizontal hydraulic gradient in the Alluvial Aquifer is about 0.004 ft/ft from the southeastern portion of the Subbasin to San Miguel.

Groundwater elevations in the Paso Robles Formation Aquifer range from about 1,300 feet above mean sea level in the southeast portion of the Subbasin to about 550 feet above mean sea level near the City of Paso Robles and the town of San Miguel. Groundwater flow direction is generally to the northwest and west over most of the Subbasin, except in the area north of Paso Robles where groundwater flow is to the northeast. Groundwater flow in the western portion of the Paso Robles Formation Aquifer converges towards pumping depressions. Groundwater gradients range from approximately 0.003 ft/ft in the southeast portion of the Subbasin to approximately 0.01 ft/ft in the areas both southeast of Paso Robles and northwest of Whitley Gardens.

ES- 4.2 Groundwater Storage

Groundwater model results for a simulation period 1981 through 2011 indicate that approximately 369,000 AF were lost from storage in the Paso Robles Formation Aquifer.

ES- 4.3 Subsidence

Three years of recent Interferometric Synthetic Aperture Radar (InSAR) data provided by the California Department of Water Resources (DWR) suggests that there was only a minor amount of historical subsidence in small areas of the Subbasin over this period. Pumping induced subsidence is not a major concern for the Subbasin. Under this GSP, the GSAs will monitor subsidence annually using DWR's InSAR data.

ES- 4.4 ~~Interconnected Surface Water and~~ Groundwater Recharge and Discharge Areas

~~There are no available data that establish whether or not the groundwater and surface water are connected through a continuous saturated zone in any aquifer. The potential for interconnected surface water and groundwater in the Subbasin will be assessed during GSP implementation.~~

Multiple methodologies have been used to identify areas of potential groundwater discharge including springs and seeps, groundwater discharge to surface water bodies, and ET by phreatophytes.

ES- 4.5 Groundwater Quality

Groundwater quality in the Subbasin is generally suitable for both municipal and agricultural uses. The most common drinking water quality standard exceedance in the Subbasin is Total Dissolved Solids (TDS). The second most common drinking water quality standard exceedance in the Subbasin is nitrate. No mapped groundwater contamination plumes from point sources exist in the Subbasin. Some historical groundwater samples from the Subbasin suggest slight to moderate restriction on irrigation use due to sodium or chloride toxicity.

ES-5 Water Budgets

Water budgets for the Paso Robles Subbasin were estimated using an integrated set of three models including a watershed model, a soil balance model, and a groundwater model. Water budgets were developed for historical, current, and future conditions. The future conditions modeled included climate change based on the approach developed by DWR. Both surface water and groundwater budgets were developed for all three time periods.

Historical and current groundwater budgets indicate a persistent groundwater storage decline in the Subbasin in the Paso Robles Formation Aquifer. Similarly, the future groundwater budget suggests continued groundwater storage decline if current water use practices continue. Historical, current, and projected sustainable yields were estimated based on the difference between current pumping practices and calculated groundwater storage deficits. While these calculated sustainable yields are a reasonable estimate of the long-term pumping that can be maintained without producing undesirable results, the definitive sustainable yield can only be determined once data show undesirable results have not occurred. Table ES-1~~Table ES-1~~ presents the general components of the three groundwater budgets, along with estimates of the historical, current, and projected sustainable yield.

The sustainable yield for the current water budget period is substantially lower than the historical and future water budgets. The reason for this lower value is because the current water budget corresponds to a drought period. In contrast, the historical water budget corresponds to a long period of representative hydrology and the future water budget was projected using an estimate of reasonable future hydrology based on historical conditions. Because the current water budget corresponds to drought conditions, it is not indicative of average long-term sustainable yield and it should not be used for sustainability planning.

Table ES-1: Historical, Current, and Future Groundwater Budget Components (in acre-feet per year)

Groundwater Inflow Component	Historical	Current	Future
Streamflow Percolation	26,900	2,700	28,800
Agricultural Irrigation Return Flow	17,800	13,100	14,500
Deep Percolation of Direct Precipitation	12,000	1,400	12,600
Subsurface Inflow into Subbasin	10,100	4,900	8,300
Wastewater Pond Percolation	3,400	4,700	3,500
Urban Irrigation Return Flow	1,200	2,100	1,800
Total	71,400	28,900	69,500
Groundwater Outflow Component	**Historical**	**Current**	**Future**
Total Groundwater Pumping	72,400	85,800	74,800
Discharge to Streams and Rivers from Alluvial Aquifer	7,300	4,300	4,600
Groundwater Flow Out of Subbasin	2,600	2,500	2,100
Riparian Evapotranspiration	1,700	1,700	1,700
Total	84,000	94,300	83,200
Sustainable Yield Estimate	**Historical**	**Current**	**Future**
	59,800	20,400	61,100

ES-6 Monitoring Networks

Achieving sustainability will be demonstrated in the data collected from monitoring networks over the GSP implementation horizon. Monitoring networks are developed for ~~four of~~ the five applicable sustainability indicators in the Subbasin. Seawater intrusion is not applicable in ~~the Paso Robles this Subbasin. While conceptually applicable, a monitoring network for the depletion of interconnected surface waters was not developed for the GSP, but will be developed in the future if new data indicate an interconnection exists~~this Subbasin.

All monitoring networks presented in the GSP are based on existing monitoring sites. The monitoring networks are limited to locations with data that are publicly available and not collected under confidentiality agreements. It will be necessary after GSP adoption to expand the existing monitoring networks sites to fully demonstrate sustainability, refine the hydrogeologic conceptual model, and improve the GSP model. The monitoring networks are designed to accomplish the following:

- Demonstrate progress toward achieving measurable objectives described in the GSP
- Identify impacts to the beneficial uses and users of groundwater
- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds

- Quantify annual changes in water budget components

~~There~~As of 2019 there are currently 23 wells in the groundwater elevation monitoring network, 22 wells in the Paso Robles Formation Aquifer and one new well owned by the City of Paso Robles in the Alluvial Aquifer. An additional nine potential future monitoring wells that have publicly available data were also identified, but the aquifer in which they are screened is unknown. These nine wells will be added to the monitoring network after the well completion information has been verified and they have been assigned to the appropriate aquifer. The locations of the groundwater elevation monitoring wells are shown on Figure ES-2~~Figure ES-2~~.

This GSP adopts groundwater elevations as a proxy for estimating change in groundwater storage. The groundwater elevation monitoring wells shown on Figure ES-2~~Figure ES-2~~, will also be used to monitor change in groundwater storage.

This GSP identifies existing groundwater elevation monitoring wells for monitoring of interconnected surface water with recommendations for additional sites. In addition, new stream gages have been installed since the beginning of the GSP development process.

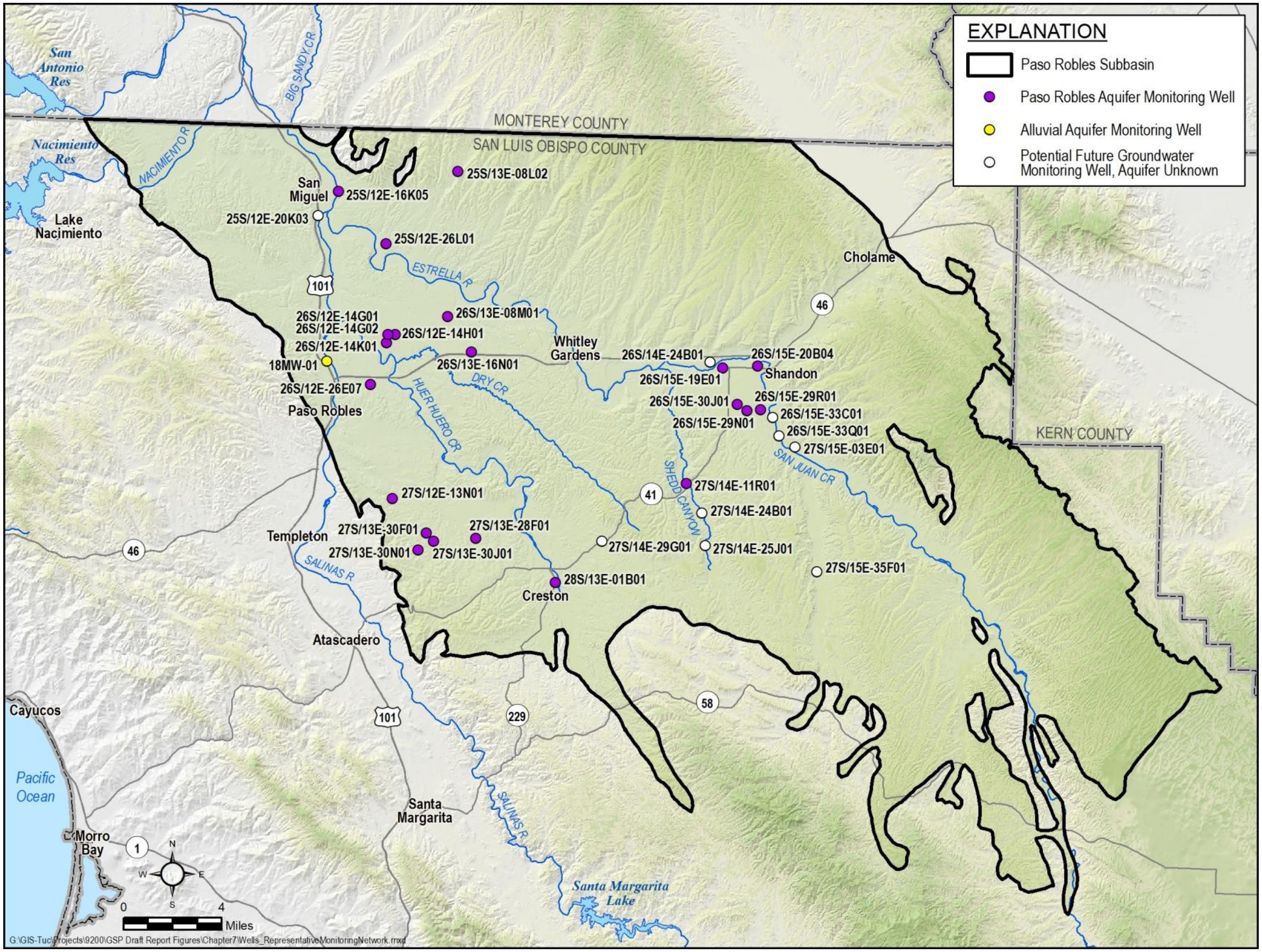


Figure ES-2: Groundwater Elevation Monitoring Well Locations

Degradation of groundwater quality is measured using existing wells. In particular, this GSP leverages groundwater quality data reported to the State Division of Drinking Water and groundwater quality data gathered as part of the State's Irrigated Lands Regulatory Program (ILRP). These two data sources provide a geographically extensive and complete network of wells to monitor groundwater quality in the Subbasin.

Land subsidence is monitored in the Subbasin with InSAR data provided by DWR. These data cover the years 2015 to 2018, and are adequate to identify areas of recent subsidence. One or more GSA may opt to contract with USGS or others with expertise in subsidence to gather any additional datasets and evaluate the cause(s) of any identified subsidence. The GSAs will continue to annually assess subsidence using the DWR provided InSAR data.

ES-7 Sustainable Management Criteria

Sustainable Management Criteria are the metrics by which sustainability is measured. Sustainable management criteria, including significant and unreasonable conditions, minimum thresholds, measurable objectives, and undesirable results, are established for ~~four of~~ the five applicable sustainability indicators in the Subbasin. Seawater intrusion is not applicable to this Subbasin. ~~Because data are insufficient to determine if surface water and groundwater are interconnected, sustainable management criteria were not established for the depletion of interconnected surface water sustainability indicator.~~

Sustainable management criteria were developed with considerable public input and review, including:

- Holding a series of public outreach meetings.
- Surveying the public and gathering input on minimum thresholds and measurable objectives.
- Analyzing survey results to assess preferences and trends relevant to Sustainable Management Criteria.
- Combining survey results, outreach efforts, and hydrogeologic data to set initial conceptual minimum thresholds and measurable objectives.
- Conducting public meetings to present initial Sustainable Management Criteria and solicit additional public input.
- Reviewing public input on preliminary Sustainable Management Criteria with the GSAs.
- Modifying criteria based on public input and GSA recommendations.

The groundwater elevation measurable objective for each representative monitoring site in the monitoring network was set to the well's average 2017 groundwater elevation. The groundwater elevation minimum thresholds for each monitoring well were set to an elevation 30 feet below the measurable objective. Analysis of historical groundwater elevation data suggested that 30 feet allows for reasonable operational flexibility that accounts for seasonal and anticipated climatic variations on groundwater elevation. Undesirable results of additional groundwater declines are described with reference to domestic wells and sustainability criteria are explained with evaluation of the effects of the criteria on beneficial uses and users of groundwater, including domestic wells.

Both the minimum threshold and measurable objectives for change in storage are set to no long-term change in storage in the Subbasin. After the subbasin achieves sustainability, there will be no ongoing loss of groundwater in storage.

This GSP sets minimum thresholds for the degradation of groundwater quality as a number of supply wells. Some supply wells already exceed groundwater quality standards. This GSP is not designed to remediate these existing exceedances. Therefore, the minimum thresholds and measurable objectives allow all existing exceedances, plus exceedances in an additional 10% of the monitoring wells. This allows for some flexibility in managing groundwater quality, while not allowing substantial degradation of groundwater quality.

Both the minimum threshold and measurable objectives for subsidence are set to no long-term decline in ground surface elevation in the Subbasin.

Potential undesirable effects of depletion of interconnected surface water are described in terms of reduction in Salinas River outflow to Salinas Valley, passage opportunity for steelhead trout, and extent, density, and health of riparian habitat. Specific minimum thresholds and measurable objectives are presented including measured extent of vegetation for isolated wetlands not located near major stream channels. Groundwater levels are used as a reasonable proxy for the rate of flow depletion along three identified defined reaches of the Salinas River, Estrella River, and San Juan Creek. The sustainability criteria based on groundwater levels are defined with recognition that additional monitoring wells are needed.

ES-8 Projects and Actions to Attain Sustainability

Achieving sustainability in the Subbasin will rely on management actions that reduce groundwater pumping. Both basin-wide and area specific management actions will be undertaken. Basin-wide management actions include monitoring and outreach, promoting best management practices for water use, promoting stormwater capture and recharge, and promoting voluntary fallowing of irrigated land.

Area specific management actions involve mandatory limitations on pumping in certain areas. The GSAs will establish a regulatory program to identify and enforce required pumping limitation as necessary to arrest persistent groundwater elevation declines in specific areas. The amount of mandatory pumping limitations is uncertain and will depend on the effectiveness and timeliness of voluntary actions by pumpers to limit pumping as well as the extent of the specific areas identified for mandatory limitations.

Developing and adopting the regulations for mandatory pumping limitations will require substantial negotiations between the GSAs, public hearings, and environmental review (CEQA). Regulations adopted by individual GSAs related to pumping limitations would need to be substantially identical to assure a consistent methodology for identifying those areas across the Subbasin. After GSP adoption, developing the regulatory program will require the following steps:

1. Establishing a methodology for determining baseline pumping in specific areas considering:
    a. Groundwater elevation trends in areas of decline and estimated yield in that area
    b. Land uses and corresponding irrigation requirements
2. Establishing a methodology to determine whose use must be limited and by how much considering, though not limited to, water rights and evaluation of anticipated benefits from projects bringing in supplemental water or other relevant actions individual pumpers take.
3. A timeline for limitations on pumping ("ramp down") in specific areas as required to avoid undesirable results
4. Approving a formal regulation to enact the program

Projects that supplement the Subbasin's water supply may be implemented by willing entities to offset pumping and lessen the degree to which the management actions would be needed. For example, stormwater capture and percolation efforts will be important for enabling the replenishments of the Subbasin on a long-term basis by water that is naturally available.

ES-9 Plan Implementation

Implementation of the GSP requires robust administrative and financial structures, with adequate staff and funding to ensure compliance with SGMA. The GSP calls for GSAs to routinely provide information to the public about GSP implementation and progress towards sustainability and the need to use groundwater efficiently. GSAs will likely hire consultant(s) or hire staff to implement the GSP.

A conceptual planning-level cost of about $7,800,000 will cover planned activities during the first five years of implementation. This equates to an estimated cost of $1,560,000 per year. This cost estimate reflects routine administrative operations, public outreach, and the basin wide and area specific management actions. This estimate assumes a centralized approach to implementation and staffing, it does not include CEQA, legal staff costs, individual GSA staff costs or responding to DWR comments, nor does it include costs associated with any projects undertaken by willing entities. The GSP will be implemented under the terms of the existing MOA between the four GSAs until DWR approves the GSP and a new or renewed cooperative agreement is established. Consistent with the current MOA, an annual operating budget will be established that is considered for approval by each GSA.

1 INTRODUCTION TO PASO ROBLES SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

1.1 Purpose of the Groundwater Sustainability Plan

In 2014, the State of California enacted the Sustainable Groundwater Management Act (SGMA). This law requires groundwater basins in California that are designated as medium or high priority be managed sustainably. Satisfying the requirements of SGMA generally requires four basic activities:

1. Forming one or multiple Groundwater Sustainability Agency(s) (GSAs) to fully cover a basin;
2. Developing one or multiple Groundwater Sustainability Plan(s) (GSPs) that fully cover the basin;
3. Implementing the GSP and managing to achieve quantifiable objectives; and
4. Regular reporting to the California Department of Water Resources (DWR).

This document fulfills the GSP requirement for the Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin (Paso Robles Subbasin or Subbasin). This GSP describes the Paso Robles Subbasin, develops quantifiable management objectives that account for the interests of the Subbasin's beneficial groundwater uses and users, and identifies a group of projects and management actions that will allow the Subbasin to achieve sustainability within 20 years of plan adoption.

The GSP was developed specifically to comply with SGMA's statutory and regulatory requirements. As such, the GSP uses the terminology set forth in these requirements (see e.g. Water Code Section 10721 and 23 CCR Section 351) which is oftentimes different from the terminology utilized in other contexts (e.g. past reports or studies, past analyses, judicial rules or findings). The definitions from the relevant statutes and regulations are attached to this report for reference.

This GSP is a planning document. The numbers in this GSP are not meant to be the basis for final determinations of individual water rights or safe yield. This GSP also does not define water rights and none of the numbers in the GSP should be considered definitive for water rights determination purposes.

1.2 Description of Paso Robles Subbasin

The Paso Robles Subbasin is identified by DWR in Bulletin 118 as Subbasin No. 3-004.06 (DWR, 2016a). The Subbasin is part of the greater Salinas Valley Basin in the Central Coastal region of California. The Subbasin as defined in this GSP encompasses an area of approximately 436,240 acres, or 681 square miles and is entirely within San Luis Obispo County. The Subbasin boundaries delineate the groundwater basin; the watershed includes the area that drains the surface water to the Subbasin, and encompasses a much larger area.

The Subbasin as originally defined by DWR (2003) was in both Monterey and San Luis Obispo Counties. On February 11, 2019, DWR released the Final 2018 Basin Boundary Modifications approving two revisions to the Subbasin boundary. One revision made the northern boundary of the Paso Basin coincident with the Monterey and San Luis Obispo County line, placing the Paso Basin entirely within San Luis Obispo County and making formal coordination with Salinas Valley Basin GSA optional. The other revision removed the basin area underlying Heritage Ranch Community Services District GSA, making them no longer subject to SGMA or required to develop a GSP. A basin boundary modification was approved by DWR that moved the northern boundary of the Paso Robles Area Subbasin to the Monterey/San Luis Obispo county line. A subsequent basin boundary adjustment was approved by DWR in 2019 to remove the land covered by Heritage Ranch Community Services District from the Subbasin. Heritage Ranch Community Services District was originally an active GSA in the Subbasin. The Plan has been modified to take out Heritage Ranch Community Services District and the land it overlies after the boundary adjustment was approved. The final basin boundary is shown on Figure 1-1~~Figure 1-1~~.

The Subbasin is bounded by two groundwater basins and two subbasins, as shown on Figure 1-1~~Figure 1-1~~.

- The Atascadero Area Subbasin (3-004-11) is located southwest of the Paso Robles Subbasin. The boundary with the Subbasin is the Rinconada Fault zone which is a leaky barrier to groundwater flow.
- The Upper Valley Aquifer Subbasin of the Salinas Valley Groundwater Basin is located north of the Paso Robles Subbasin. Its aquifers are in hydraulic continuity with those in the Subbasin.
- The Cholame Valley (3-005) groundwater basin is located east of the Paso Robles Subbasin. Its western boundary is the San Andreas Fault that is a barrier to groundwater flow.
- The Carrizo Plain (3-019) groundwater basin is located southeast of the Paso Robles Subbasin. The Carrizo Plain boundary with the Subbasin is a topographic high with sediments in hydraulic continuity with the Basin.

The Atascadero, Carrizo Plain and Cholame Valley groundwater basins are designated as very low priority and therefore not required to submit GSPs. Although not required to develop a GSP, the Atascadero Area Subbasin is planning to prepare and adopt a GSP. The Paso Robles

Subbasin and Salinas Valley Upper Valley Aquifer Subbasin are subject to SGMA and are required to develop GSPs.

The Subbasin includes the incorporated City of Paso Robles. The Subbasin additionally includes the unincorporated census-designated places of Cholame, Creston, San Miguel, Shandon, and Whitley Gardens (Figure 1-1Figure 1-1).

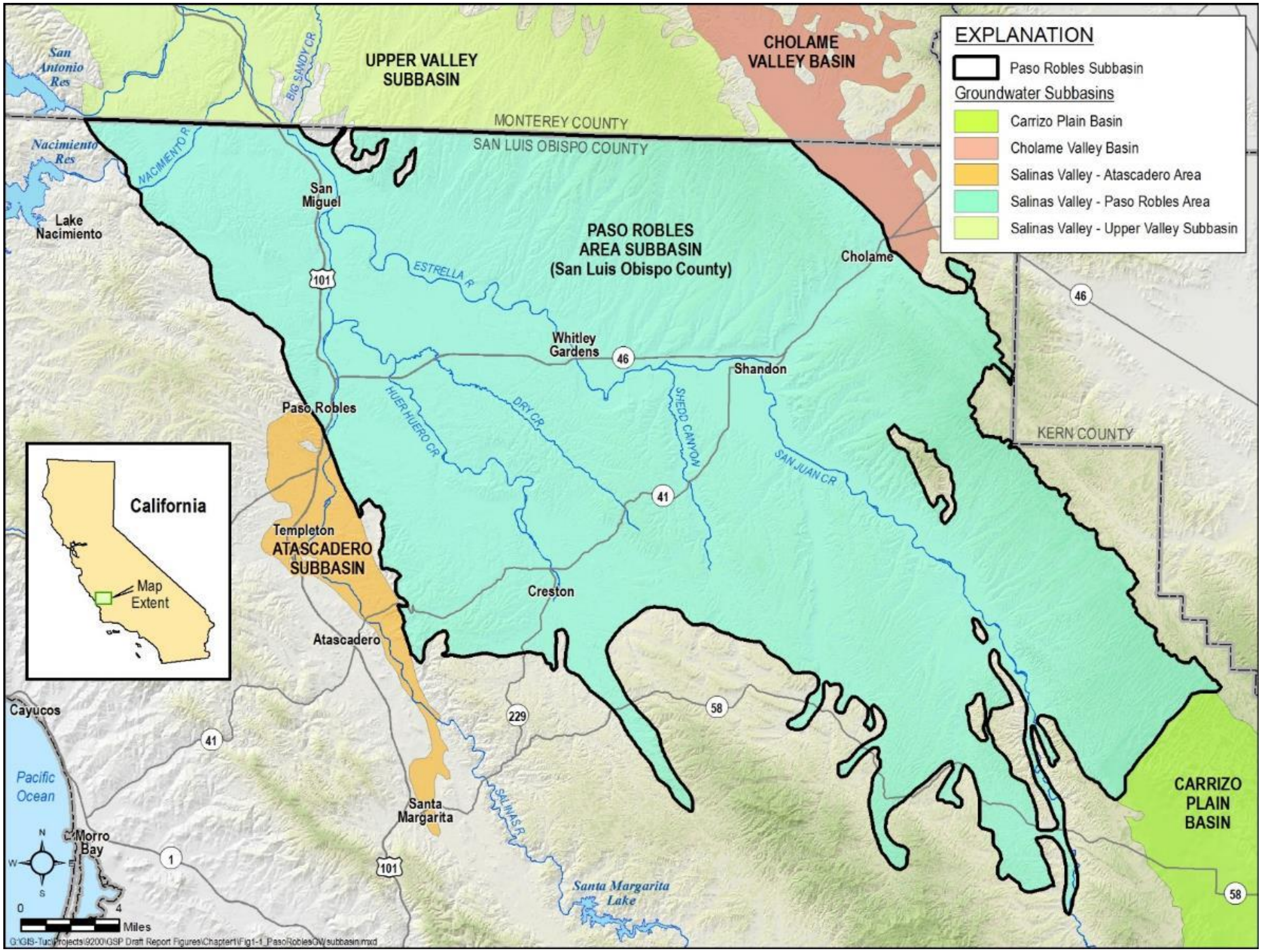


Figure 1-1. Paso Robles Subbasin and Surrounding Subbasins

2 AGENCIES' INFORMATION

The Paso Robles Subbasin GSP has been jointly developed by four GSAs:

- City of Paso Robles
- Paso Basin - County of San Luis Obispo GSA
- San Miguel Community Services District (CSD)
- Shandon - San Juan GSA

2.1 Agencies' Names and Mailing Addresses

The following contact information is provided for each GSA pursuant to California Water Code § 10723.8.

City of Paso Robles GSA
1000 Spring Street
City of Paso Robles, CA 93635

Paso Basin - County of San Luis Obispo GSA
C/O County of San Luis Obispo Department of Public Works - Water Resources
County Government Center, Room 206
San Luis Obispo, CA 93408

San Miguel Community Services District GSA
P.O. Box 180
San Miguel, CA 93451

Shandon - San Juan GSA
P.O. Box 150
Shandon, CA 93461

2.2 Agencies' Organization and Management Structure

The organization and management structures of each of the four subbasin GSAs are described below. Each of the GSAs appoints a representative to a Cooperative Committee that is further described in Section 2.3.2. The Cooperative Committee coordinates activities among all the GSAs during the GSP development phase.

2.2.1 City of Paso Robles GSA

The City of Paso Robles is an incorporated city that operates under a Council-Manager general law form of government. The City Council consists of five members elected at-large, on a non-partisan basis. Council members serve four-year overlapping terms. The mayor is directly elected and serves a two-year term. Decisions on all GSA-related matters require an affirmative vote of a majority of the five-member City Council. One member from the City Council sits on the Cooperative Committee that coordinates activities among all GSAs in accordance with the Memorandum of Agreement (MOA) further described in section 2.3.1.5 and included in Appendix A. The City of Paso Robles GSA's activities are staffed through the City's Department of Public Works.

2.2.2 Paso Basin - County of San Luis Obispo GSA

The County of San Luis Obispo is governed by a five-member Board of Supervisors. Board members are elected to staggered four-year terms. Decisions on all GSA-related matters require an affirmative vote of a majority of the Board. One member from the Board of Supervisors sits on the Cooperative Committee that coordinates activities among all GSAs in accordance with the MOA further described in section 2.3.1.5 and included in Appendix A. The Paso Basin - County of San Luis Obispo GSA's activities are staffed through the County's Department of Public Works.

2.2.3 San Miguel Community Services District GSA

San Miguel CSD is governed by a five-member Board of Directors. Directors are elected to four-year terms. Decisions on all GSA-related matters require an affirmative vote of a majority of the five Board of Directors members. One member from the San Miguel CSD Board of Directors sits on the Cooperative Committee that coordinates activities among all in accordance with the MOA further described in section 2.3.1.5 and included in Appendix A. The San Miguel CSD GSA's activities are staffed by the CSD's staff engineer.

2.2.4 Shandon - San Juan GSA

The Shandon-San Juan Water District is governed by a five-member Board of Directors elected to staggered four year terms. The District elected to serve as the exclusive GSA for the portion of the Subbasin situated within the boundaries of the District, and therefore also functions as the Shandon-San Juan GSA. Decisions on all GSA-related matter require an affirmative vote of a majority of the five-member Board of Directors. One member from the Shandon - San Juan GSA Board of Directors sits on the Cooperative Committee that coordinates activities among all in accordance with the Memorandum of Agreement (MOA) further described in section 2.3.1.5 and included in Appendix A. The Shandon - San Juan GSA's activities are staffed by members of the Water District or their representatives and by contracted professional engineers.

2.3 Authority of Agencies

Each of the GSAs developing this coordinated GSP is formed in accordance with the requirements of California Water Code § 10723 *et seq*. The resolutions of formation for all GSAs are included in Appendix A. The specific authorities for forming a GSA and implementing the GSP for each of the agencies that formed GSAs are listed below.

2.3.1 Individual GSAs

2.3.1.1 City of Paso Robles GSA

The City of Paso Robles is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents. The City is therefore a local agency under California Water Code § 10721 with the authority to establish itself as a GSA. Upon establishing itself as a GSA, the City obtains all the rights and authorities provided to GSAs under California Water Code § 10725 *et seq.* subject to the terms and conditions set forth therein. In addition, the City retains its ability to manage groundwater pursuant to its police powers and well permitting authority.

2.3.1.2 Paso Basin - County of San Luis Obispo GSA

The County of San Luis Obispo has land use authority over the unincorporated areas of the County, including areas overlying the Paso Robles Subbasin. The County of San Luis Obispo is therefore a local agency under California Water Code § 10721 with the authority to establish itself as a GSA. Upon establishing itself as a GSA, the County obtains all the rights and authorities provided to GSAs under California Water Code § 10725 *et seq*. subject to the terms and conditions set forth therein. In addition, the County retains its ability to manage groundwater and the construction of wells pursuant to its police powers.

2.3.1.3 San Miguel Community Services District GSA

San Miguel CSD is a local public agency of the State of California, organized and operating under the Community Services District Law, Government Code § 6100 *et seq*. San Miguel CSD provides water and sewer services to its residents. San Miguel CSD is therefore a local agency under California Water Code § 10721 with the authority to establish itself as a GSA. Upon establishing itself as a GSA, San Miguel CSD obtains all the rights and authorities provided to GSAs under California Water Code § 10725 *et seq*. subject to the terms and conditions set forth therein.

2.3.1.4 Shandon - San Juan GSA

The Shandon - San Juan Water District was formed in accordance with California's Water District Law, California Water Code § 34000 *et seq*. In accordance with California's Water District Law, the Shandon - San Juan Water District obtains the water supply and management authorities included in California Water Code § 35300 *et seq.*, with the exception of the ability to export groundwater beyond the boundaries of the Paso Robles subbasin. The Shandon - San Juan Water District is therefore a local agency under California Water Code § 10721 with the authority to establish itself as a GSA. Upon establishing itself as a GSA, the District obtains all the rights and authorities provided to GSAs under California Water Code § 10725 *et seq*. subject to the terms and conditions set forth therein.

2.3.1.5 Memorandum of Agreement for GSP Development

The five GSAs overlying the original Subbasin entered into a Memorandum of Agreement (MOA) in September 2017. Heritage Ranch CSD was an original party to the MOA. With the basin boundary modification approval by DWR in 2019, Heritage Ranch is no longer part of the Subbasin. A copy of the MOA is included in Appendix A.

The purpose of the MOA is to establish a committee to develop a single GSP for the entire Paso Robles Subbasin. The single GSP developed under this MOA will be considered for adoption by each individual GSA and subsequently submitted to DWR for approval. Per §12.2 of the MOA, the MOA shall automatically terminate upon DWR's approval of the adopted GSP. The GSAs may decide to enter into a new agreement to coordinate GSP implementation at that time.

The MOA establishes the Paso Basin Cooperative Committee (Cooperative Committee) consisting of one member and one alternate from each of the GSAs. The Cooperative Committee conducts activities related to GSP development and SGMA implementation. The full list of activities the Cooperative Committee is authorized to undertake is included in the MOA in Appendix A; highlights include:

- Developing a GSP that achieves the goals and objectives outlined in SGMA;
- Reviewing and participating in the selection of consultants related to Cooperative Committee efforts;
- Developing annual budgets and additional funding needs;
- Developing a stakeholder participation plan; and

The MOA sets forth each GSAs' weighted voting percentages and the votes needed to implement certain actions or make certain recommendations to the individual GSAs. In particular, the MOA states that the Cooperative Committee must unanimously vote to recommend that the GSAs adopt the final GSP, though the MOA provides that each GSA may adopt the GSP for its jurisdiction without the Cooperative Committee's recommendation. Any vote to recommend changes to the MOA requires unanimous approval by the Cooperative Committee Members.

2.3.2 Memorandum of Agreement for GSP Implementation

Pursuant to Section 1 of the MOA, the GSAs intend to use the current MOA as a basis for continued cooperation in the management of the Subbasin during the period between adoption of the GSP by each GSA and approval of the GSP by DWR.

2.3.3 Coordination Agreements

The single GSP developed by the GSAs completely covers the entire Paso Robles Subbasin. Therefore, no coordination agreements with other GSAs are necessary.

2.3.4 Legal Authority to Implement SGMA Throughout the Plan Area

Figure 2-1~~Figure 2-1~~ shows the extent of the GSP plan area, along with the jurisdictional boundary of each of the exclusive GSAs cooperating on this GSP. This figure shows that the entire plan area is covered by the exclusive GSAs, and no portion of the Subbasin is covered by a non-exclusive GSA. Therefore, the combination of the GSAs provides the legal authority to implement this GSP throughout the entire plan area. No authority is needed from any other GSA to implement this plan.

2.4 Contact Information for Plan Manager

The County of San Luis Obispo Director of ~~Public Works~~Groundwater Sustainability, Blaine T. Reely, PhD, P.E., has been designated as the Plan Manager. The Plan Manager can be reached at 805-781-~~5252~~4206 or ~~publicworks@co.slo.ca.us.~~breely@co.slo.ca.us

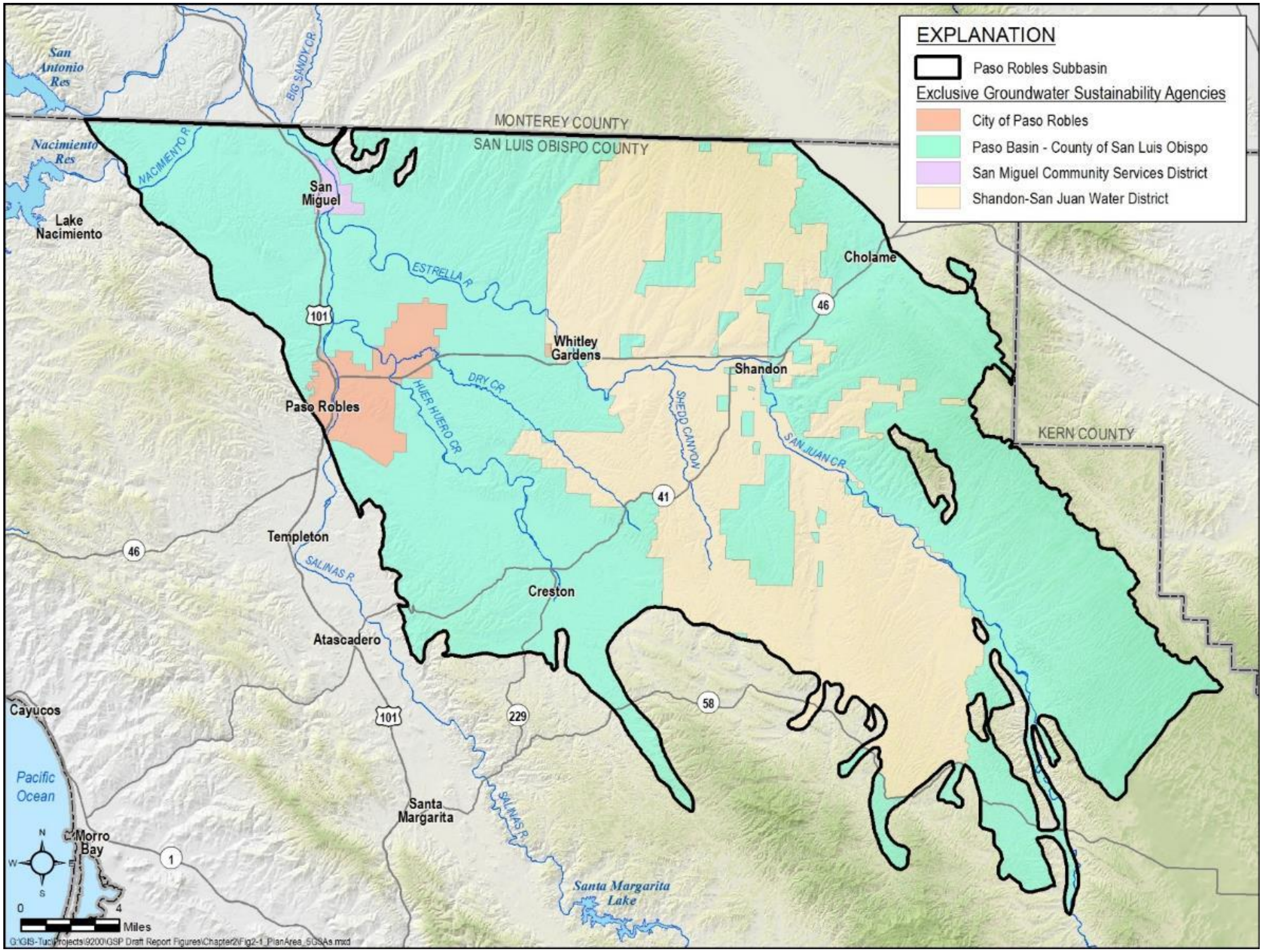


Figure 2-1. Extent of GSP Plan Area and Exclusive Groundwater Sustainability Agencies

3 DESCRIPTION OF PLAN AREA

3.1 Paso Robles Subbasin Introduction

This GSP covers the entire Paso Robles Subbasin. The Subbasin lies in the northern portion of San Luis Obispo County. The majority of the Subbasin comprises gentle flatlands near the Salinas River Valley, ranging in elevation from approximately 445 to 2,387 feet above mean sea level. The Subbasin is drained by the Salinas River. Tributaries to the Salinas River include the Estrella River, Huer Huero Creek, and San Juan Creek. Communities in the Subbasin are the City of Paso Robles and the communities of San Miguel, Creston, and Shandon. Highway 101 is the most significant north-south highway in the Subbasin, with Highways 41 and 46 running east-west across the Subbasin. Figure 3-1~~Figure 3-1~~ shows the extent of the plan area as well as the significant water bodies, communities, and highways.

3.2 Adjudicated Areas, Other GSAs, and Alternative Plans

As of the date that this GSP was completed and submitted to DWR for evaluation: (1) No part of the Subbasin nor any surrounding subbasin is identified in SGMA (Water Code § 10720.8) as an adjudicated area and no part of the Subbasin nor any surrounding subbasin has been the subject of a comprehensive common law groundwater adjudication or comprehensive adjudication as described in Code of Civil Procedure Section 830 *et seq.*; (2) No other GSAs exist within the Subbasin; and (3) No alternative plans have been submitted for any part of the Subbasin, nor for any surrounding subbasin. Consequently, no map is included in the GSP for adjudicated areas, other GSAs or alternative plans.

3.3 Other Jurisdictional Areas

In addition to the GSAs, there are several federal, state, and local agencies that have some degree of water management authority in the Subbasin. Each agency or organization is discussed below. A map of the jurisdictional extent of the Federal and State agencies within the Subbasin is shown on Figure 3-2~~Figure 3-2~~. The source of this information is the DWR SGMA data viewer, available on the DWR SGMA website. A map showing the jurisdictional extent of city and local jurisdictions within the Subbasin is shown on Figure 3-3~~Figure 3-3~~, though boundaries are unknown, and therefore not included in the map, for other entities with water management/supply responsibilities (mutual water companies, small water systems, etc.).

3.3.1 Federal Jurisdictions

Federal agencies with land holdings in the Subbasin include the National Forest Service and the Bureau of Land Management. A portion of the Los Padres National Forest covers a small area near the southern boundary of the Subbasin. The Bureau of Land Management owns two small parcels in the Red Hills area that partially overlie the Subbasin.

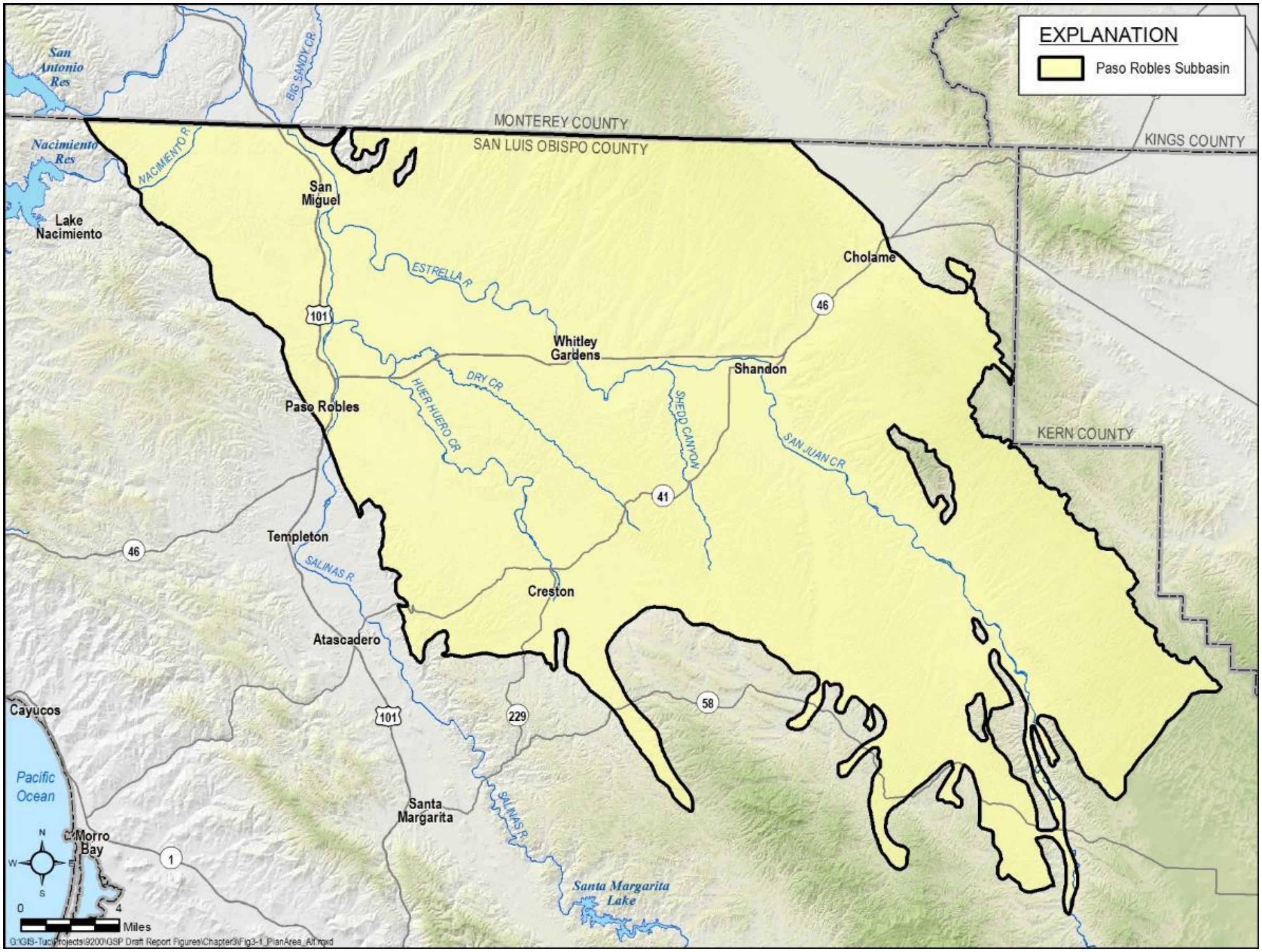


Figure 3-1. Area Covered by GSP

3.3.2 Tribal Jurisdiction

The Paso Basin is located in an area historically occupied by two Native American groups, the Obispeño Chumash and Salinan. The Chumash occupied the coast between San Luis Obispo and northwestern Los Angeles County, inland to the San Joaquin Valley. They were divided into two broad groups, of which the Obispeño were the northern group. The Salinan were northern neighbors of the Chumash, and although the presence of a firm boundary between the Chumash and the Salinan is uncertain, ethnographic accounts have placed Salinan territories in the northern portion of the County. Neither tribal group has recognized tribal lands in the Paso Basin.

3.3.3 State Jurisdictions

State agencies in the Subbasin include the California National Guard and the California Department of Fish and Wildlife. The California National Guard occupies Camp Roberts at the north end of the Subbasin. The California Department of Fish and Wildlife oversees an area along the Salinas River near Camp Roberts. The Department of Fish and Wildlife additionally has three conservation easements that partially overlie the eastern boundary of the Subbasin.

3.3.4 County Jurisdiction

The County of San Luis Obispo and the associated San Luis Obispo County Flood Control and Water Conservation District (SLOFCWCD) have jurisdiction over the entire Subbasin. Land owned or managed by the County in the Subbasin includes a conservation easement south of the City of Paso Robles operated by the Land Conservancy of San Luis Obispo County; CW Clark Park in Shandon; and Wolf Property Natural Area in San Miguel.

3.3.5 City and Local Jurisdictions

The City of Paso Robles lies on the west side of the Subbasin. The City has water management authority over its incorporated area and manages a number of parks and recreational sites. One community service district exists in the Subbasin: the San Miguel CSD. Two primarily agricultural water districts exist in the Subbasin: the Shandon - San Juan Water District and the Estrella-El Pomar-Creston Water District.

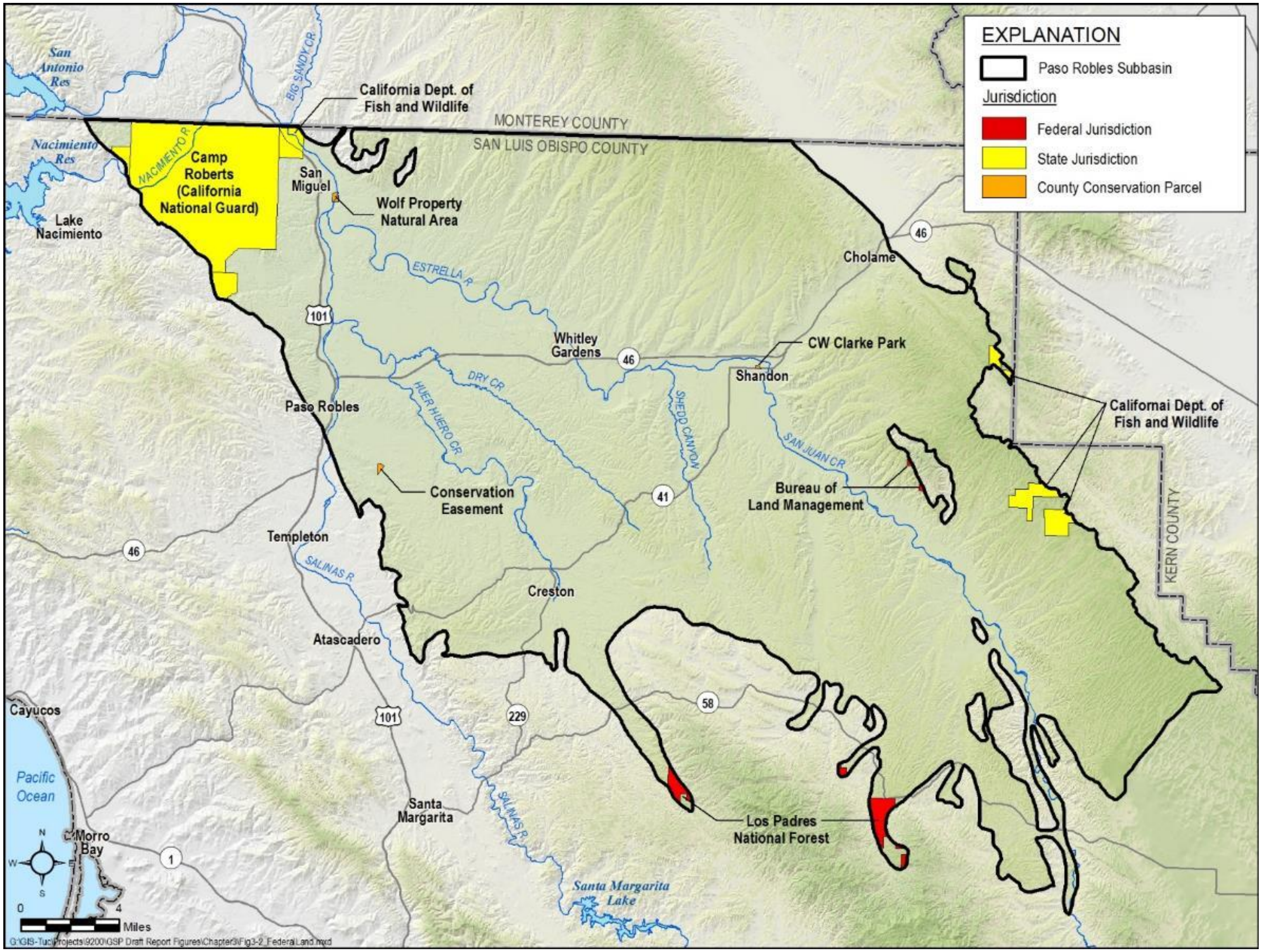


Figure 3-2. Map of Federal Jurisdictional Areas, State Jurisdictional Areas and County Conservation Parcels

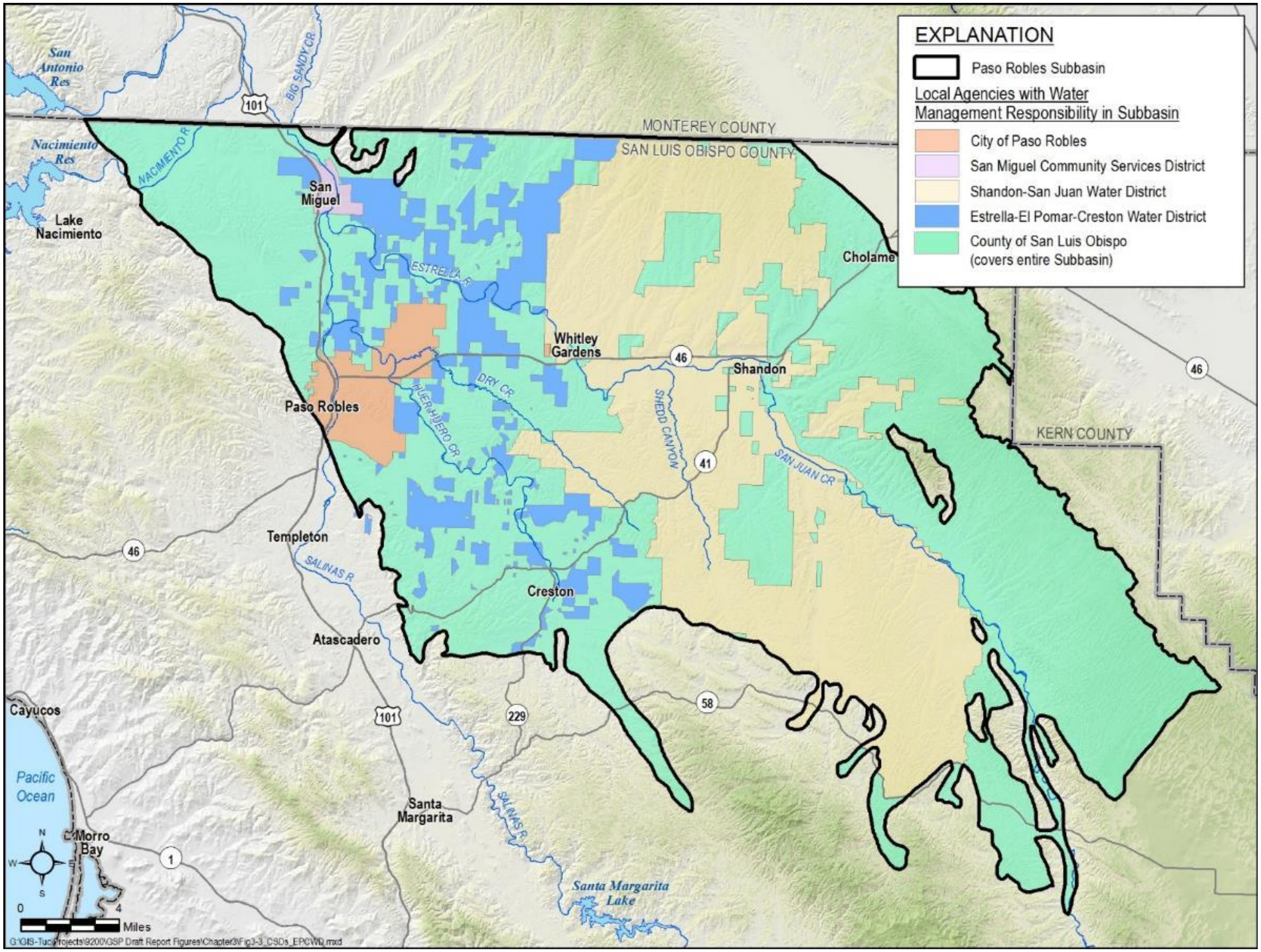


Figure 3-3. Map of City, CSD, and Water District Jurisdictional Areas

3.4 Land Use

Land use planning authority in the Subbasin is the responsibility of the City of Paso Robles (within its boundary) and of the County of San Luis Obispo (within all other areas of the Subbasin). Current land use in the Subbasin is shown on Figure 3-4~~Figure 3-4~~ and is summarized by group in Table 3-1~~Table 3-1~~. The urban land use category is provided by DWR based on data compiled by Land IQ from 2014 (LandIQ, 2017). The agricultural land use categories and acreage is provided by the County of San Luis Obispo's Agricultural Commissioner's Offices (SLO County ACO) (2016). The balance of the 436,240 acres in the GSP Plan Area is classified as native vegetation and could include dry farmed land.

Table 3-1. Land Use Summary

Land Use Category	Acres
Citrus	397
Deciduous	471
Alfalfa	1,590
Nursery	63
Pasture	667
Vegetable	1,691
Vineyard	35,349
Native vegetation	387,435
Urban	8,577
Total	**436,240**

Sources: Department of Water Resources and County of San Luis Obispo's Agricultural Commissioner Offices

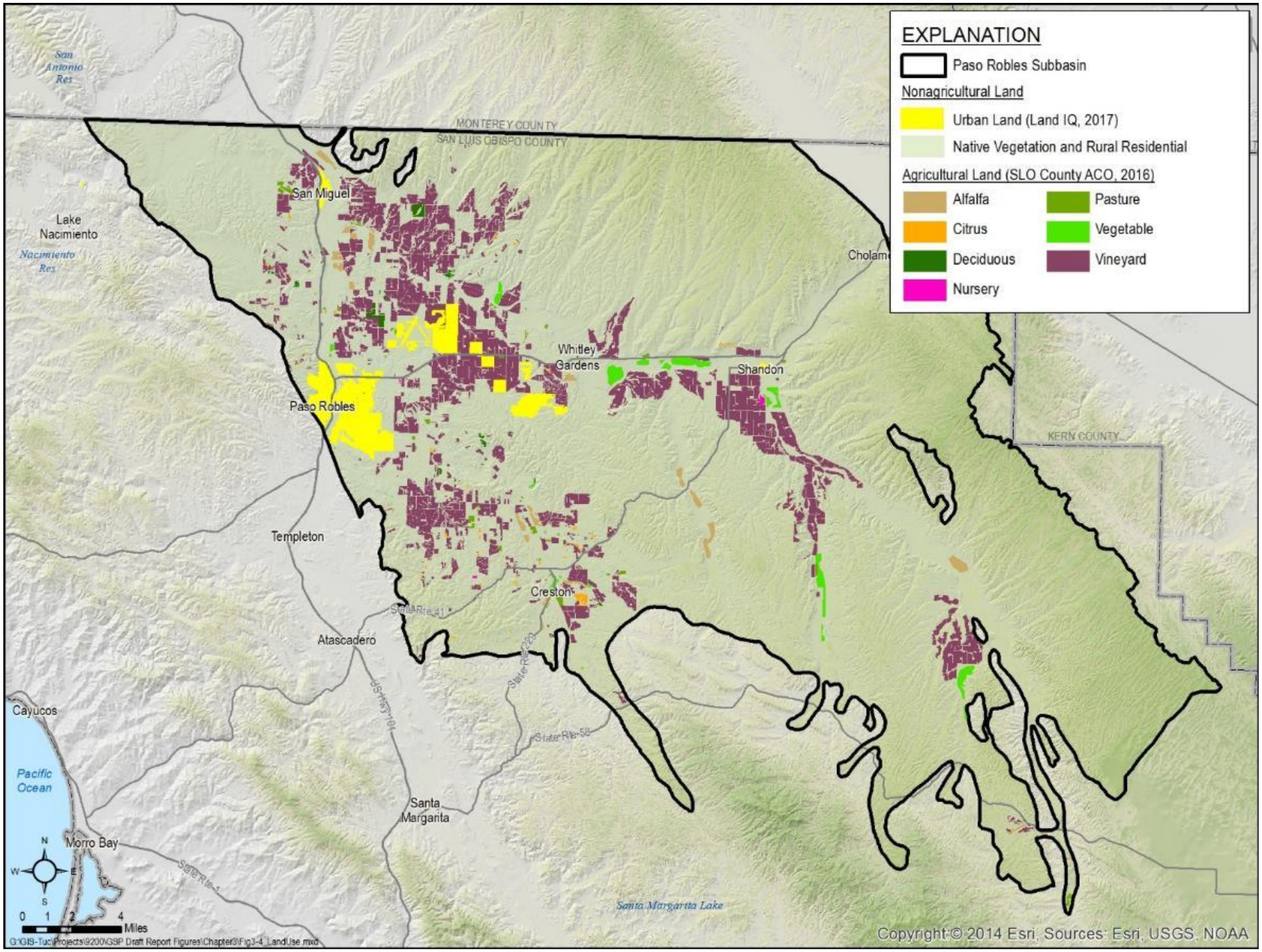


Figure 3-4. Existing Land Use Designations

3.4.1 Water Source Types

The Subbasin has three water source types: groundwater, surface water, and recycled water. Until 2015, all water demands in the Subbasin were met with groundwater. Figure 3-5Figure 3-5 shows the communities, defined as cities and census-designated places that depend on groundwater as the source of water.

The City of Paso Robles began using Nacimiento Project Water in 2015. (Todd Groundwater, 2016). The City has a contractual entitlement to 6,488 acre-feet per year (AFY). Community Service Area 16 (CSA16), surrounding the community of Shandon, has a State Water Project (SWP) contract entitlement to 100 AFY from the Coastal Branch of the SWP. In 2017, CSA16 took delivery of 99 AF of water, which was the first delivery of SWP water. The locations of the pipelines supplying these water sources are shown on Figure 3-5Figure 3-5, along with the land areas supplied by these surface water sources.

Historically, recycled water has not been used as a source of water in the Subbasin. The City of Paso Robles, San Miguel CSD, and Camp Roberts operate wastewater treatment plants. The City of Paso Robles is currently upgrading its water treatment system and plans to use its treated wastewater for irrigation and other non-potable uses. San Miguel CSD is also investigating non-potable use of wastewater. Currently, there is no land using wastewater as a water source type.

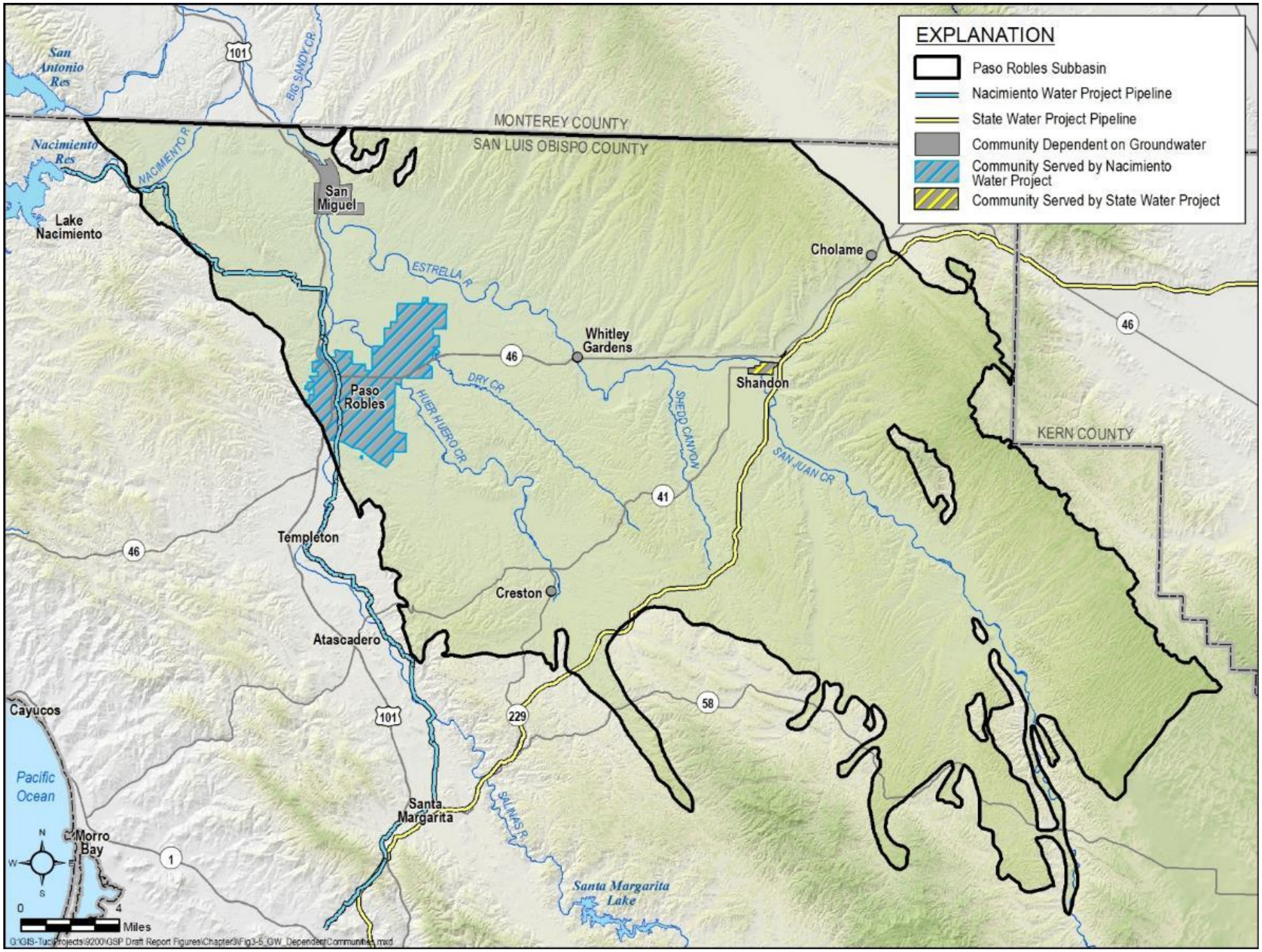


Figure 3-5. Communities Dependent on Groundwater and With Access to Surface Water

3.4.2 Water Use Sectors

Water demands in the Basin are organized into the six water use sectors identified in the SGMA Regulations. The urban, agricultural, and native vegetation areas are the same as the land use categories that were defined in Figure 3-4~~Figure 3-4~~ and Table 3-1~~Table 3-1~~. These are:

- **Urban**. Urban water use is assigned to non-agricultural water uses in the cities and census-designated places. Domestic use outside of census-designated places is not considered urban use.
- **Industrial**. There is limited industrial water use in the Subbasin. DWR does not have any records of wells in the subbasin that are categorized solely for industrial use. Industrial use within the City is lumped into the urban water use sector and, since most industrial use outside of the City is associated with agriculture, it is lumped into the agricultural water use sector.
- **Agricultural**. This is the largest water use sector in the Subbasin by water use.
- **Managed wetlands**. There are no managed wetlands in the Subbasin.
- **Managed recharge**. There is no managed recharge in the Subbasin. Recycled water discharge to ponds is included in the urban water use sector
- **Native vegetation.** This is the largest water use sector in the Subbasin by land area. This sector, required by the SGMA Regulations, includes rural residential areas. Native vegetation is the term used in the SGMA Regulations for all other unmanaged and non-irrigated land use sectors.

Figure 3-6~~Figure 3-6~~ shows the distribution of the water use sectors in the Subbasin.

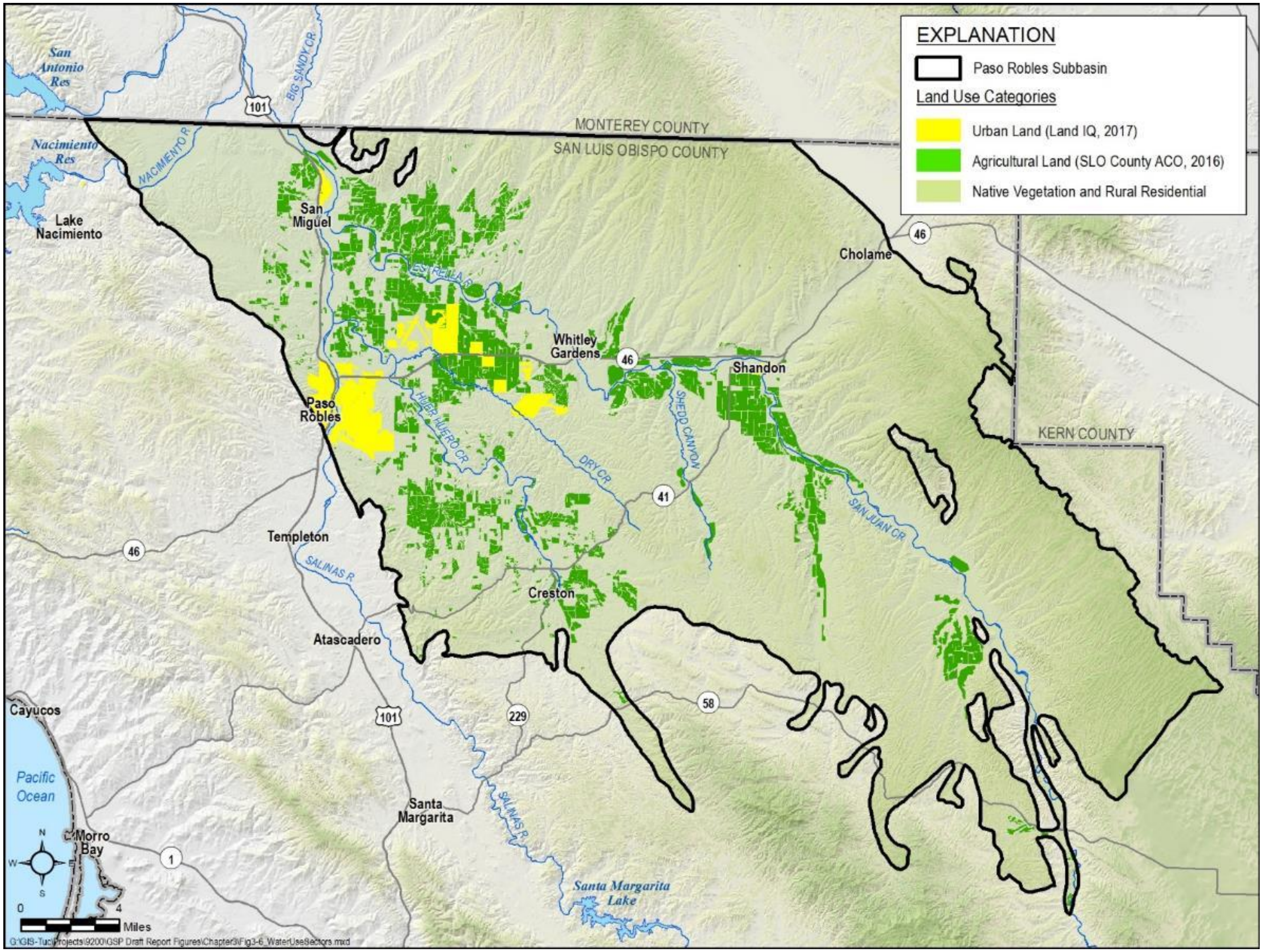


Figure 3-6. Water Use Sectors

3.5 Existing Well Types, Numbers, and Density

The total number of existing and active wells is not known. Well types, well depth, and well distribution data were downloaded from DWR's well completion report map application (DWR, 2018). DWR provided this information specifically for developing GSPs. DWR categorizes wells in this mapping application as either domestic, production, or public supply. These categories are based on the well use information submitted with the well logs to DWR. The majority of the wells categorized on well logs as production wells are used for agriculture. Most of the wells in the Subbasin are used for domestic purposes.

Figure 3-7~~Figure 3-7~~ through Figure 3-9~~Figure 3-9~~ show the density of these DWR wells in the Subbasin by their types of use. These DWR data used to develop these maps are not the same set of well data from other sources listed below. DWR data were used to develop maps of well densities because they are organized for easy mapping of well density per square mile. These maps should be considered representative of well distributions, but not definitive.

In addition to DWR datasets, described above, other well information is available from other public databases. Many wells in these databases may have been destroyed or abandoned. Some wells are located in more than one database. Additionally, it is possible that some wells exist in multiple sources listed below due to multiple well naming conventions. The number of wells in each database is listed below. These numbers are updated as of June 12, 2019 and contain duplicates (i.e. each well was included in the count for every source the well was found):

- Online System for Well Completion Reports (OSWCR): 5,854 wells
- SGMA Data Viewer: 20 wells
- SLO County Public Data: 41wells
- SLO County Confidential Data: 193 wells
- SLO County Public Health Department Data Request: 207 wells
- City of Paso Robles: 1 well
- CASGEM: 9 wells

Finally, the County of SLO Public Health Department has a well inventory database of wells permitted between 1965 and the present. The database is based on the best available historical data compiled from the Environmental Health Services well construction permit application process. Of the 5,164 wells documented in the subbasin, most are domestic wells, and approximately 600 are irrigation wells (County of SLO Public Health Department, June 2019).

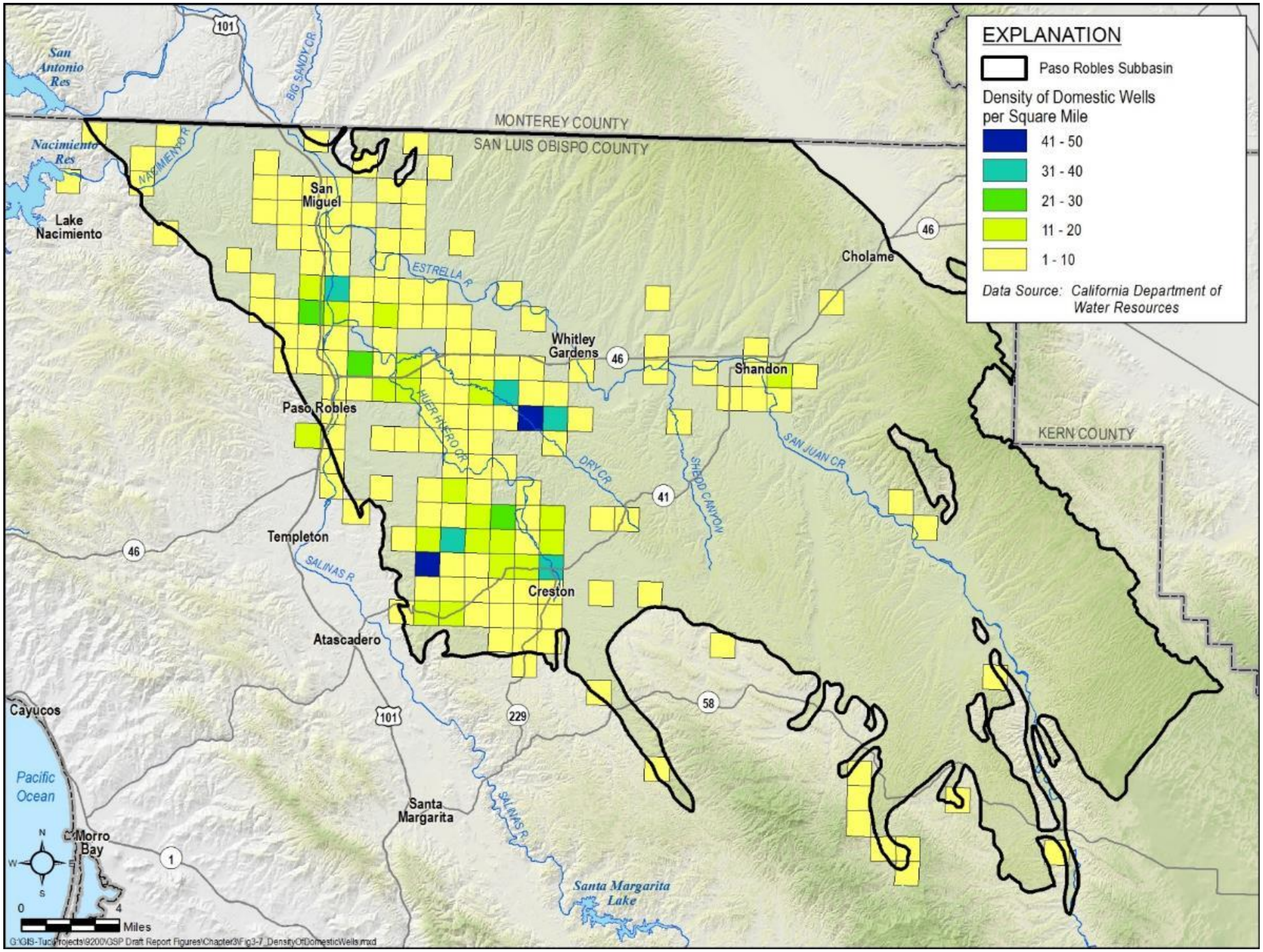


Figure 3-7. Density of Domestic Wells per Square Mile

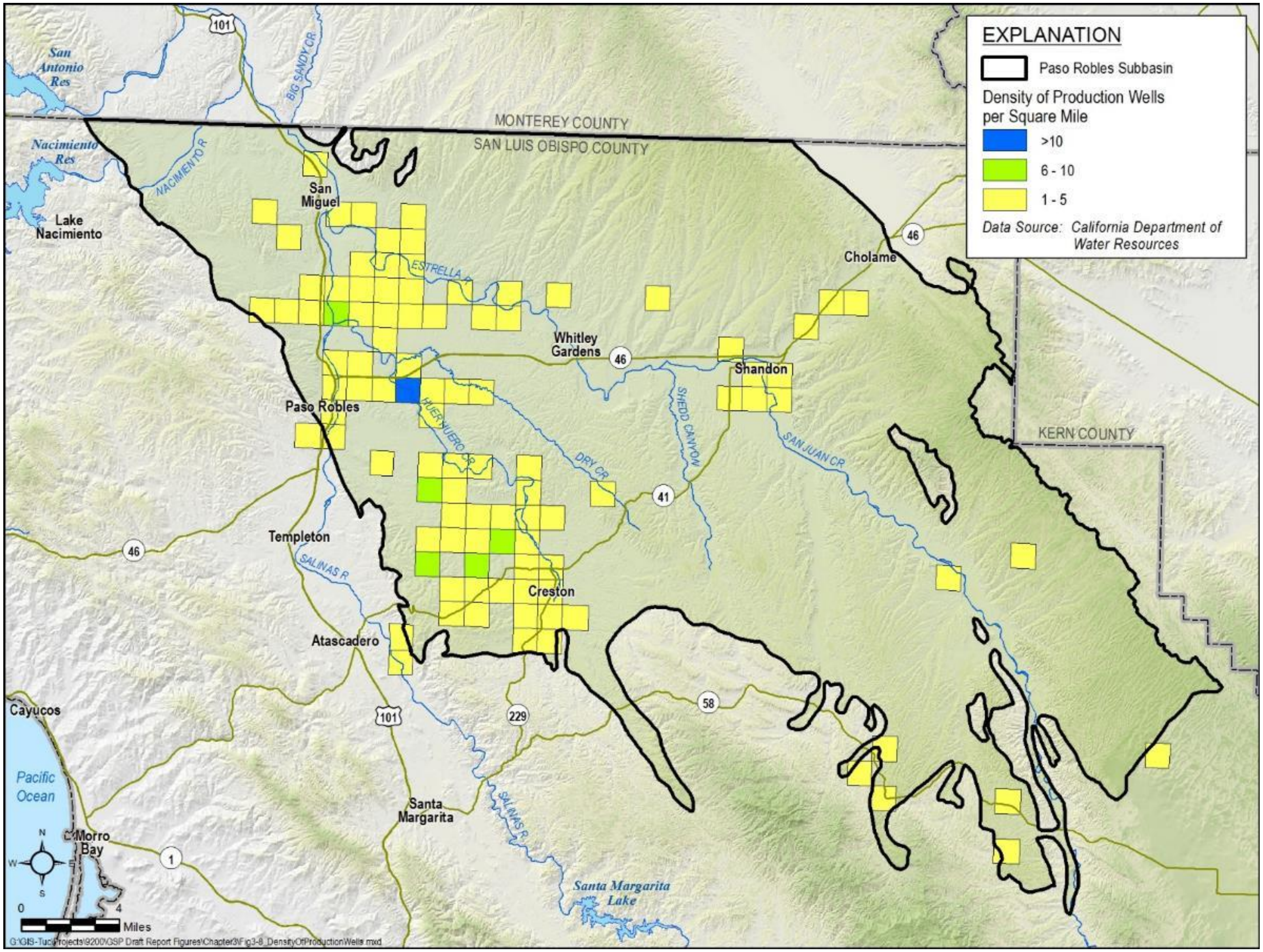


Figure 3-8. Density of Production Wells per Square Mile

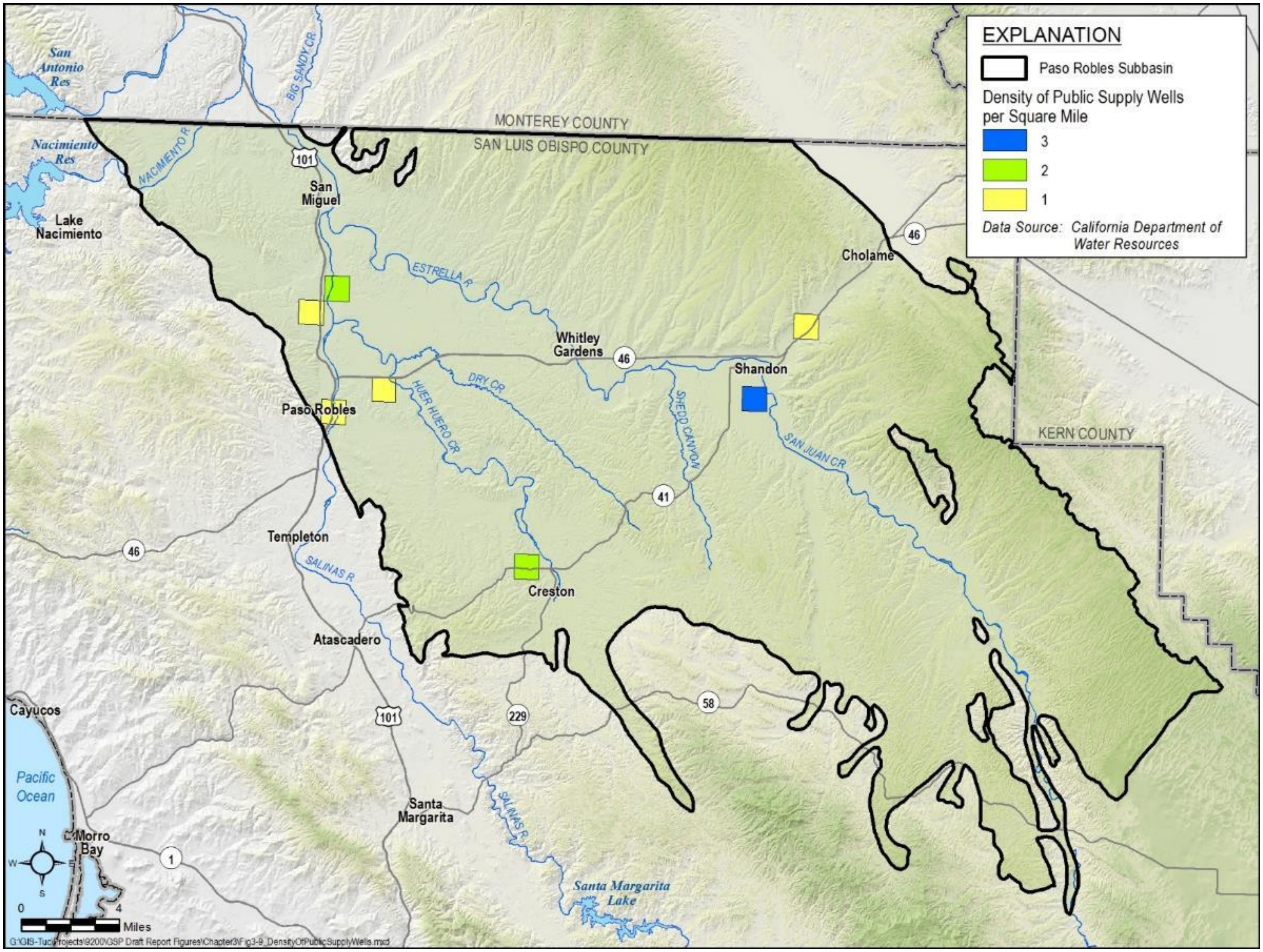


Figure 3-9. Density of Public Water Supply Wells per Square Mile

3.6 Existing Monitoring Programs

3.6.1 Groundwater Level Monitoring

The SLOFCWCD has been monitoring groundwater levels county-wide on a semi-annual basis for more than 50 years to support general planning and for engineering purposes. Groundwater level measurements are taken once in the spring and once in the fall. The monitoring takes place from a voluntary network of wells. The voluntary monitoring network has changed over time as access to wells has been lost or new wells have been added to the network.

The U.S. Geological Survey (USGS) monitors groundwater levels at two monitoring wells in the Basin. The two wells in the Paso Robles Subbasin only have one measurement, collected in November 2017. The frequency for monitoring is given as "periodic" so the frequency is unknown at this time.

Routine monitoring of groundwater levels is conducted in the Subbasin by County Staff through the SLOFCWCD program. Figure 3-10~~Figure 3-10~~ shows the locations of monitoring wells in the SLOFCWCD's database that are designated as public and the locations of monitoring wells reported to the state's California Statewide Groundwater Elevation Monitoring (CASGEM) system. The monitoring network also includes a number of other wells in the Plan Area that are not shown on this map as the data was gathered under confidentiality agreements between monitoring network participants and SLOFCWCD. Additional evaluation of the current monitoring program was conducted for the GSP to establish a representative monitoring network of wells with public data that will be used during plan implementation to track groundwater elevations and ensure that minimum thresholds, described in Chapter 8, Sustainable Management Criteria, have not been exceeded.

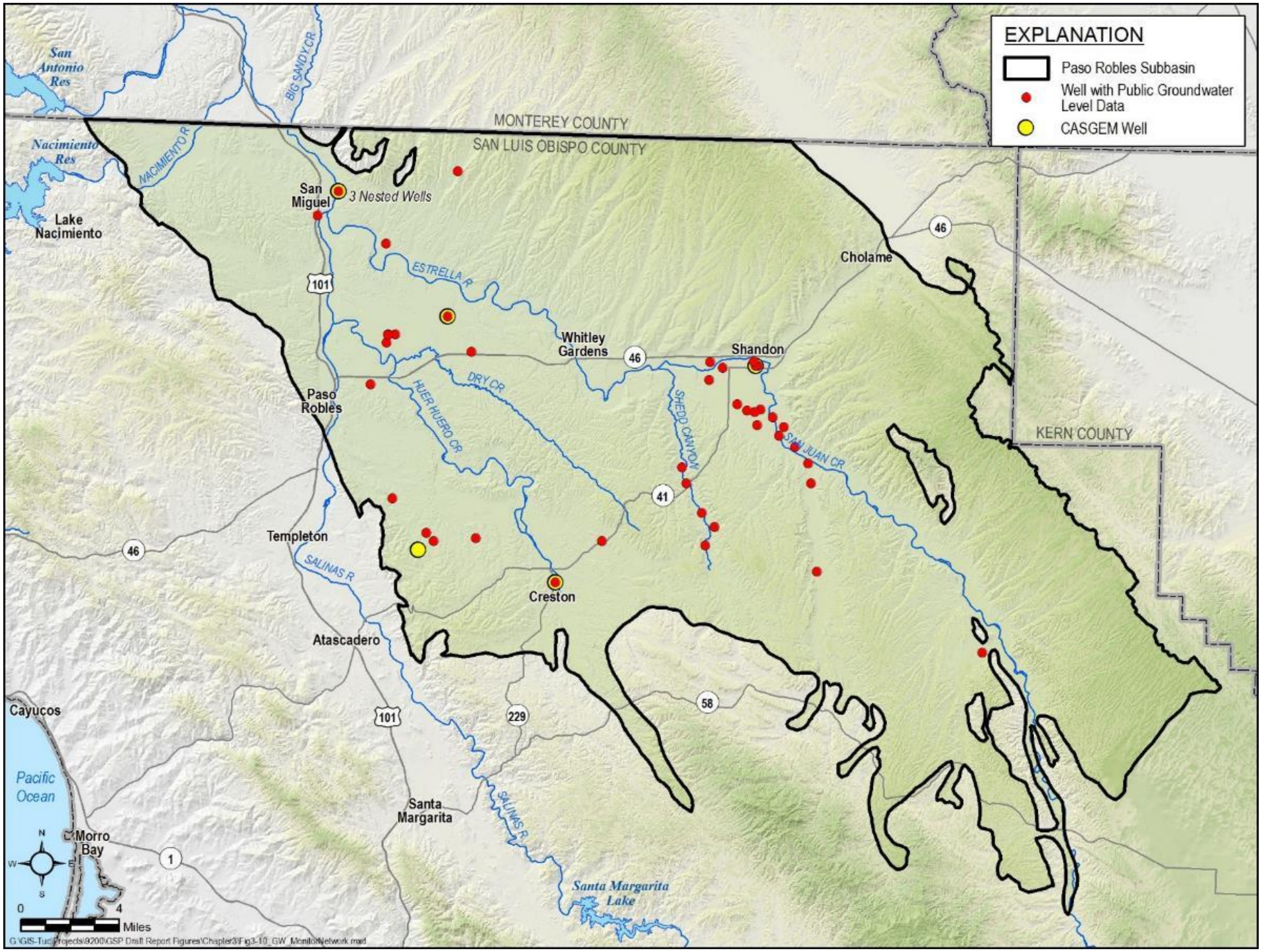


Figure 3-10. Wells with Publicly Available Groundwater Level Data

3.6.2 Groundwater Quality Monitoring

Groundwater quality is monitored under several different programs and by different agencies including:

- Municipal and community water purveyors must collect water quality samples on a routine basis for compliance monitoring and reporting to the California Division of Drinking Water.
- The USGS collects water quality data on a routine basis under the Groundwater Ambient Monitoring and Assessment (GAMA) program. These data are stored in the State's GAMA/Geotracker system.
- The State Water Resources Control Board's 2009 Recycled Water Policy required the development of Salt Nutrient Management Plans for groundwater basins in California. This plan was developed in 2015 for the Paso Robles Subbasin (RMC, 2015).
- There are multiple sites that are monitoring groundwater quality as part of investigation or compliance monitoring programs through the Central Coast Regional Water Quality Control Board.

Figure 3-11~~Figure 3-11~~ shows the location of wells in the State's GAMA Geotracker database. The USGS monitors groundwater quality at two monitoring wells in the Subbasin. Only one sample has been collected (in 2017) from each of the wells. The monitoring frequency is unknown.

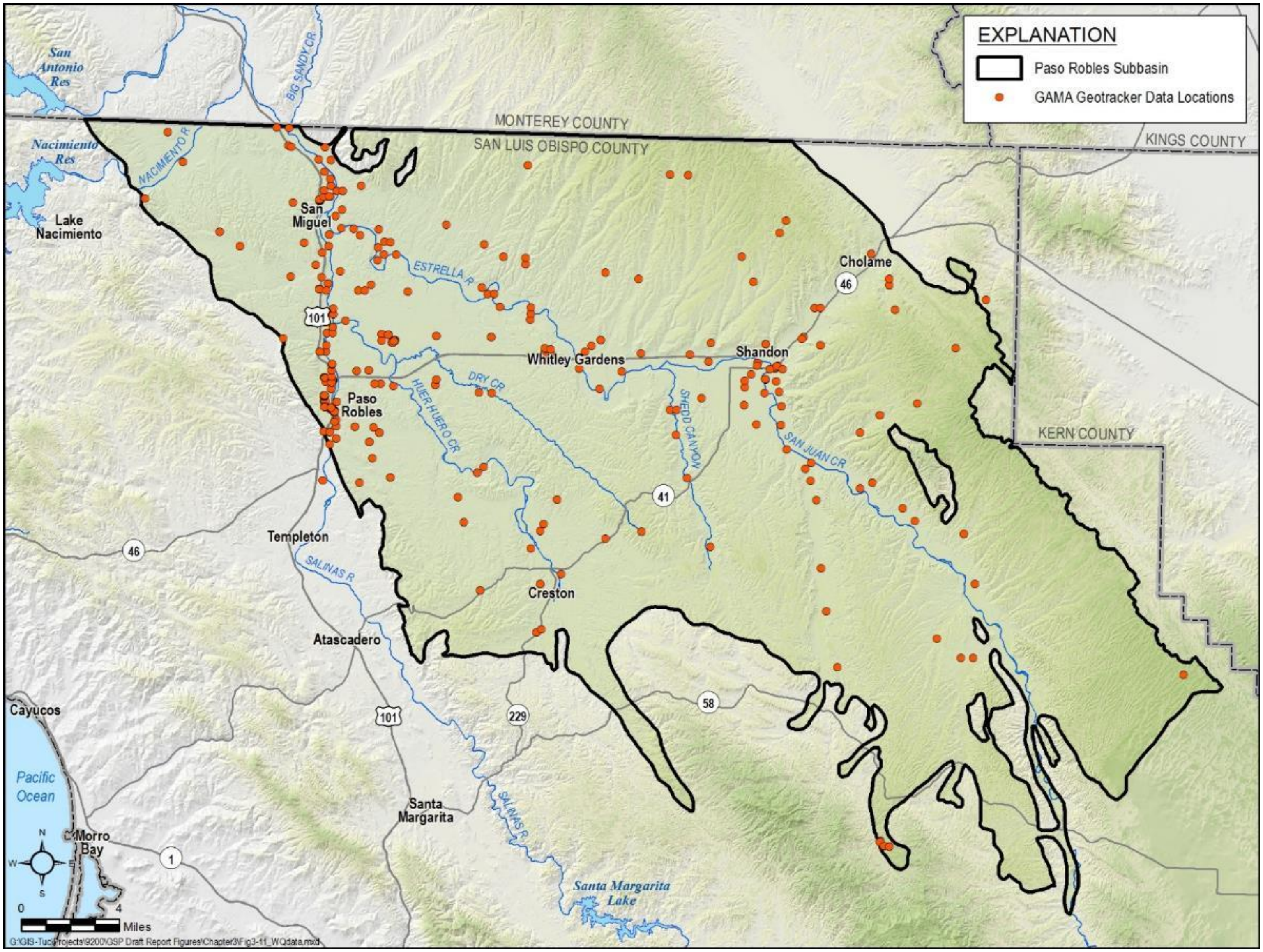


Figure 3-11. Groundwater Quality Monitoring Well Locations

3.6.3 Surface Water Monitoring

Stream gauges have historically been maintained and monitored by the USGS and the SLOFCWCD. Data are stored electronically in National Water Information System (NWIS) files and are retrievable from the USGS Water Resources Internet site.

The SLOFCWCD also stores electronic stream gauge data. There are various SLOFCWCD stream gauges surrounding the Subbasin, but no SLOFCWCD stream gauges lie within the Subbasin. Of the USGS stream gauges with historical data, only three gauges are currently active in the Subbasin:

- Salinas River above the City of Paso Robles,
- Estrella River near Estrella,
- Nacimiento River below the Nacimiento Dam near Bradley

A fourth stream gauge, the Salinas River gauge, lies at the base of Santa Margarita dam upstream of the Subbasin. This gauge is important for this GSP because it provides estimates of the streamflow released towards the Subbasin. Figure 3-12~~Figure 3-12~~ shows the locations of the three active stream gauges in the Subbasin and the one SLOFCWCD gauge upstream of the Subbasin. These three stream gauges in the study area report daily average stream flows.

3.6.4 Climate Monitoring

Climate data are measured at seven stations located in the Subbasin. Data from these seven stations were obtained from the SLOFCWCD. The locations of the stations are shown on Figure 3-13~~Figure 3-13~~. A discussion of climate will be provided in another chapter of the GSP (Chapter 6 – Water Budgets).

Figure 3-13

~~Figure 3-13~~ displays the long-term precipitation record at the Paso Robles station.

The Paso Robles precipitation station measures daily temperatures in addition to rainfall. The California Irrigation Management Information System (CIMIS) station number 163 in Atascadero measures a number of climatic factors that allow a calculation of daily reference evapotranspiration (ETo) for the area. Table 3-2~~Table 3-2~~ provides a summary of average monthly rainfall, temperature, and reference ETo for the Basin.

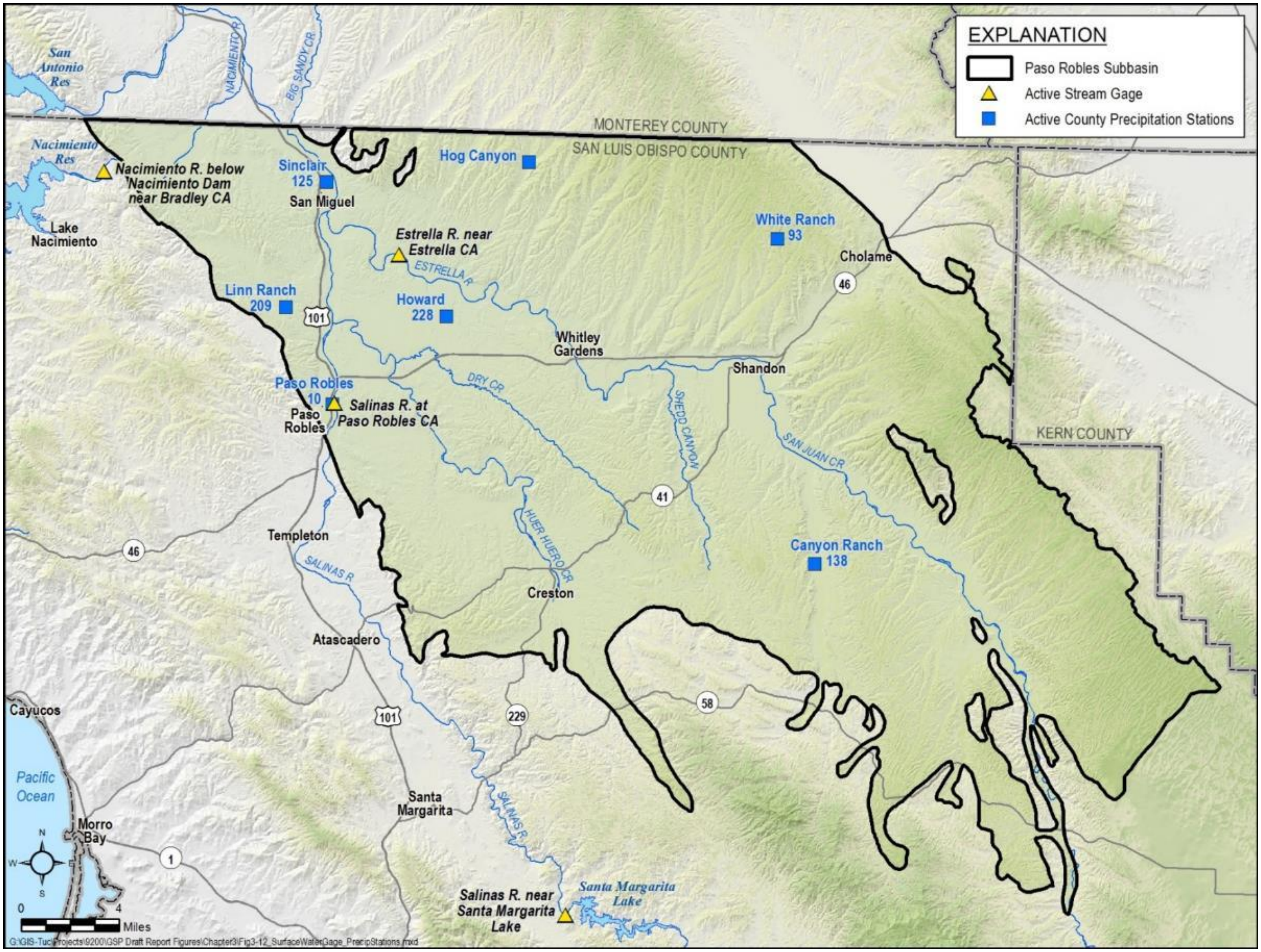


Figure 3-12. Surface Water Gauging and Precipitation Stations

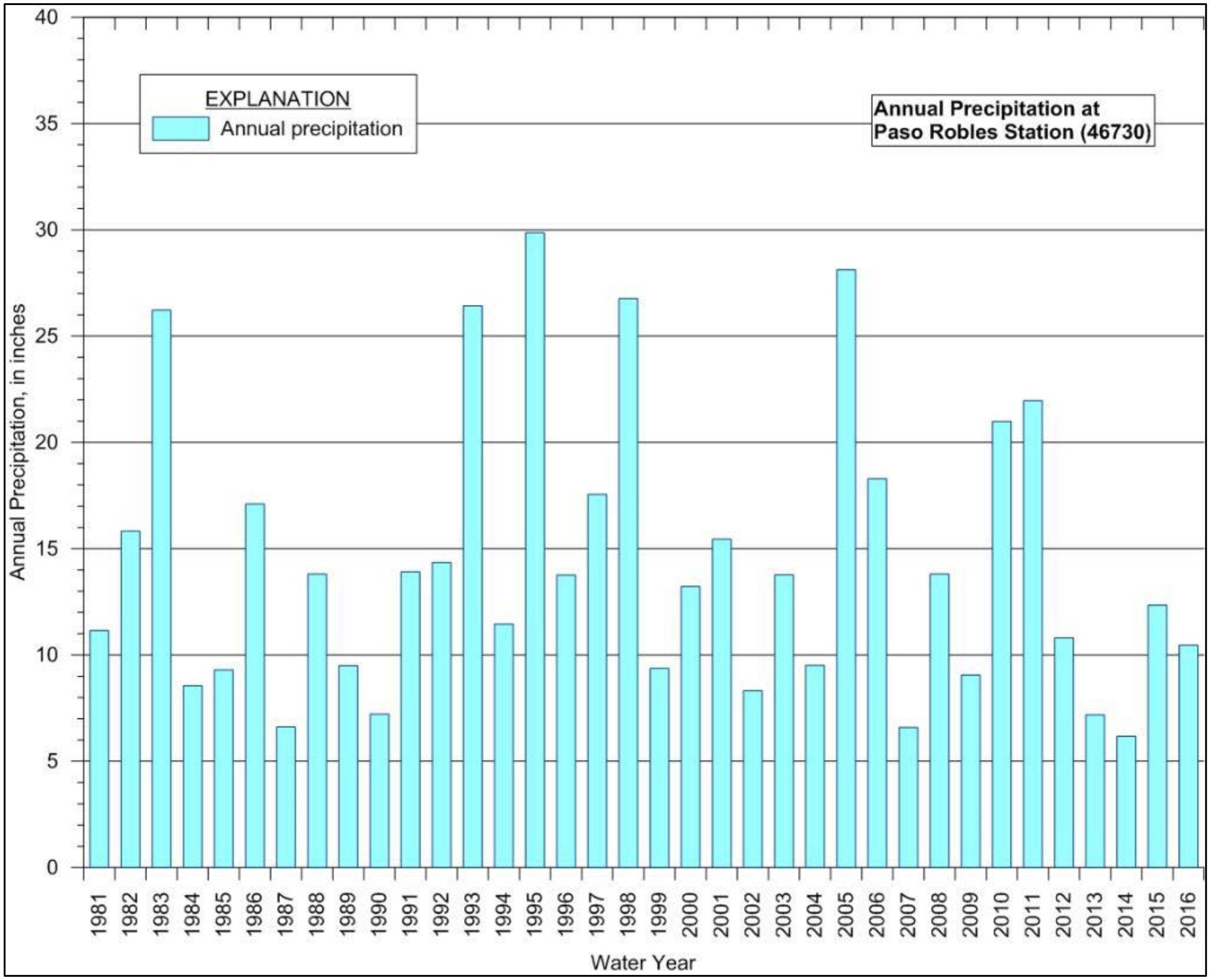


Figure 3-13. Annual Precipitation at the Paso Robles Station

Table 3-2. Average Monthly Climate Summary

Month	Average Rainfall (inches)[a]	Average ET_o (inches)[b]	Average Daily Temperature (F°)[c]
January	3.4	1.7	46.7
February	3.1	2.1	49.6
March	2.6	3.6	54.0
April	0.8	4.7	57.4
May	0.4	6.5	61.5
June	0.0	7.5	68.6
July	0.1	8.0	70.8
August	0.0	7.2	70.5
September	0.2	5.6	68.4
October	0.9	3.7	60.9
November	1.0	2.3	51.2
December	2.4	1.4	45.2
Monthly Average	1.2	4.5	-
Average Calendar Year [d]	15.0	54.5	58.7

[a] Average of monthly precipitation at Paso Robles Station 046730 for Jan 1989-Dec 2017 (NOAA NCDC).

[b] ETo = Average of monthly evapotranspiration at Paso Robles Station PR-1 for Jan 1989 through Dec 2017. PR-1 is operated by Western Weather Group. Data prior to Jan 2010 was compiled by Geoscience Support Services, Inc.

[c] Average daily temperature at Paso Robles Station (PR-1) for Jan 2010 through Dec 2017.

[d] Average Calendar Year is not the sum of monthly averages, but rather a historical annual average over the period of record.

3.6.4.1 Incorporating Existing Monitoring Programs into the GSP

The SLOFCWCD, the City of Paso Robles, and the City of San Miguel's monitoring programs provide a foundation of groundwater level data to develop the GSP. Chapter 7 of this GSP describes the long-term GSP Monitoring Program, including its relationship to the existing SLOFCWCD program.

The current water quality monitoring program for the production wells will be incorporated into this GSP to demonstrate that groundwater quality undesirable results do not occur based on data from a representative number of production wells. The existing stream gauges will also be incorporated into this GSP monitoring plan.

3.6.4.2 Limits to Operational Flexibility

The existing monitoring programs are not anticipated to limit the operational flexibility of this GSP.

3.7 Existing Management Plans

There are multiple groundwater and water management plans that cover the Subbasin. These plans are described in the following subsections, along with brief descriptions of how they relate to the management of current water supply, projected water supplies, and land use.

3.7.1 Groundwater Management Plan (2011)

The City of Paso Robles, having authority to manage the groundwater resources within their city limits, and SLOFCWCD, having authority to prepare a groundwater management plan within the unincorporated portions of the Paso Basin within San Luis Obispo County, developed a Groundwater Management Plan (GMP) (GEI, 2011) that is compliant with AB3030 and SB1938 legislation. The plan covered both the Atascadero and Paso Robles Subbasins but excluded the area between the San Juan and San Andreas Faults.

The GMP included a list of 73 groundwater management activities that could be implemented in the Subbasin. The groundwater management activities were grouped into various categories including stakeholder involvement, monitoring and data collection, resource protection, sustainability, and water management. The plan included an implementation schedule and a requirement for periodic updates.

3.7.2 San Luis Obispo County Master Water Report (2017)

The Master Water Report (MWR) (Carollo, 2017) is a compilation of the current and future water resource management activities being undertaken by various entities within San Luis Obispo County and is organized by Water Planning Areas (WPA). The MWR explores how these activities interrelate, analyzes current and future supplies and demands, identifies future water management strategies and ways to optimize existing strategies, and documents the role of the MWR in supporting other water resource planning efforts. The MWR evaluates and compares the available water supplies to the water demands for the different water planning areas. This was accomplished by reviewing or developing the following:

- Current water supplies and demands based on available information
- Forecast water demands and water supplies available in the future under current land use policies and designations
- Criteria under which there is a shortfall when looking at supplies versus demands

- Criteria for analyzing potential water resource management strategies, projects, programs, or policies
- Potential water resource management strategies, projects, programs, or policies to resolve potential supply deficiencies.

3.7.3 San Luis Obispo County Region Integrated Regional Water Management Plan (2014)

The San Luis Obispo County Integrated Regional Water Management Plan (IRWMP) was initially developed and adopted by the SLOFCWCD in 2005 (GEI Consultants, 2005), and has been updated several times. The 2014 IRWMP (San Luis Obispo County, 2014) included goals and objectives that provide the basis for decision-making and are used to evaluate project benefits. The goals and objectives reflect input from interested stakeholders on the region's major water resources issues.

The SLOFCWCD, in cooperation with the SLOFCWCD's Water Resources Advisory Committee (WRAC), prepared the IRWMP to align the region's water resources management planning efforts with the State's planning efforts. The IRWMP is used to support the Region's water resource management planning and submittal of grant applications to fund these efforts. The IRWMP integrated 19 different water management strategies that have or will have a role in protecting the region's water supply reliability, water quality, ecosystems, groundwater, and flood management objectives. The integration of these strategies resulted in a list of action items (projects, programs, and studies) needed to implement the IRWMP. The IRWMP is currently being updated, with a DWR submittal target date of October 2019.

3.7.4 Salt and Nutrient Management Plan for the Paso Robles Groundwater Basin (2015)

The City of Paso Robles, along with the City of Atascadero, San Miguel CSD, Templeton CSD, Heritage Ranch CSD, County of San Luis Obispo, and Camp Roberts, prepared a Salt and Nutrient Management Plan (SNMP) for the Subbasin in accordance with the State's 2009 Recycled Water Policy (RMC, 2015).

In the SNMP, baseline groundwater quality conditions were established as a framework under which salt and nutrient issues can be managed, and to streamline the permitting process of new recycled water projects while meeting water quality objectives and protecting beneficial uses. The SNMP will eventually be used by the Central Coast Regional Water Quality Control Board (CCRWQCB) to aid in the management of basin groundwater quality.

3.7.5 City of Paso Robles Urban Water Management Plan (2016)

The Urban Water Management Plan (UWMP) (Todd Groundwater, 2016) describes the City's current and future water demands, identifies current water supply sources, and assesses supply reliability for the City. The UWMP describes the City's reliance on groundwater and its support for efforts to mitigate or avoid conditions of overdraft by developing additional sources. The UWMP provides a forecast of future growth, water demand and water sources for the City through 2035. These sources include water conservation, surface water from Lake Nacimiento, and the use of recycled water for irrigation. The UWMP identifies beneficial impacts to groundwater quality through the use of these sources.

3.8 Existing Groundwater Regulatory Programs

There are several water-related regulatory programs in the Subbasin.

3.8.1 Salinas River Live Stream Agreement (SWRCB, 1972)

In 1972, the State Water Resources Control Board (SWRCB) issued a decision regarding the storage of water at Salinas Reservoir in order to protect vested downstream rights. The decision presumed that downstream rights would be met if a visible surface flow (i.e., a "live" stream) existed in the Salinas River between the Salinas Reservoir and the confluence with the Nacimiento River. If there was no live stream, then total daily inflow to the Salinas Reservoir was to be released to pass downstream.

The Live Stream Agreement was first implemented in 1972 using flow at the stream gauge on the Salinas River near the City of Paso Robles as an indicator of "live" stream conditions. In 1976, a set of six observation points was established to determine "visible surface flow". A seventh observation point, located immediately upstream of the Graves Creek confluence, was added in 1978. It is this seventh point that has always been the first point to go dry, triggering the live stream release period.

3.8.2 Groundwater Export Ordinance (2015)

In 2015, the County of San Luis Obispo passed an Exportation of Groundwater ordinance that requires a permit for the export of groundwater out of a groundwater basin or out of the County. An export permit is only approved if the Department of Public Works Director or his/her designee finds that moving the water would not have any adverse impacts to groundwater resources, such as causing aquifer levels to drop, disrupting the flow of neighboring wells or resulting in seawater intrusion. Export permits are only valid for one year.

3.8.3 County of San Luis Obispo Water Demand Offset Ordinance (2015)

In October 2015, the Board of Supervisors adopted the Ordinance and Resolution 2015-288. The Ordinance limited new or expanded irrigated agriculture in areas within the Subbasin except by offset of existing irrigated agriculture either on the same property or on a different property in the Subbasin. The Ordinance also identified areas of severe decline in groundwater elevation and properties overlying these areas would be further restricted from planting new or expanded irrigated agriculture except for those converting irrigated agriculture on the same property into a different crop type. Resolution 2015-288 established the Countywide Water Conservation Program (CWWCP). The CWWCP helps to substantially reduce increases in groundwater extraction in areas that have been certified Level of Severity (LOS) III.

In June 2019, the Board of Supervisors directed the County of San Luis Obispo Department of Planning and Building to develop recommendations for extending the Ordinance such that there is no gap between the expiration of the Ordinance and any pumping restrictions or controls that may be implemented as part of this GSP. The Department of Planning and Building is developing a two-phase extension. It is anticipated that the first phase will be presented to the Board of Supervisors in November, 2019, and will include a time extension as well as additions to the Ordinance that do not trigger significant review under CEQA. The second phase will likely be presented to the Board of Supervisors sometime in 2020, and will include Ordinance additions that may trigger more significant CEQA review.

3.8.4 Agricultural Order (RWQCB, 2017)

In 2017 the CCRWQCB issued Agricultural Order No. R3-2017-0002, a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (Agricultural Order). The permit requires that growers implement practices to reduce nitrate leaching into groundwater and improve surface receiving water quality. Specific requirements for individual growers are structured into three tiers based on the relative risk their operations pose to water quality.

Growers must enroll, pay fees, and meet various monitoring and reporting requirements according to the tier to which they are assigned. All growers are required to implement groundwater monitoring, either individually or as part of a cooperative regional monitoring program. Growers electing to implement individual monitoring (i.e., not participating in the regional monitoring program implemented by the Central Coast Groundwater Coalition or CCGC) are required to test all on-farm domestic wells and the primary irrigation supply well for nitrate or nitrate plus nitrite, and general minerals, including, but not limited to, total dissolved solids (TDS), sodium, chloride and sulfate.

3.8.5 Water Quality Control Plan for the Central Coast Basins (SWRCB, 2017)

The Water Quality Control Plan for the Central Coastal Basin (Basin Plan) was most recently updated in September 2017. The objective of the Basin Plan is to outline how the quality of the surface water and groundwater in the Central Coast Region should be managed to provide the highest water quality reasonably possible.

The Basin Plan lists beneficial users, describes the water quality which must be maintained to allow those uses, provides an implementation plan, details SWRCB and CCRWQCB plans and policies to protect water quality and a statewide surveillance and monitoring program as well as regional surveillance and monitoring programs.

Present and potential future beneficial uses for inland waters in the Basin are: surface water and groundwater as municipal supply (water for community, military or individual water supplies); agricultural; groundwater recharge; recreational water contact and non-contact; sport fishing; warm fresh water habitat; wildlife habitat; rare, threatened or endangered species; and, spawning, reproduction, and/or early development of fish.

Water Quality Objectives for both groundwater (drinking water and irrigation) and surface water are provided in the Basin Plan.

Total Maximum Daily Load (TMDLs) requirements have been developed for Fecal Indicator Bacteria and Alternative Implementation Program for the Cholame Creek Watershed and Lower San Antonio River Subwatershed in San Luis Obispo and Monterey Counties. A TMDL for boron in the Estrella River Subwatershed, San Luis Obispo and Monterey Counties has also been developed. A TDML for to the Upper Salinas River has not been developed.

The Basin Plan identified actions to be implemented in the Basin, including:

- Dischargers along the Salinas River should remain as separate treatment facilities with land disposal to evaporation/percolation systems and land application (irrigation) systems where possible. Disposal should be managed to provide maximum nitrogen reduction (e.g., through crop irrigation or wet and dry cycle percolation).
- The City of Paso Robles owns and operates a nominal 5 mgd secondary wastewater treatment plant. Treated wastewater is discharged to the Salinas River channel. Beneficial use of reclaimed water should be investigated and implemented, if feasible.
- The City of Paso Robles also owns and operates the wastewater facility serving the California Youth Authority and Paso Robles Airport. Wastewater from the California Youth Authority is currently treated at the City of Paso Robles' WWTP. This wastewater is part of the Recycled Water project that is currently in construction.

3.8.6 Requirements for New Wells

In October, 2017, Governor Brown signed Senate Bill (SB) 252 which became effective on January 1, 2018. SB 252 requires well permitting authorities to request certain information, such as depth of the proposed well, identification of existing wells on the property, the planned category of water use and the estimated cumulative extraction volume before January 1, 2020, from a well permit applicant to construct a new well within a critically overdrafted basin and to post the information provided. The law is subject to certain exceptions, such as the applicant would be a *de minimis* extractor, the proposed well is a replacement well that would not result in an increase in extraction, or the proposed well is located within an area subject to a GSP. The requirements set forth in SB 252 become inoperative on January 30, 2020.

3.8.7 Title 22 Drinking Water Program (SWRCB)

The SWRCB Division of Drinking Water (DDW) regulates public water systems in the State to ensure the delivery of safe drinking water to the public. A public water system is defined as a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. Private domestic wells, wells associated with drinking water systems with less than 15 residential service connections, industrial and irrigation wells are not regulated by the DDW. County of SLO Environmental Health has primacy and regulates smaller community systems less than 200 connections.

The SWRCB-DDW enforces the monitoring requirements established in Title 22 of the California Code of Regulations (CCR) for public water system wells, and all the data collected must be reported to the DDW. Title 22 also designates the regulatory limits (known as maximum contaminant levels [MCLs]) for various waterborne contaminants, including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters.

3.9 Monitoring and Management Programs with GSP

3.9.1 Incorporation into GSP

Information in these plans have been incorporated into this GSP and used during the preparation of Sustainability Goals, when setting Minimum Thresholds and Measurable Objectives, and were considered during development of Projects and Management Actions. This GSP specifically incorporates the following plans and programs, described above:

- The Salt and Nutrient Management Plan for the Paso Robles Groundwater Basin is incorporated into the existing conditions and the Sustainable Management Criteria.

- The County of San Luis Obispo Water Demand Offset Ordinance is acknowledged as an important tool for controlling new land uses dependent on groundwater until groundwater management controls can be finalized as part of GSP implementation.
- The Salinas River Live Stream Agreement requirements are incorporated into the Sustainable Management Criteria and sustainability projects as a restriction on the Salinas Dam operations and impacts to the Salinas River.
- The Groundwater Export Ordinance is incorporated as a limitation on groundwater use in the Projects and Management Actions.
- Agricultural Order (CCRWQCB, 2017) is incorporated into the monitoring plan and Sustainable Management Criteria as monitoring locations for agricultural water quality.

3.9.2 Limits to Operational Flexibility

Some of the existing management plans and ordinances will limit operational flexibility. These limits to operational flexibility have already been incorporated into the sustainability projects and programs included in this GSP. Examples of limits on operational flexibility include:

- The Groundwater Export Ordinance prevents export of water out of the Subbasin. This is likely not a significant limitation because exporting water out of the Subbasin hinders sustainability.
- The Basin Plan and the Title 22 Drinking Water Program restrict the quality of water that can be recharged into the Subbasin.

3.9.3 Conjunctive Use Programs

There are no active conjunctive use programs currently operating within the Subbasin.

3.10 Land Use Plans

The County of San Luis Obispo, the City of Paso Robles and Camp Roberts have land use authority. The GSAs do not have land use authority by virtue of being GSAs. Land use is an important factor in water management as described below. The following sections provide a general description of these land use plans and how implementation may affect groundwater. Per statute, when there is a substantial amendment to a city or county's general plan, the planning agency must review and consider the GSP.

3.10.1 City of Paso Robles General Plan (2011)

The City of Paso Robles General Plan is the fundamental land use policy document of the City of Paso Robles. The City's General Plan was developed to address several areas within the City's

Planning Area; which includes areas defined as City Limits, the Sphere of Influence, and the Planning Impact Area. The City's General Plan defines the framework by which the City's physical and economic resources are to be managed and used in the future. This City General Plan has a planning horizon of 2025.

Present City policy recommends that residential growth be managed toward a target population of 44,000 in 2025. Most growth is anticipated to occur within the existing City limits where services and public facilities are available. Additional growth is likely to occur in the urban area east of the Salinas River, but minor annexations to the City would be necessary in order to fully develop at the densities recommended in the City's General Plan.

3.10.2 San Luis Obispo County General Plan (2014)

The County of San Luis Obispo General Plan contains three pertinent elements that are related to land use and water supply. Pertinent sections include:

- Land Use Element
- Agricultural Element
- Inland Area Plans Element

The County General Plan also contains programs which are specific, non-mandatory actions or policies recommended by the Land Use and Circulation Element (LUCE) to achieve community or area wide objectives. Implementing each LUCE program is the responsibility of the County or other public agency that is identified in the program. Because programs are recommended actions rather than mandatory requirements, implementation of any program by the County should be based on consideration of community needs and substantial community support for the program and its related cost.

The LUCE, adopted in 2014, consolidates and reorganizes the former Adelaida, El Pomar-Estrella, Las Pilitas, Nacimiento, and Salinas River planning areas, and the northern portions of the Los Padres and Shandon-Carrizo planning areas, into a single watershed-based planning area called the North County planning area. The Planning Area does not conform to the Subbasin boundaries but does provide a general representation of the land use in the area.

Article 9 and Article 10 of the LUCE incorporates a number of community plans that were developed for the communities in the Subbasin. These include the Creston Village Plan, the North County Villages Plan, the San Miguel Community Plan, and the Shandon Community Plan.

The County General Plan identifies land use types and acres within the North County planning area. The data from the 2014 update are summarized on Table 3-3~~Table 3-3~~.

Table 3-3. Land Use Acreage

Land Use Category	Adelaida	El Pomar-Estrella	Las Pilitas	Los Padres North	Nacimiento	Salinas River	Shandon[2]	Total
Agriculture	152,715	104,762	21,270	11,613	36,049	52,954	348,569	**727,932**
Rural Lands	26,711	14,613	3,528	21,133	31,334	7,945	3,941	**109,205**
Recreation	277	0	460	0	2,725	664	0	**4,126**
Open Space	1,352	0	3,520	74,943	9,954	13,630	1,421	**104,820**
Residential Rural	77	11,816	625	0	2,363	5,530	170	**20,581**
Residential Suburban	0	363	0	0	0	82	0	**445**
Residential Single Family	0	0	0	0	0	22	0	**22**
Residential Multi-Family	0	0	0	0	0	0	0	**0**
Commercial Retail	0	0	8	0	0	5	3	**16**
Commercial Service	0	0	0	0	0	87	3	**90**
Industrial	0	0	0	0	0	20	0	**20**
Public Facilities	26,146	2	0	0	0	86	0	**26,234**
Dalidio Ranch	0	0	0	0	0	0	0	**0**
Total	**207,278**	**131,556**	**29,411**	**107,689**	**82,425**	**81,025**	**354,107**	**993,491**

[1]Acreage quantities are current as of the last major update to each of the former North County area plans (refer to Table 1-1).
[2]Northern half of the former Shandon-Carrizo planning area.

Projected growth in the planning subareas in the Subbasin as defined in the County General Plan includes:

- The City of Paso Robles population in 1995 was estimated to be 21,539, or 15.9 percent above the population of 18,138 in 1990, increasing at an average annual growth rate of 3.1 percent.
- Population in the Adelaida sub-area has been steadily increasing, but slower than the county as a whole. This pattern will likely continue, declining slightly as the countywide growth rate also declines.
- The Las Pilitas sub-area's present population is estimated to be 1,101. Since the sub- area contains no urban areas, a large population increase is not expected. Population growth in the Las Pilitas sub-area has been slightly less than 2 percent per year and is expected to slowly decline as the countywide growth rate also declines.

The SLO County Planning Department estimated potential water demands from rural residential areas in the County. They assumed that a reasonable ultimate build-out equates to development of 75 percent of all possible parcels currently zoned for rural residential areas. This would result in a rural residential demand of just over 37,000 AFY. This estimate includes small community water systems. If ultimate build-out occurred by 2025, the annual growth rate would be an unrealistic 12.8 percent. In order to determine the demand in 2025, a growth rate of 2.3 percent per year was assumed. As a result, the County estimated rural residential pumping in 2025 will be 16,504 AF, which is 44 percent of ultimate build-out.

An overarching assumption in this plan is that any future increases in groundwater use within the Subbasin will be offset by equal reductions in groundwater use in other parts of the Subbasin, or in other words, groundwater neutral through implementation of the GSP.

In addition, in 1990, the County created the Resource Management System (RMS) with the purpose of establishing a process whereby development could be sustained through planned resource management. The RMS focuses on collecting data, identifying issues and recommending solutions with respect to a number of resources, including water and sewage disposal. As part of the RMS, the County Planning and Building Department produces Biannual Resource Summary Reports (RSRs) and, under certain circumstances, Resource Capacity Studies (RCSs). When a resource deficiency becomes apparent, efforts are made to determine how the resource capacity might be expanded, where conservation measures could be introduced to extend the availability of the unused capacity, or where development should be limited or redirected to areas with remaining resource capacity.

The RMS uses resource-related data and analyses to classify resource deficiencies using three alert levels known as levels of severity (LOS). The criteria for each LOS in the context of water supply are as follows:

- LOS I is reached when water demand projected over 20 years equals or exceeds the estimated dependable supply.
- LOS II occurs when water demand projected over 15-20 years (or other lead time determined by an RCS) equals or exceeds the estimated dependable supply.
- LOS III is reached when water demand projected over 15 years (or other lead time determined by an RCS) equals or exceeds the estimated dependable supply or the time required to correct the problem is longer than the time available before the dependable supply is reached.

In 2007, the County Board of Supervisors directed staff to prepare an RCS for the water supply in the Paso Basin. The RCS addresses the state of the Paso Basin based on work already completed, which included:

- Paso Robles Groundwater Basin Study (Fugro, 2002)

- Paso Robles Groundwater Basin Study Phase II - Numerical Model Development, Calibration, and Application (Fugro, 2005)
- Evaluation of Paso Robles Groundwater Basin Pumping- Water Year 2006 (Todd, 2009)
- Paso Robles Groundwater Basin Water Balance Review and Update (Fugro, 2010)

These studies have calculated the water use by major water use sectors (agriculture, rural land uses, small commercial uses, municipal systems, and small community systems). These studies show that outflows exceed inflows on an average annual basis.

In February 2011, the County Board of Supervisors adopted the RCS, which recommended an LOS III for the Paso Basin and an LOS I for the Atascadero Basin. The RCS also recommended actions to include:

- Water conservation measures that will lead to more efficient water use.
- Land use controls that will reduce conflicts over the limited groundwater resource.

The RCS recognized various decision-making constraints that complicated potential actions by the County at that time, such as the limited regulatory role over water use throughout the entire basin. However, SGMA "…declares that it is vital that there be close coordination and consultation between California's water supply or management agencies and California's land use approval agencies to ensure that proper water supply and management planning occurs to accommodate projects that will result in increased demands on water supplies or impact water resource management." (Government Code 653525). Therefore it will be important to coordinate the County's land use authority with the planning and actions necessary to achieve the sustainability goals identified in local GSPs.

3.10.3 Camp Roberts Joint Land Use Study

Located north of the City of Paso Robles and spanning nearly 43,000 acres, Camp Roberts is one of the state's three main training bases for the California National Guard and trains more than 15,000 guardsmen in a typical year. Most of the base is in San Luis Obispo County, within the Subbasin, with the remainder in Monterey County. The Camp Roberts Joint Land Use Study was developed to improve communication between the installation and local communities about land use regulation and conservation decisions as well as natural resource management issues (Matrix Design Group, 2013).

The plan acknowledges groundwater supply planning must be coordinated to ensure viable water resources: "Groundwater supply is of great concern for San Luis Obispo and Monterey Counties. The increases in well drilling for development—residential, commercial, and agriculture—causes more concern in maintaining adequate levels of the Paso Robles Groundwater Basin.

Camp Roberts is a minimal user of the Basin, but development must be strategically planned to avoid unnecessary draws on the Basin."

The plan outlines the following monitoring activities related to water:

- Monitor surface water quality on Camp Roberts and throughout the watershed. Focus studies on the relationship between surface water and groundwater resources. Camp Roberts should allow collection of water samples on Camp Roberts by other agencies, if needed.

- Coordinate with local, regional and state water supply providers and permitting agencies to ensure continued availability of adequate potable water supplies. Identify primary users and anticipated needs through a future time period. Develop plans to sustain and manage water resources more efficiently and update plans regularly.

3.10.4 Land Use Plans Outside of Basin

The stakeholders submitting this GSP have not included information regarding the implementation of land use plans outside the Subbasin, as these adjacent subbasins are also required to implement SGMA and their GSPs will require them to achieve sustainable groundwater management.

4 HYDROGEOLOGIC CONCEPTUAL MODEL

This chapter describes the hydrogeologic conceptual model of the Paso Robles Subbasin, including the Subbasin boundaries, geologic formations and structures, and principal aquifer units. The chapter also summarizes general Subbasin water quality, the ~~conceptual~~ interaction between groundwater and surface water, and generalized groundwater recharge and discharge areas. This chapter draws upon previously published studies, primarily hydrogeologic and geologic investigations by Fugro Consultants Inc. completed for SLOFCWCD in 2002 and 2005. Subsequent groundwater model updates (GSSI 2014 and 2016), relied upon the original geologic interpretations (Fugro, 2002 and 2005), with the exception of the basin boundaries that are defined in accordance with Bulletin 118 (DWR 2003 and 2016a). The Hydrogeologic Conceptual Model presented in this chapter is a summary of aspects of the Subbasin hydrogeology that influence groundwater sustainability based on available information. The basin understanding will be adapted as hydrogeology is better understood in the future. Detailed information can be found in the original reports (Fugro, 2002 and 2005). This chapter, along with Chapter 3 – Description of Plan Area, sets the framework for subsequent chapters on groundwater conditions and water budgets.

4.1 Subbasin Topography and Boundaries

The Subbasin is a structural northwest-trending trough filled with sediments that have been folded and faulted by regional tectonics. The top of the Subbasin is the ground surface. The elevation of the Subbasin ranges from approximately 2,000 feet above mean sea level (msl) at the southeastern corner to approximately 600 feet above msl in the northwest where the Salinas River exits the Subbasin.

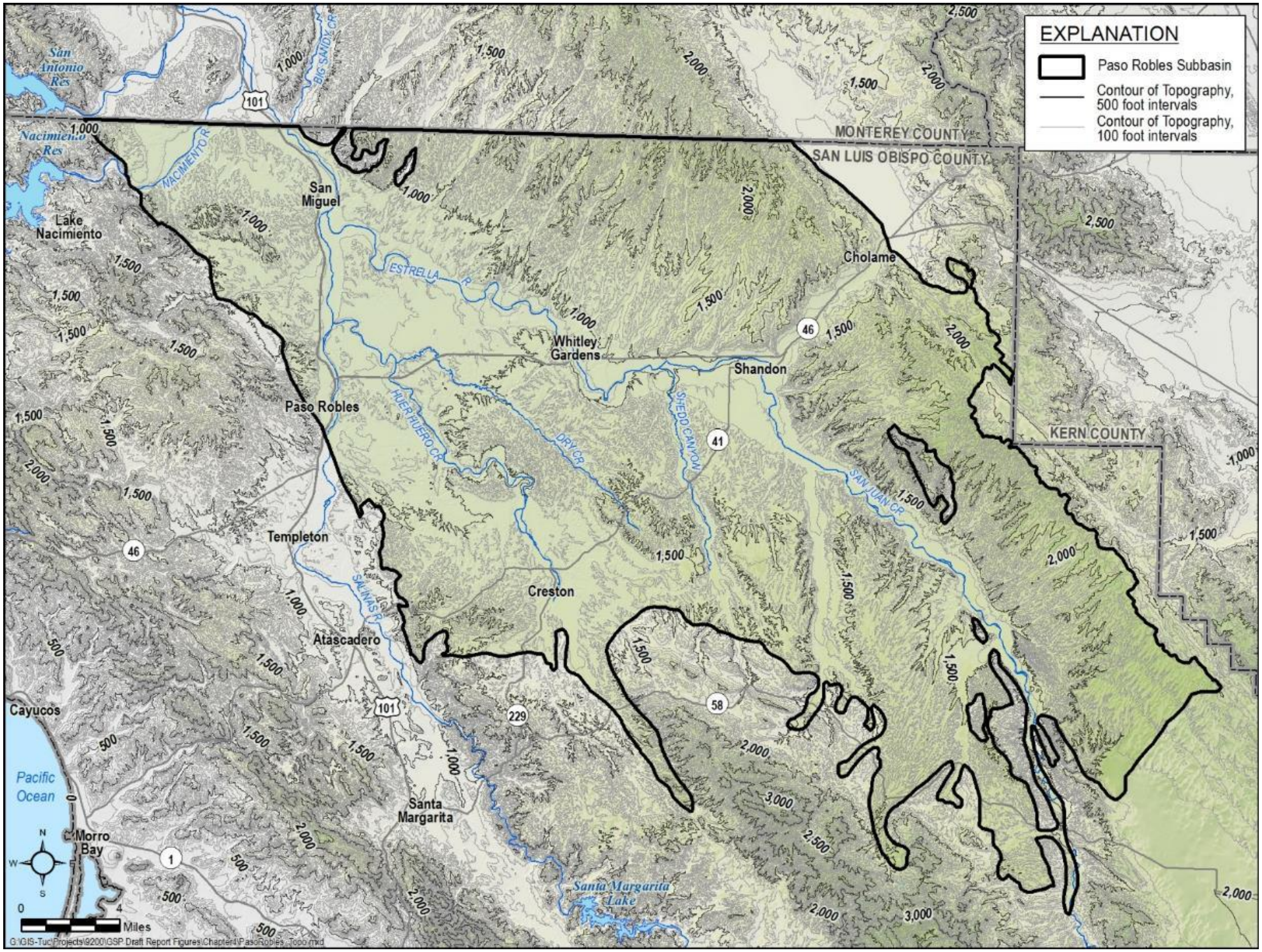


Figure 4-1. Paso Robles Subbasin Topography

Figure 4-1 shows the topography of the Subbasin using 100-foot contour intervals. The Subbasin is bounded by sediments with low permeability, sediments with poor groundwater quality, rock, and structural faults. In some areas the sediments of the Subbasin are continuous with adjacent subbasins.

The bottom of the Subbasin is generally defined as the base of the Paso Robles Formation, an irregular surface formed as the result of folding, faulting, and erosion (Fugro, 2002). The Subbasin bottom is not considered an absolute barrier to flow because some of the geologic units underlying the Paso Robles Formation produce sufficient quantities of water, but the water is generally of poor quality and therefore, is not considered part of the Subbasin. Figure 4-2 shows the lateral boundaries of the Subbasin and the approximate depth to the bottom of Paso Robles Formation in areas where it is saturated.

The Subbasin lateral boundaries are as follows:

- The western boundary of the Subbasin is defined by the contact between the sediments in the Subbasin and the sediments of the Santa Lucia Range. An additional section of the western boundary is defined by the San Marcos-Rinconada fault system which separates the Paso Robles Subbasin from the Atascadero Subbasin.
- The northern boundary of the Subbasin is defined by the county line between San Luis Obispo County and Monterey County. This boundary is not defined by a physical barrier to groundwater flow; water-bearing sediments are continuous with the Salinas Valley Upper Valley Subbasin in Monterey County.
- The eastern boundary of the Subbasin is defined by the contact between the sediments in the Subbasin and the sediments of the Temblor Range. The San Andreas Fault generally forms the northeastern Subbasin boundary, although the basin boundary was identified in the groundwater model as further west, in the area of the White Canyon/Red Hills/San Juan faults (Fugro, 2002).
- The southern boundary of the Subbasin is defined by the contact between the sediments in the Subbasin and the sediments of the La Panza Range. To the southeast, a watershed divide separates the Subbasin from the adjacent Carrizo Plain Basin; sedimentary layers are likely continuous across this divide.

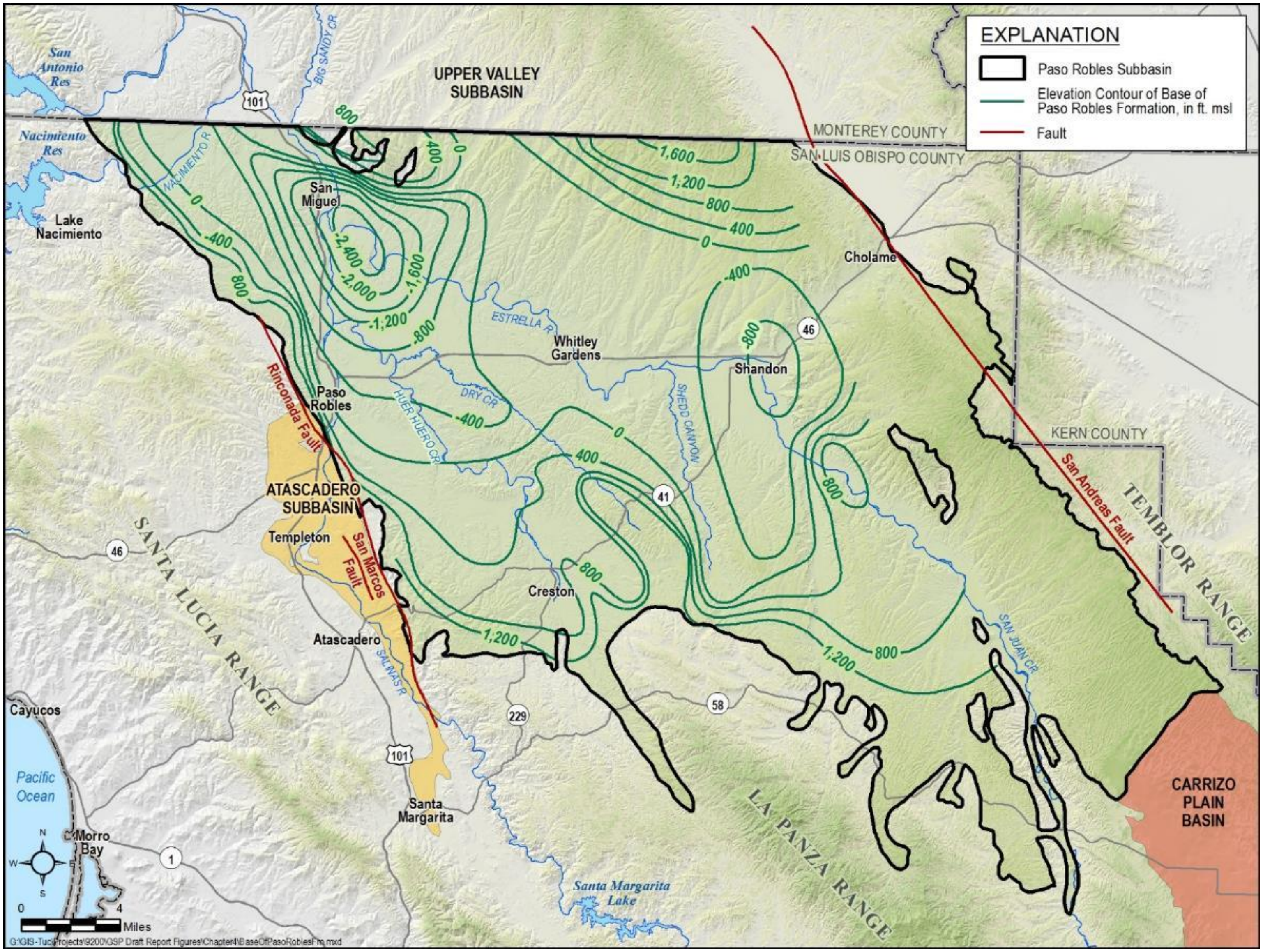


Figure 4-2. Base of Subbasin as Defined by the Base of the Paso Robles Formation

4.2 Soils Infiltration Potential

Saturated hydraulic conductivity of surficial soils is a good indicator of the soil's infiltration potential. Soil data from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (USDA NRCS, 2018) is shown by the four hydrologic groups on Figure 4-3. The soil hydrologic group is an assessment of soil infiltration rates that is determined by the water transmitting properties of the soil, which includes hydraulic conductivity and percentage of clays in the soil, relative to sands and gravels. The hydrologic soil group is "determined by the water transmitting soil layer with the lowest saturated hydraulic conductivity and depth to any layer that is more or less water impermeable or depth to a water table" (USDA NRCS, 2007).The groups are defined based on characteristics within 100 centimeters (40 inches) of the surface as:

- Group A – High Infiltration Rate: water is transmitted freely through the soil; soils typically less than 10 percent clay and more than 90 percent sand or gravel
- Group B – Moderate Infiltration Rate: water transmission through the soil is unimpeded; soils typically have between 10 and 20 percent clay and 50 to 90 percent sand
- Group C – Slow Infiltration Rate: water transmission through the soil is somewhat restricted; soils typically have between 20 and 40 percent clay and less than 50 percent sand
- Group D – Very Slow Infiltration Rate: water movement through the soil is restricted or very restricted; soil typically have greater than 40 percent clay, less than 50 percent sand

The hydrologic group of the soil generally correlates with the hydraulic conductivity of underlying geologic units, with lower soil hydraulic conductivity zones correlating to areas underlain by clayey portions of the Paso Robles Formation. The higher soil hydraulic conductivity zones correspond to areas underlain by alluvium or areas of coarser sediments within the Paso Robles Formation.

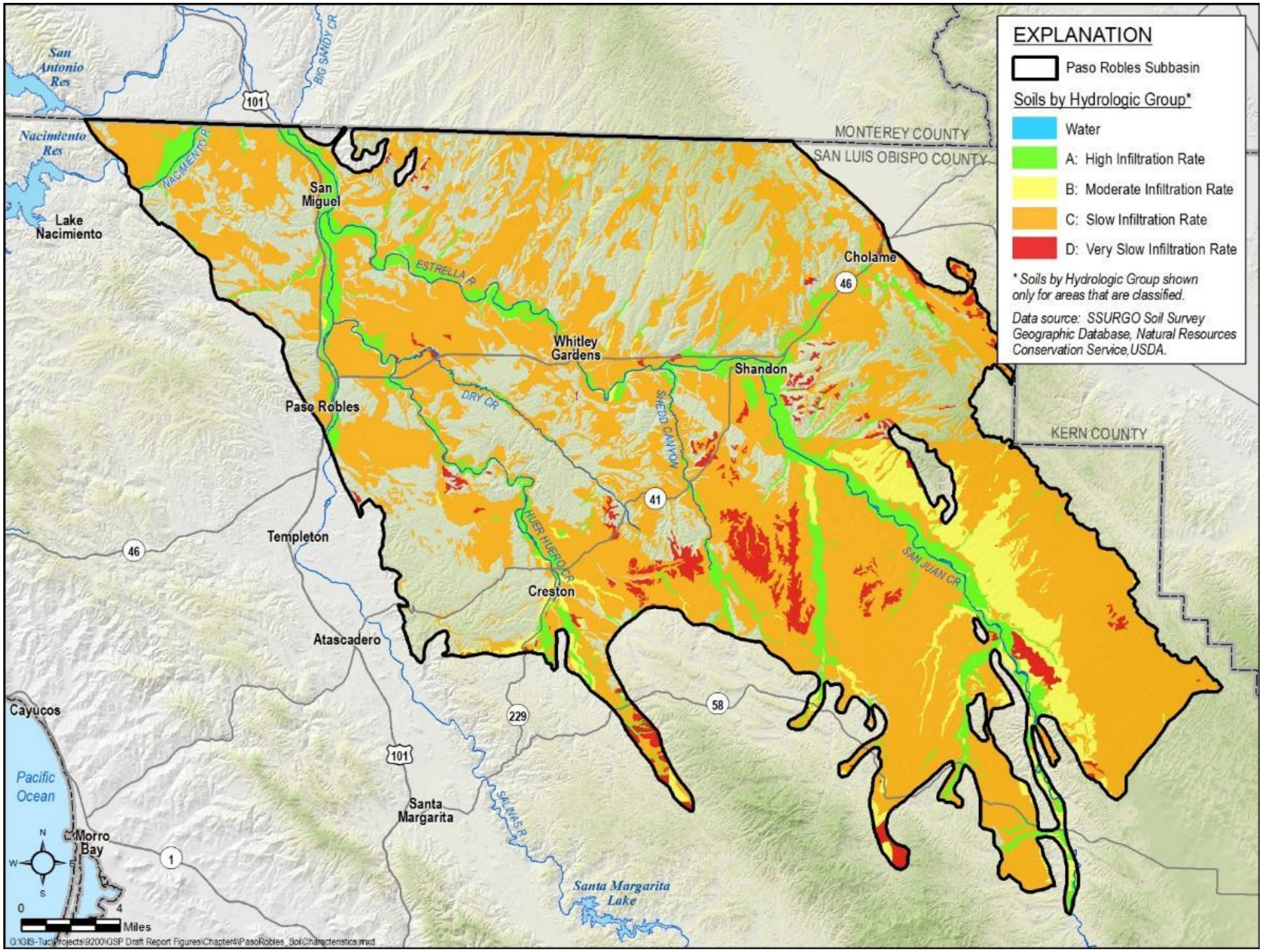


Figure 4-3. Paso Robles Subbasin Soil Characteristics

4.3 Regional Geology

This section provides a description of the geologic formations in the Subbasin. These descriptions are summarized from previously published reports by Fugro (2002 and 2005). Figure 4-4 shows the surficial geology and geologic structures of the Subbasin (County of SLO, 2007). Figure 4-5 provides the location of the geologic cross-sections shown on Figure 4-6 through Figure 4-10. The selected geologic cross-sections illustrate the relationship of the geologic formations that constitute the Subbasin and the geologic formations that underlie and surround the Subbasin based on lithologic data from wells. The cross-sections are from different reports so the format differs but the geologic units are consistent. Likewise, the cross sections were created from base maps that are not included in this report but the general geologic units and structures are the same as represented in Figure 4-4. Figure 4-6 through Figure 4-8 are from Fugro (2002). Figure 4-9 and Figure 4-10 are from Fugro (2005), which also label the various layers from the groundwater model that was developed at this time. The groundwater model was subsequently updated (GSSI, 2016) and is presented in Chapter 6.

4.3.1 Regional Geologic Structures

The base of the Subbasin is locally divided by two semi-parallel bedrock ridges: the San Miguel Dome and the Creston Anticlinorium (Figure 4-4). These two bedrock ridges are often not exposed at the ground surface, but are apparent in the east – west subsurface cross-sections, which show subsurface expression of the bedrock. Cross sections Figure 4-6 and Figure 4-8 show these areas where bedrock (generally consisting of the Pancho Rico Formation, the Santa Margarita Formation, or the Monterey Formation) is shallow or exposed at the surface. The shallow bedrock ridge does not appear to be present between San Miguel and Creston (Figure 4-7).

The deepest portion of the Subbasin is west of the San Miguel Dome and north of Paso Robles, with over 3,000 feet of sediments (Fugro, 2005). This deep trough extends through the Paso Robles area and shallows progressively to the south. As shown on Figure 4-6, the sediments are generally relatively thin on the order of a few hundred feet in the Creston area. East of the San Miguel Dome and near the community of Shandon the Paso Robles Formation is over 2,000 feet thick.

The faults within and along the borders of the Subbasin boundaries are shown on Figure 4-6 and are based on the basin boundaries defined by the State's Bulletin 118 – 2003 Update (DWR, 2003). The predominant fault near the western side of the Subbasin is the San Marcos-Rinconada fault system. The predominant fault near the eastern side of the Subbasin is the San Andreas Fault. Within the Subbasin and sub-parallel to the San Andreas Fault are the Red Hill, San Juan, and White Canyon faults, but it is unknown to what degree these faults are barriers to groundwater flow. These faults could create compartments in the sediments and limit the ability of groundwater to move within the Subbasin. The Paso Robles Formation is either not present or not saturated east of the San Juan fault system; there is very little well data in this portion of the Subbasin.

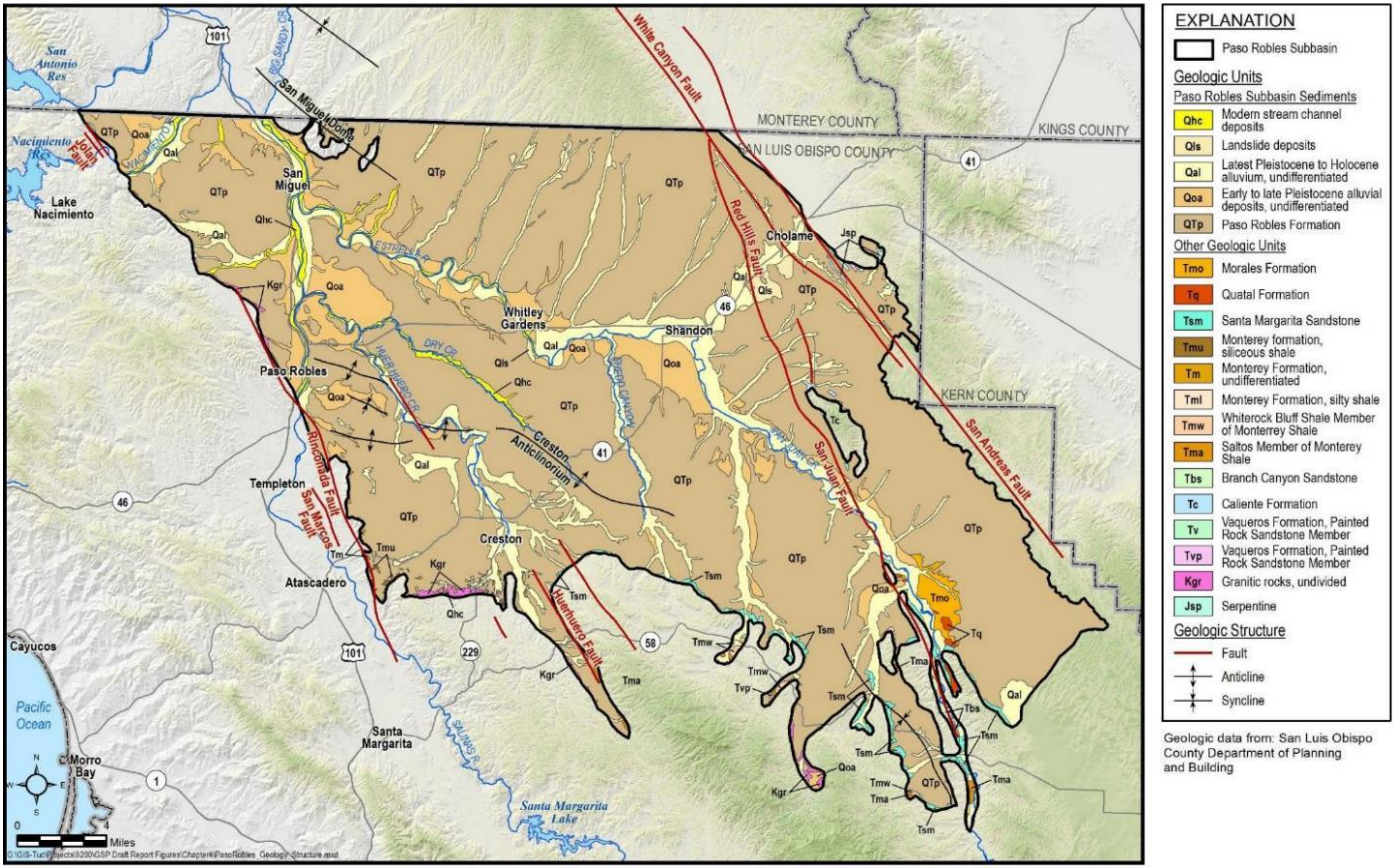


Figure 4-4. Surficial Geology and Geologic Structures

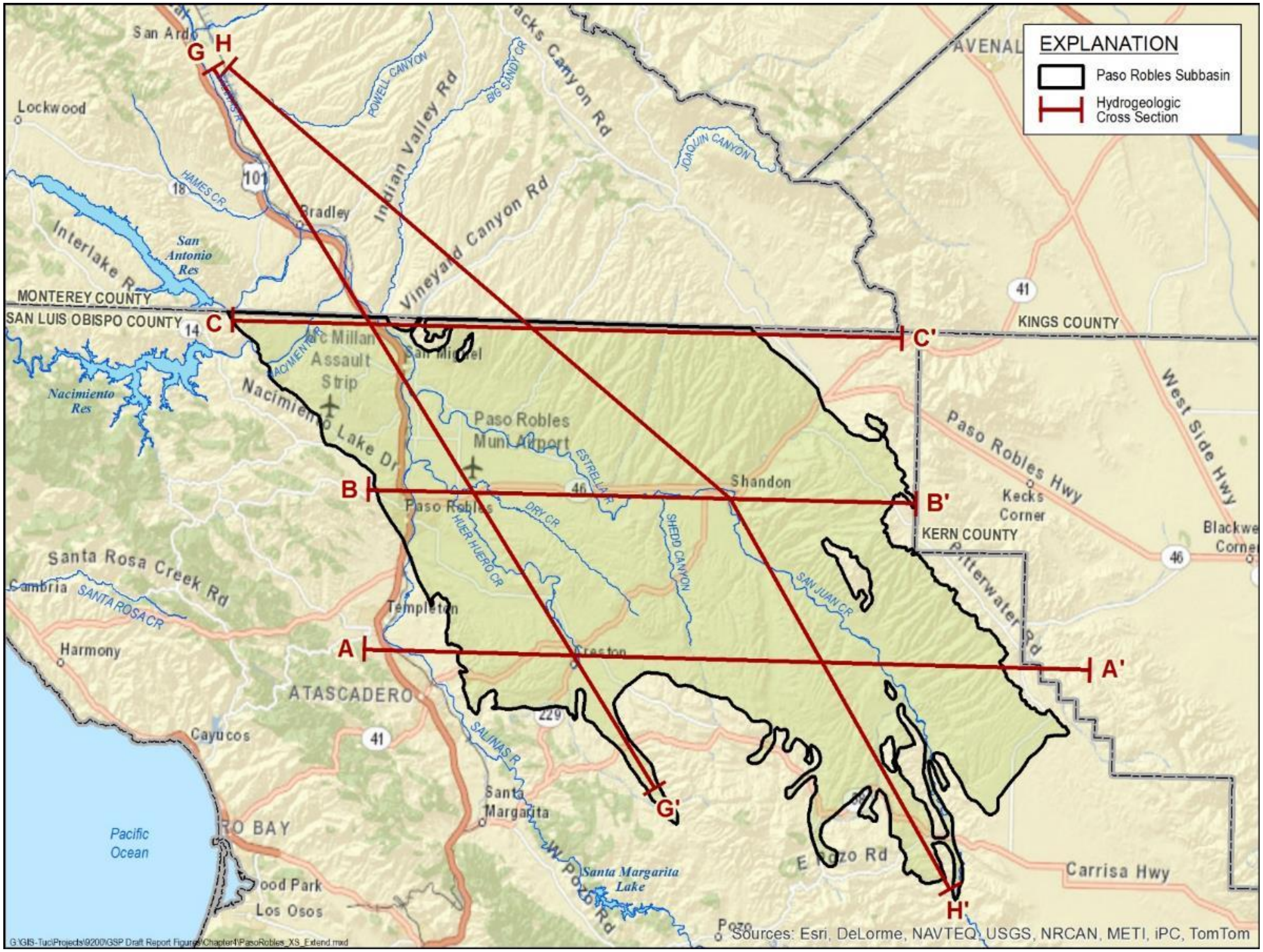
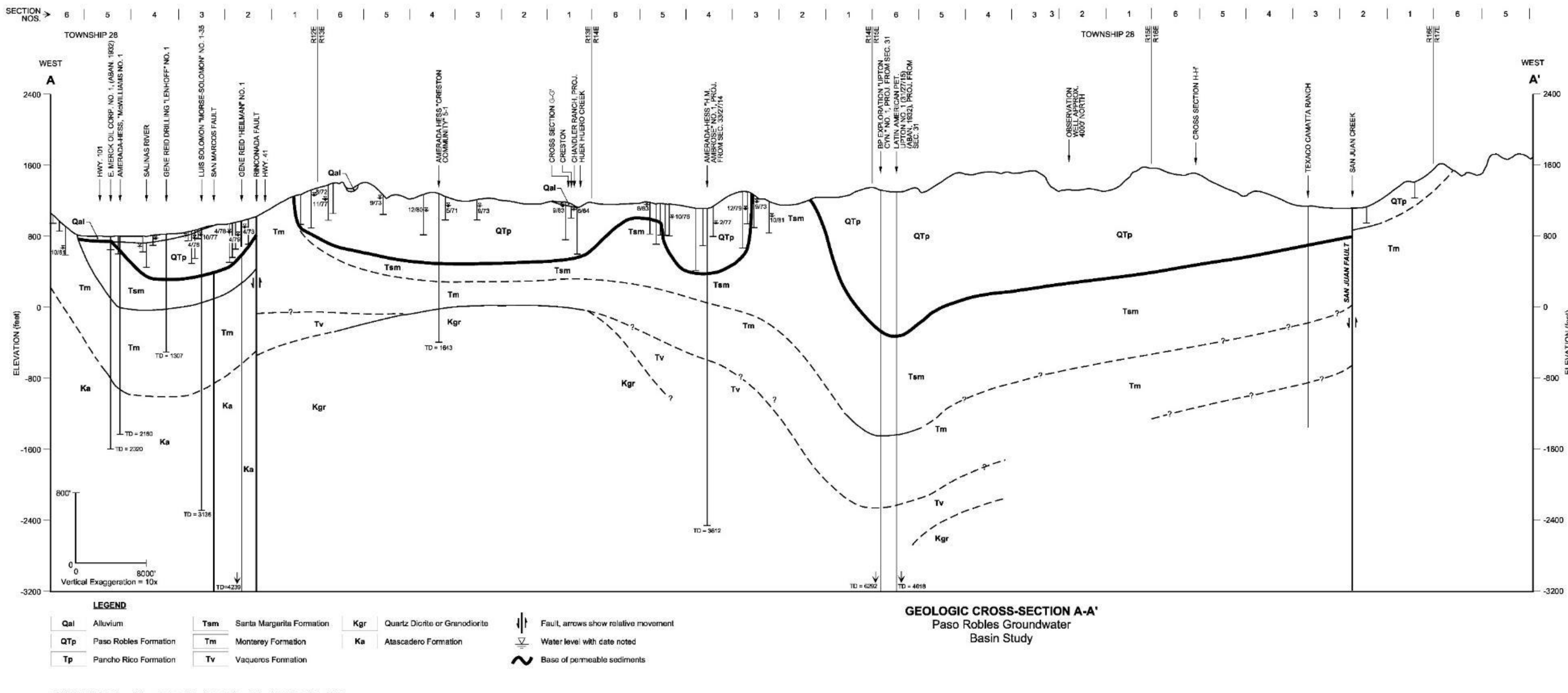
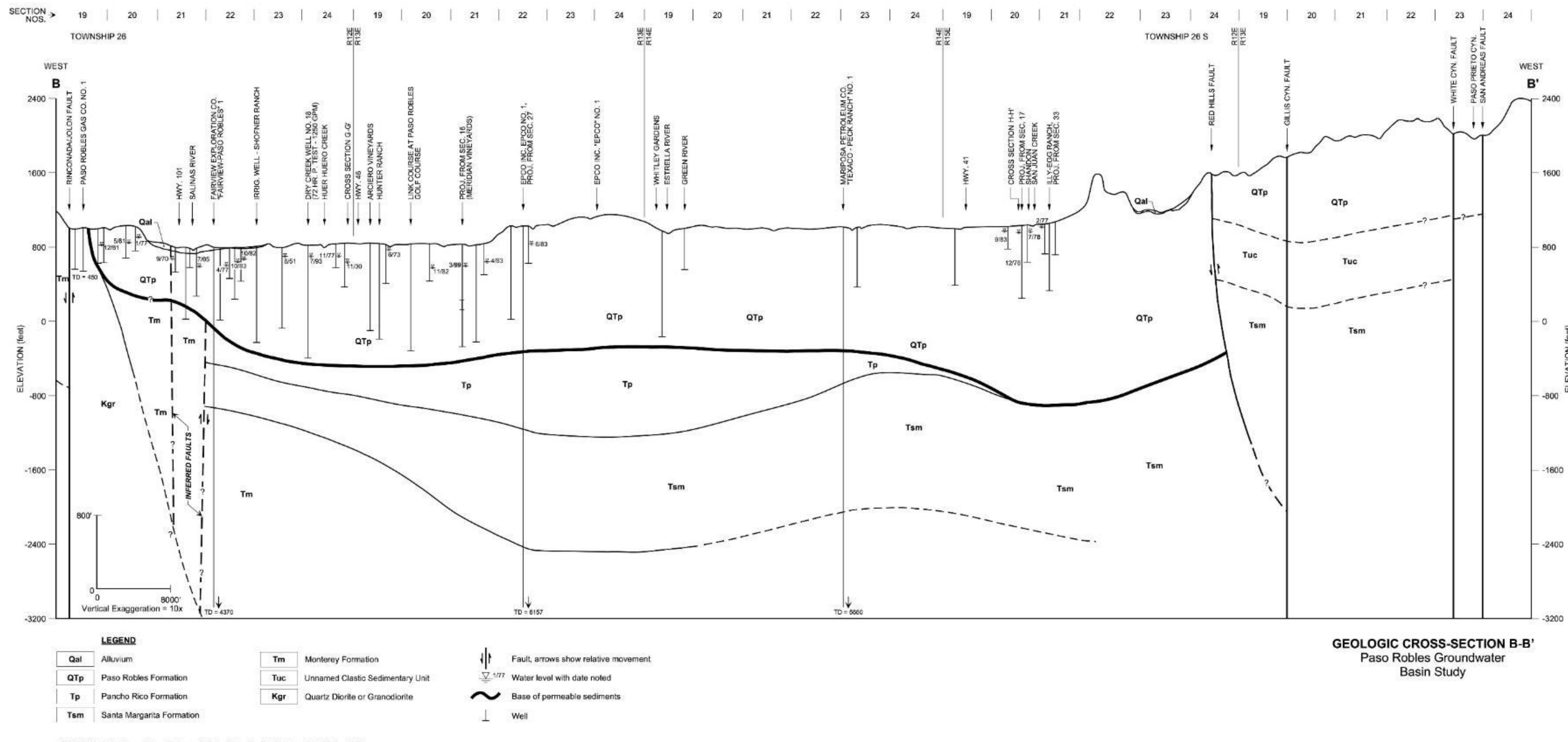


Figure 4-5. Cross Sections Locations



Source: Modified from Fugro (2002)

Figure 4-6. Geologic Section A-A'



Source: Modified from Fugro (2002)

Figure 4-7. Geologic Section B-B'

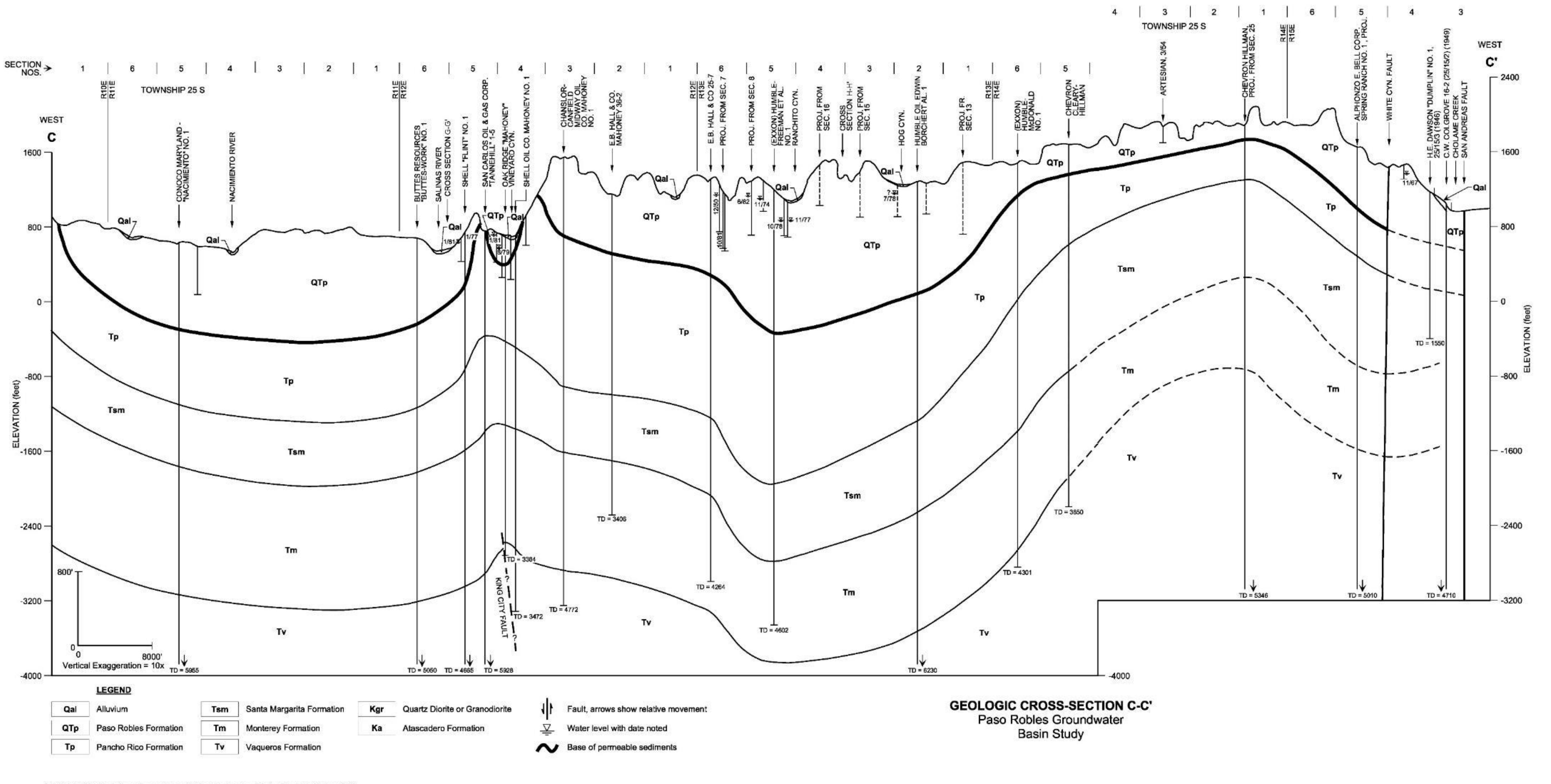


Figure 4-8. Geologic Section C-C'

Source: Modified from Fugro (2002)

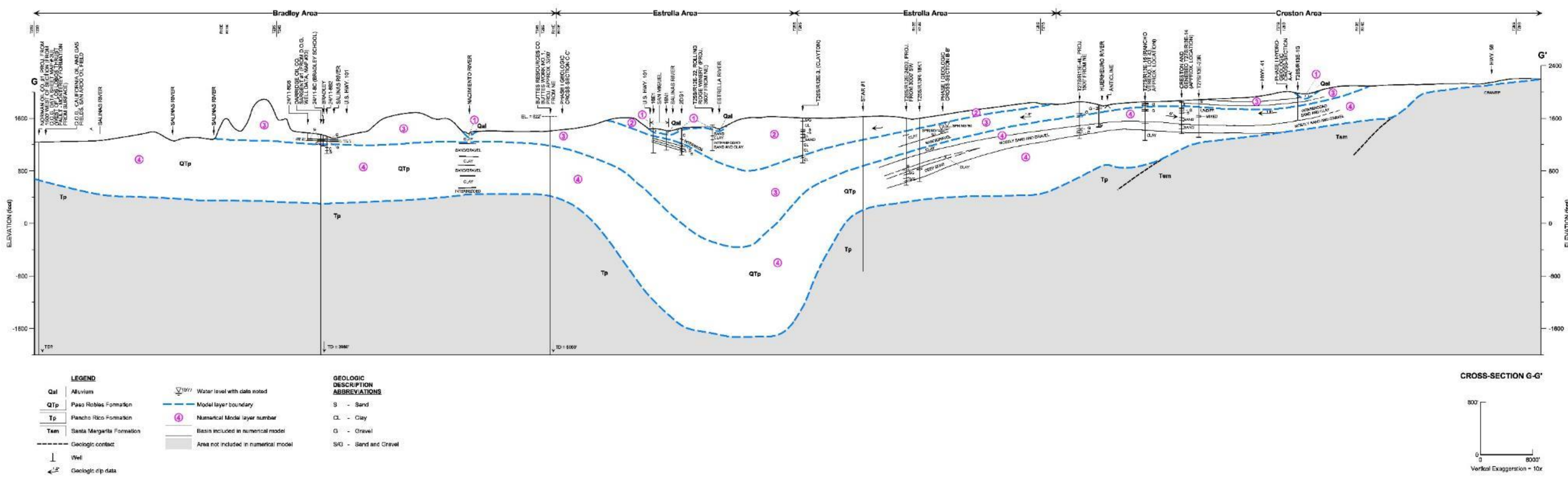


Figure 4-9. Geologic Section G-G’

Source: Modified from Fugro (2005)

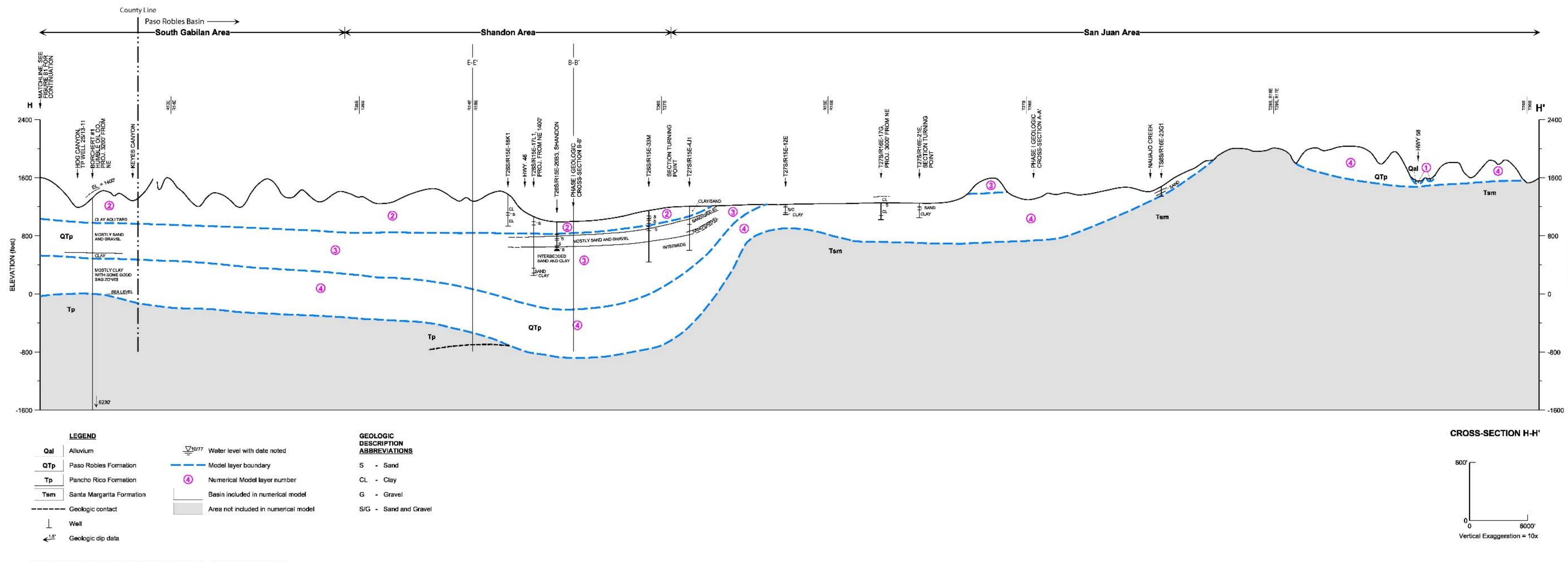


Figure 4-10. Geologic Section H-H'

Source: Modified from Fugro (2005)

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4.3.2 Geologic Formations Within the Subbasin

The main criteria used by previous authors for defining which geologic formations constitute the groundwater basin are:

1. The formation must have sufficient permeability and storage potential for the movement and storage of groundwater such that wells can reliably produce more than 50 gallons per minute (gpm), and

2. The groundwater produced from the geologic formation must be of generally acceptable quality (Fugro, 2002) based on the classification by DWR (1979) of groundwater with a conductivity of 3,000 micromhos/centimeter or less as fresh water.

The only two geologic formations that reliably meet these two criteria are the Quaternary-age alluvial deposits and the Tertiary-age Paso Robles Formation. Therefore, these are the only two formations that constitute the Subbasin. A general discussion of these two formations is presented below.

4.3.2.1 Alluvium

Alluvium occurs beneath the flood plains of the rivers and streams within the Subbasin. Figure 4-4 shows the location of the alluvial deposits, labeled as Quaternary alluvium, identified as Qal. These deposits are typically no more than 100 feet thick and comprise coarse sand and gravel with some fine-grained deposits. The alluvium is generally coarser than the Paso Robles Formation, with higher permeability that results in well production capability that often exceeds 1,000 gpm.

4.3.2.2 Paso Robles Formation

The largest volume of sediments in the Subbasin is in the Paso Robles Formation. This formation has sedimentary layers up to 3,000 feet thick in the northern part of the Estrella area and up to 2,000 feet near Shandon. Figure 4-4 shows the location of the Paso Robles Formation deposits, identified as QTp. Throughout most of the Subbasin the Paso Robles Formation sediments have a thickness of 700 to 1,200 feet.

The Paso Robles Formation is derived from erosion of nearby mountain ranges. Sediment size decreases from the east and the west, becoming finer towards the center of the Subbasin, indicating sediment source areas are both to the east and west. The Paso Robles Formation is a Plio-Pleistocene, predominantly non-marine geologic unit comprising relatively thin, often discontinuous sand and gravel layers interbedded with thicker layers of silt and clay. The formation was deposited in alluvial fan, flood plain, and lake depositional environments. The formation is typically unconsolidated and generally poorly sorted. The sand and gravel beds in the Paso Robles Formation have a high percentage of eroded Monterey shale and have lower permeability compared to the overlying alluvial unit. The formation also contains minor amounts of gypsum and woody coal.

Poor quality groundwater with elevated concentrations of iron, manganese, and in some cases hydrogen sulfide odor has been observed within deeper portions of the Paso Robles Formation in some areas. There is no published evidence of elevated arsenic. The 2002 Fugro report says, “No fluoride, arsenic, selenium, or uranium radioactivity exceeded the MCL in the samples reviewed from public water purveyor wells” and “Dissolved arsenic concentrations are present in most areas of the basin, typically at levels below 10 µg/l.”

4.3.3 Geologic Formations Surrounding the Subbasin

Underlying and surrounding the Subbasin are older geologic formations that either typically have low well yields or have poor quality water. In general, the geologic units underlying the Subbasin include:

1. Tertiary-age or older consolidated sedimentary beds;
2. Cretaceous-age metamorphic rocks; and
3. Granitic rock.

Figure 4-11 shows the location of oil and gas exploration wells drilled in the Subbasin. These oil and gas wells help identify the depth and extent of the geologic formations that surround and underlie the Subbasin.

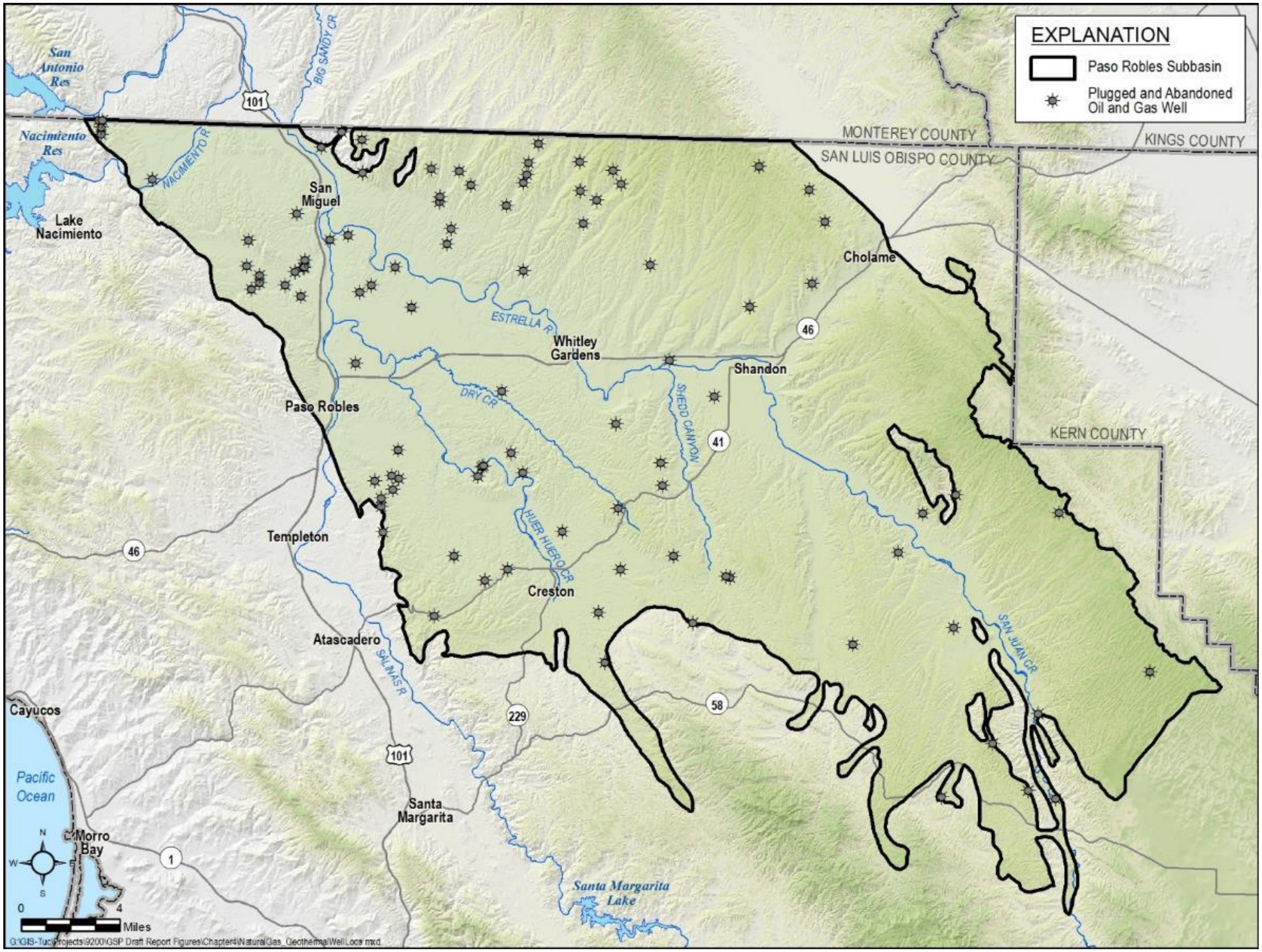


Figure 4-11. Natural Gas Exploration Well Locations and Geothermal Wells

4.3.3.1 Pancho Rico Formation

The Pancho Rico Formation (Tp) is a Pliocene-age marine deposit found mostly in the northern portion of the study area. In places it appears to be time-correlative to the Paso Robles Formation, and may be in lateral contact as a facies change. The unit predominantly consists of fine-grained sediments up to 1,400 feet thick that yield low quantities of water.

4.3.3.2 Santa Margarita Formation

The Santa Margarita Formation (Tsm) is an upper Miocene-age marine deposit, consisting of a white, fine-grained sandstone and siltstone with a thickness of up to 1,400 feet. The unit is found beneath most of the Subbasin. The Santa Margarita Formation is relatively permeable, but is not considered part of the Subbasin because the water quality is usually very poor. The geothermal waters contained in the Santa Margarita Formation in this area are often highly mineralized and characterized by elevated boron concentrations that restrict agricultural uses.

4.3.3.3 Monterey Formation

The Miocene-age Monterey Formation (Tm) consists of interbedded argillaceous and siliceous shale, sandstone, siltstone, and diatomite. The unit is as great as 2,000 feet thick in the study area, and is often highly deformed. Wells in the Monterey Formation are generally of too low yield to consider the Monterey Formation part of the Subbasin; although isolated areas in the Monterey Formation can yield more than 50 gpm. Additionally, groundwater produced from the Monterey Formation often has high concentrations of hydrogen sulfide, total organic carbon, manganese, and iron.

4.3.3.4 Vaqueros Formation

The marine Oligocene-age Vaqueros Formation (Tv) is a highly cemented fossiliferous sandstone that reaches a thickness up to 200 feet. Springs in the Vaqueros Formation with flows up to 25 gpm are common in canyons on the western and southern sides of the study area. Most water wells tapping this formation produce less than 20 gpm. Generally, the quality of water in this unit is good, though hard due to the calcareous cement within the rock.

4.3.3.5 Metamorphic and Granitic Rocks

The southern and western edges of the Subbasin are bordered by Cretaceous-age metamorphic and granitic rock. The metamorphic rock units include the Franciscan, Toro, and Atascadero Formations. The Franciscan consists of discontinuous outcrops of shale, chert, metavolcanics, graywacke, and blue schist, with or without serpentinite. The Toro Formation (Kt) is a highly consolidated claystone and shale that does not typically yield significant water to wells. The

Atascadero Formation (Ka) is highly consolidated, but does have some sandstone beds that yield limited amounts of water to wells.

The granitic rock unit (Kgr) lies east of the Rinconada fault system, south of Creston, east of Atascadero, and in the area northwest of Paso Robles. The granitic rocks are often capped by a layer of granular decomposed granite that may be weathered to clay. This decomposed granite may be up to 80 feet in thick and may contain limited amounts of groundwater.

4.4 Principal Aquifers and Aquitards

Water-bearing sand and gravel beds that may be laterally and vertically discontinuous are generally grouped together into zones that are referred to as aquifers. The aquifers can be vertically separated by fine-grained zones that can impede movement of groundwater between aquifers. Two aquifers exist in the Subbasin:

- A relatively continuous aquifer comprising alluvial sediments that underlie streams;
- An interbedded and discontinuous aquifer comprising sand and gravel lenses in the Paso Robles Formation.

Figure 4-4 shows the location of geologic sections that were used to depict the aquifers in the subsurface. Figure 4-12 through Figure 4-15 show the aquifers that are interpreted from the geologic logs, geophysical logs, groundwater levels, and water quality (Fugro, 2002 and 2005). Water-bearing zones are interpreted to be discontinuous lenses of sand and gravel and shown as tapering off on the cross sections. Because these cross sections are adopted from a study that supported a groundwater model, the cross sections include labels identifying the various layers from the groundwater model. The groundwater model was subsequently updated (GSSI, 2016) and is presented in Chapter 6. For the GSP several additional well logs were added to the sections to refine the extent of the aquifers. These logs have been labeled with the state well inventory number (e.g. E0188061). Appendix B contains the well logs used to update the sections that have publicly available data.

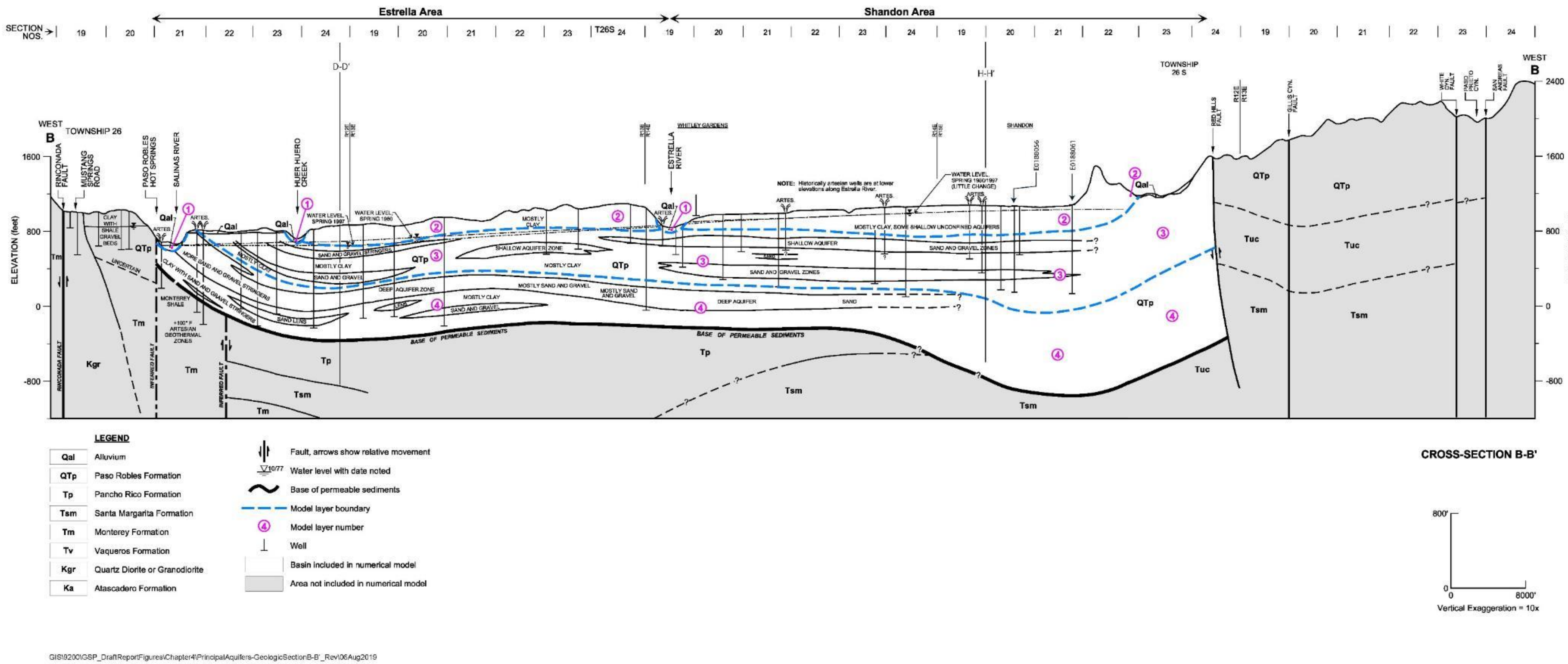


Figure 4-12. Aquifers - Geologic Section B-B'

Source: Modified from Fugro (2005)

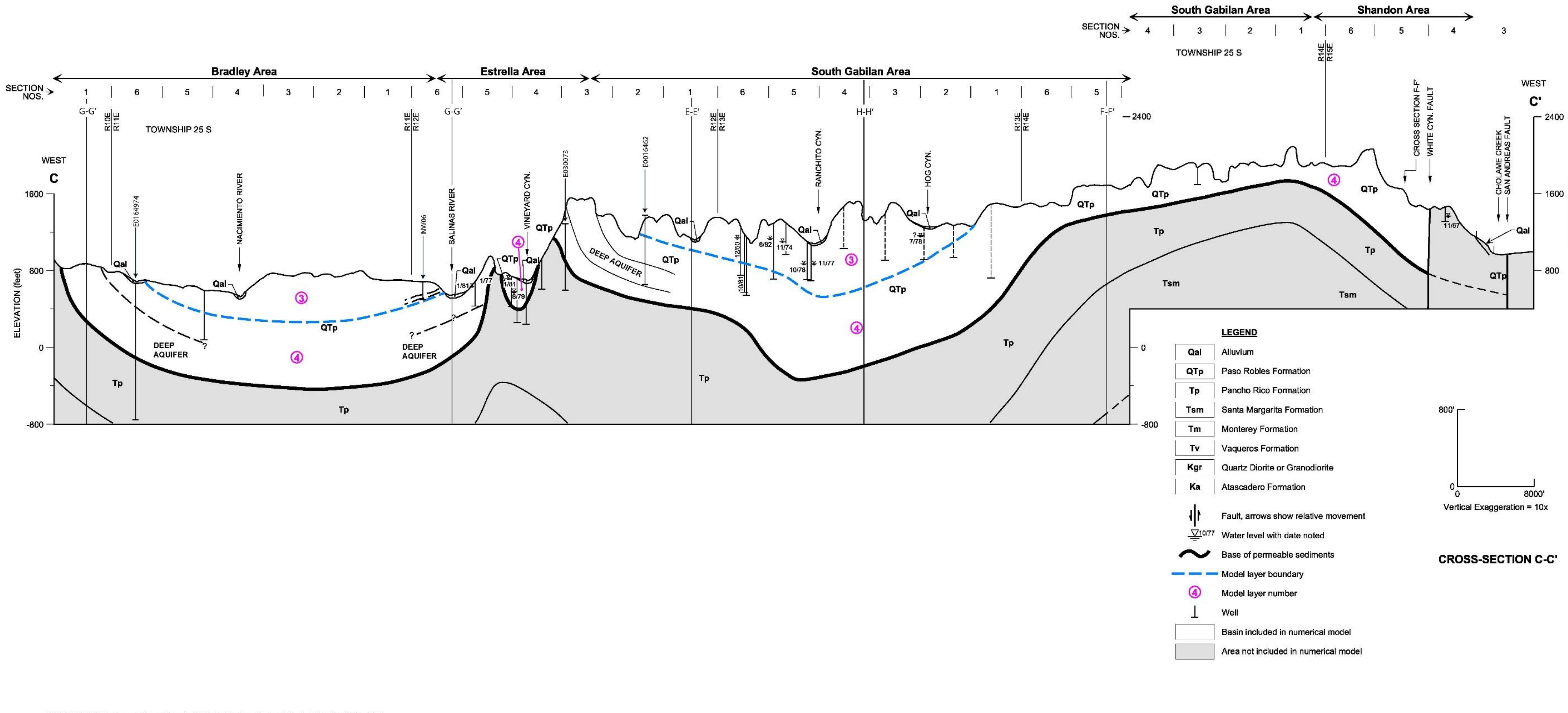


Figure 4-13. Aquifers - Geologic Section C-C'

Source: Modified from Fugro (2005)

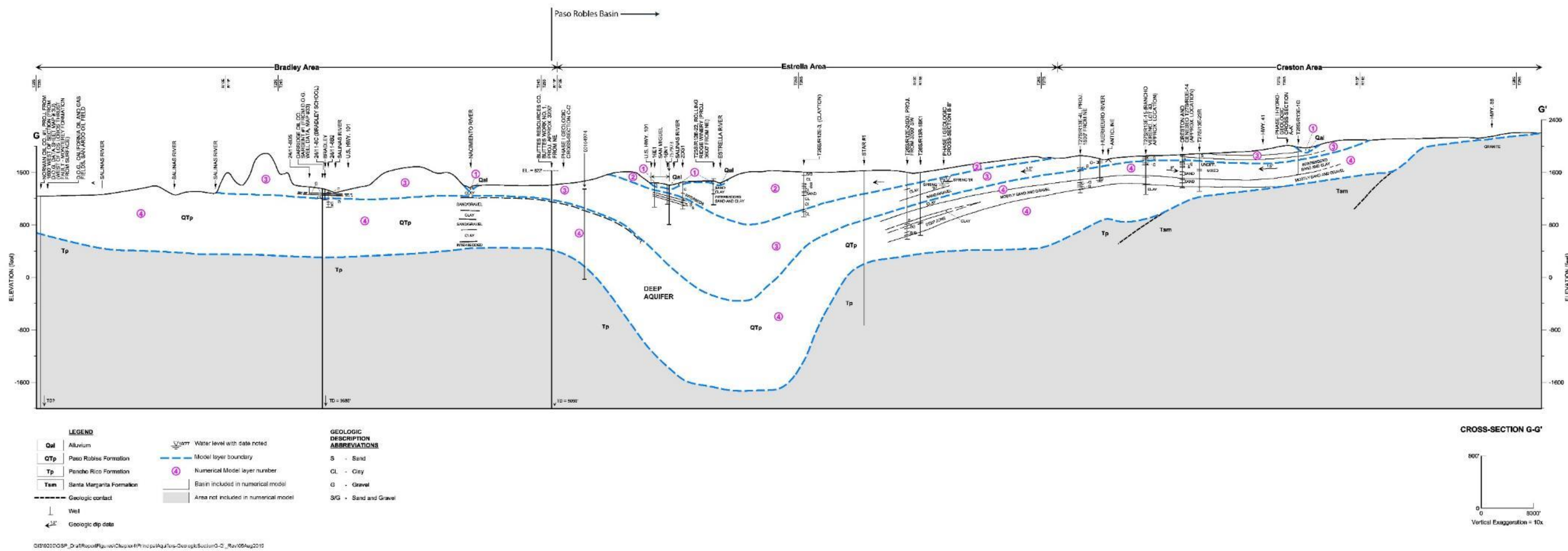


Figure 4-14. Aquifers - Geologic Section G-G'

Source: Modified from Fugro (2005)

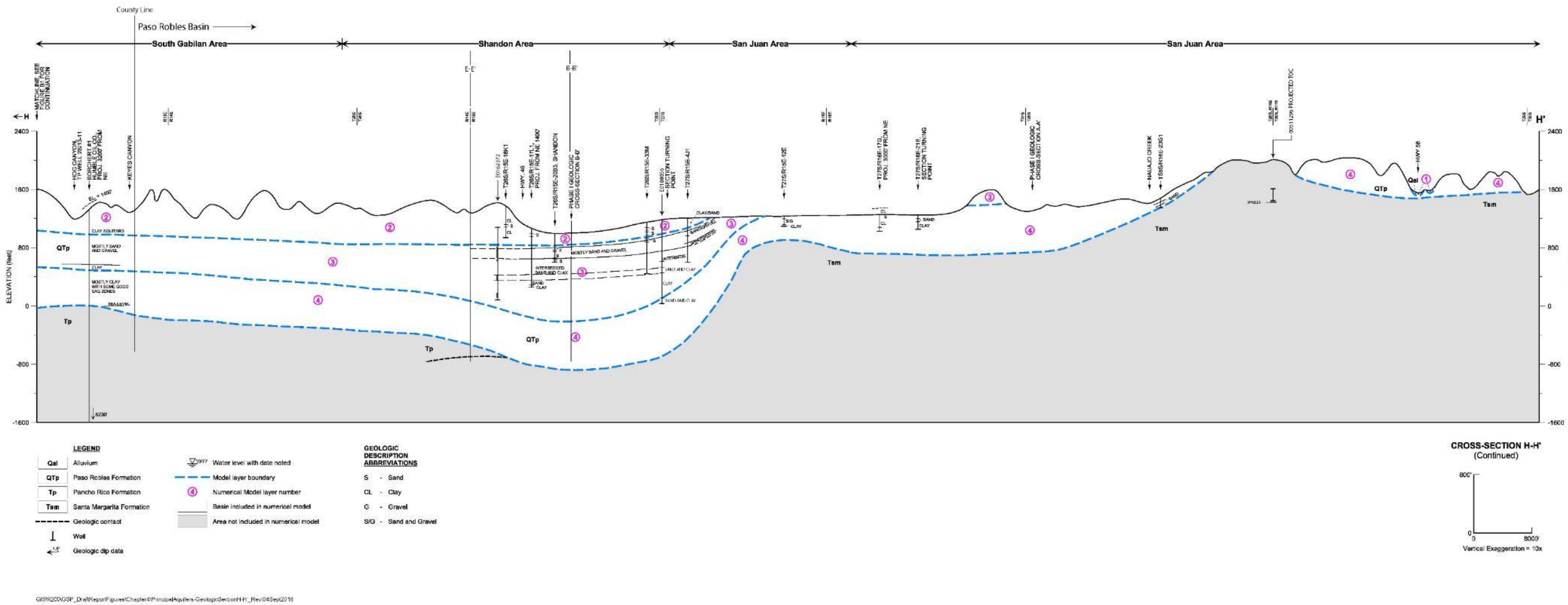


Figure 4-15. Aquifers - Geologic Section H-H'

Source: Modified from Fugro (2005)

4.4.1 Alluvial Aquifer

The unconfined Alluvial Aquifer is generally composed of saturated coarse-grained sediments and occurs along Huer Huero Creek, the Salinas River, and the Estrella River; the extent of this aquifer is shown on Figure 4-4. The alluvial aquifer varies in thickness, but is generally about 100 feet thick. The Alluvial Aquifer is highly permeable. Wells screened in the alluvial aquifer can yield up to a 1,000 gpm (Fugro, 2005).

4.4.2 Paso Robles Formation Aquifer

Geologic information reported in Fugro (2002) suggests that the sand and gravel zones that constitute the Paso Robles Formation Aquifer are generally thin, discontinuous, and are usually separated vertically by relatively thick zones of silts and clays. Figure 4-4 shows the extent of the Paso Robles Formation in the Subbasin. In general, the sand and gravel zones occur throughout the Paso Robles Formation, although they may be locally discontinuous or absent in some areas. As shown on Figure 4-14, near Creston the shallow sand and gravel zones are shown as disconnected from western parts of the Paso Robles aquifer, although data is limited in this region.

4.4.3 Aquifer Properties

Data reported in Fugro (2002) were reviewed to estimate representative aquifer hydraulic properties. Most aquifer tests have been conducted in the Estrella and Creston areas. Estimated aquifer properties are summarized in Table 4-1, which includes the following characteristics (Driscoll, 1986):

- Hydraulic conductivity: the rate of flow of water in gallons per day through a cross section of one square foot under a unit hydraulic gradient.
- Specific capacity: the rate of discharge of a water well per unit of drawdown, commonly expressed in volume of water at a reference temperature.
- Storativity: the volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head.
- Transmissivity: the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient.

Table 4-1. Paso Robles Subbasin Aquifer Hydrogeologic Properties

Well Location	Test Duration (hours)	Flow (gpm)	Well Depth (feet)	Perforated Interval (ft)	Transmissivity (gpd/ft)	Specific Capacity (gpm/ft)	Hydraulic Conductivity (ft/day)
Alluvial Aquifer							
28S/13E-36	24	367	70	40	186,300	68	620
Paso Robles Formation Aquifer							
27S/12E-09	72	300	450	170	8,800	4.9	6.9
26S/12E-22	12	220	430	100	900	1.2	1.2
25S/11E-24	12	150	350	90	800	0.62	1.2
27S/12E-18	8	140	225	35	4,100	3	15.7
26S/12E-20	48	115	400	50	7,600	10	20
26S/12E-36	24	400	660	280	8,800	5.1	4.2
26S/12E-35	18	690	830	370	7,900	4.9	2.9
27S/14E-18	24	600	740	220	6,100	5.5	3.7
26S/13E-16	24	200	820	350	3,100	2.63	1.2
26S/12E-25	24	500	730	340	5,700	3.6	2.2
25S/13E-30	24	600	720	260	6,900	79	3.5
26S/13E-7	24	600	825	380	3,200	3	1.1
26S/13E-7	24	600	990	610	5,000	4.2	1.1
24S/11E-34	24	850	612	100	2,805	4.5	3.8

Source: Fugro, 2002

Based on limited aquifer property data available for the Alluvial Aquifer, the transmissivity may be in the range of 150,000 to 200,000 gallons per day per foot (gpd/ft); or between 20,000 and 27,000 square feet per day (ft^2/day). Hydraulic conductivity of the Alluvial Aquifer may be over 500 feet per day (ft/d) based on estimated transmissivity and the thickness of the well's perforated interval.

The estimated transmissivity of the Paso Robles Formation Aquifer ranges between 800 gpd/ft and about 9,000 gpd/ft; or between 100 and 1,200 ft^2/day. The geometric mean of the Paso Robles Formation transmissivity values is about 4,200 gpd/ft, or 560 ft^2/day.

The estimated hydraulic conductivity of the Paso Robles Formation Aquifer ranges from about 1 ft/d to about 20 ft/d. The geometric mean of the tabulated hydraulic conductivity values for the Paso Robles Formation Aquifer is 5 ft/d.

Limited data exist to assess the confined storage properties, such as storativity, of the Paso Robles Formation aquifer (Fugro, 2002). Table 4-2 summarizes reported estimates of specific yield for unconfined portions of the aquifers. Average specific yield was estimated by analyzing 10 to 20 of the deepest well completion logs for each area. Each interval was assigned a specific yield by comparison of the formation description with published estimates based on extensive field and laboratory investigations conducted in southern coastal basins by the DWR and modified for the Paso Robles Formation (DWR, 1958). The assigned specific yield was then weighted according to the thickness of each bed and averaged over the entire depth of the well (Fugro, 2002). Results of this analysis suggested that a representative average value for specific yield for the Paso Robles Formation in the Subbasin was 0.09. This specific yield may be low. Average specific yields for unconsolidated sand and gravel sedimentary aquifers are commonly between 0.1 and 0.3 (Driscoll, 1986).

Table 4-2. Paso Robles Subbasin Specific Yield Estimates

Area	Number of Wells Used to Calculate	Average Estimated Specific Yield
Creston Area	47	0.09
Estrella	20	Not provided
San Juan	5	0.10
Shandon	20	0.08
North and South Gabilan	20	0.09
Basin Wide Average		0.09

Estimates of vertical hydraulic conductivity for each of the aquifers were not in reports from previous studies for the Subbasin. Estimates of vertical hydraulic conductivity incorporated into the basin-wide groundwater model are discussed in Appendix E.

4.4.4 Confining Beds and Geologic Structures

There is limited information regarding the continuity of stratigraphic features in the Subbasin that restrict groundwater flow within the Subbasin. Conceptually, the presence of laterally continuous zones of fine-grained strata within the Paso Robles Formation can restrict vertical movement of groundwater. These fine-grained zones are generally shown on the sections on Figure 4-12 through Figure 4-15. These figures show that the fine-grained strata are likely more continuous than the sand and gravel layers. These fine-grained zones act as confining beds, and are the cause of the artesian wells that were historically reported in the Subbasin. Fine-grained layers that limit vertical movement of groundwater appear to be more prevalent in the Estrella and Creston areas than in the eastern portion of the Shandon area. This may indicate that infiltration and recharge is more limited in the central part of the basin than it is to the east in the Shandon area.

There is some anecdotal evidence that subsurface geologic structures such as folds and faults may affect groundwater flow in the Subbasin, particularly in the Whitley Gardens area between Estrella and Shandon. Additional investigations would be needed to characterize the effect of structures on groundwater flow.

4.5 Primary Users of Groundwater

The primary groundwater users in the Subbasin include municipal, agricultural, rural residential, small community water systems, small commercial entities and environmental users (such as GDEs). Municipal, domestic, and agricultural demands in the Subbasin currently rely almost entirely on groundwater. Some municipal demands are partially met through imported surface water as presented previously in Chapter 3. The municipal sector pumps primarily from the Paso Robles Aquifer in the Subbasin. The agriculture sector uses groundwater from the Alluvial Aquifer and the Paso Robles Aquifer.

4.6 General Water Quality

This section presents a general discussion of the natural groundwater quality in the Subbasin, focusing on general minerals. The general water quality of the Subbasin described in this section is a summary of results in the Fugro 2002 report. A more complete discussion of the distribution and concentrations of specific constituents is presented in Chapter 5.

Groundwater in the Subbasin is generally suitable for drinking and agricultural uses. The two main water types as defined by water chemistry in the Subbasin are calcium bicarbonate and sodium bicarbonate. Calcium-bicarbonate type is the most prominent and is found in the Creston and San Juan areas. Sodium-bicarbonate is the second most dominant water type and is found in the Estrella and Shandon areas. Minor areas of sodium-chloride type water can be found in the eastern portion of the Subbasin and near Cholame Valley. In the northwest portion of the Subbasin, magnesium bicarbonate waters are found in the San Miguel area and a mixed water type is seen in the Bradley area. Summary tables of general groundwater quality are provided in Chapter 5.

4.7 Groundwater Recharge and Discharge Areas

Areas of significant, natural, areal recharge and discharge within the Paso Robles Subbasin are discussed below. Quantitative information about natural and anthropogenic recharge and discharge is provided in Chapter 6.

4.7.1 Groundwater Recharge Areas Inside the Subbasin

In general, natural areal recharge occurs via the following processes:

1. Distributed areal infiltration of precipitation, and
2. Infiltration of surface water from streams and creeks.

Appendix B includes a table of annual precipitation data for the Paso Robles weather station (USC00046730) for the water years from 1894 to 2019. Figure 4-16 is a map that ranks soil suitability to accommodate groundwater recharge based on five major factors that affect recharge potential, including: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. The map[1] was developed by the California Soil Resource Lab at UC Davis and the University of California Agricultural and Natural Resources Department.

Areas with excellent recharge properties are shown in green. Areas with poor recharge properties are shown in red. Not all land is classified, but this map provides good guidance on where natural recharge likely occurs. Natural recharge is discussed in more detail in Chapter 6.

[1] Figure 4-16 shows the Soil Agricultural Groundwater Banking Index (SAGBI) map for the Paso Robles Subbasin. While the UC Davis database title SAGBI includes the term “banking”, its use in this section is strictly as a dataset for evaluating recharge potential in the basin.

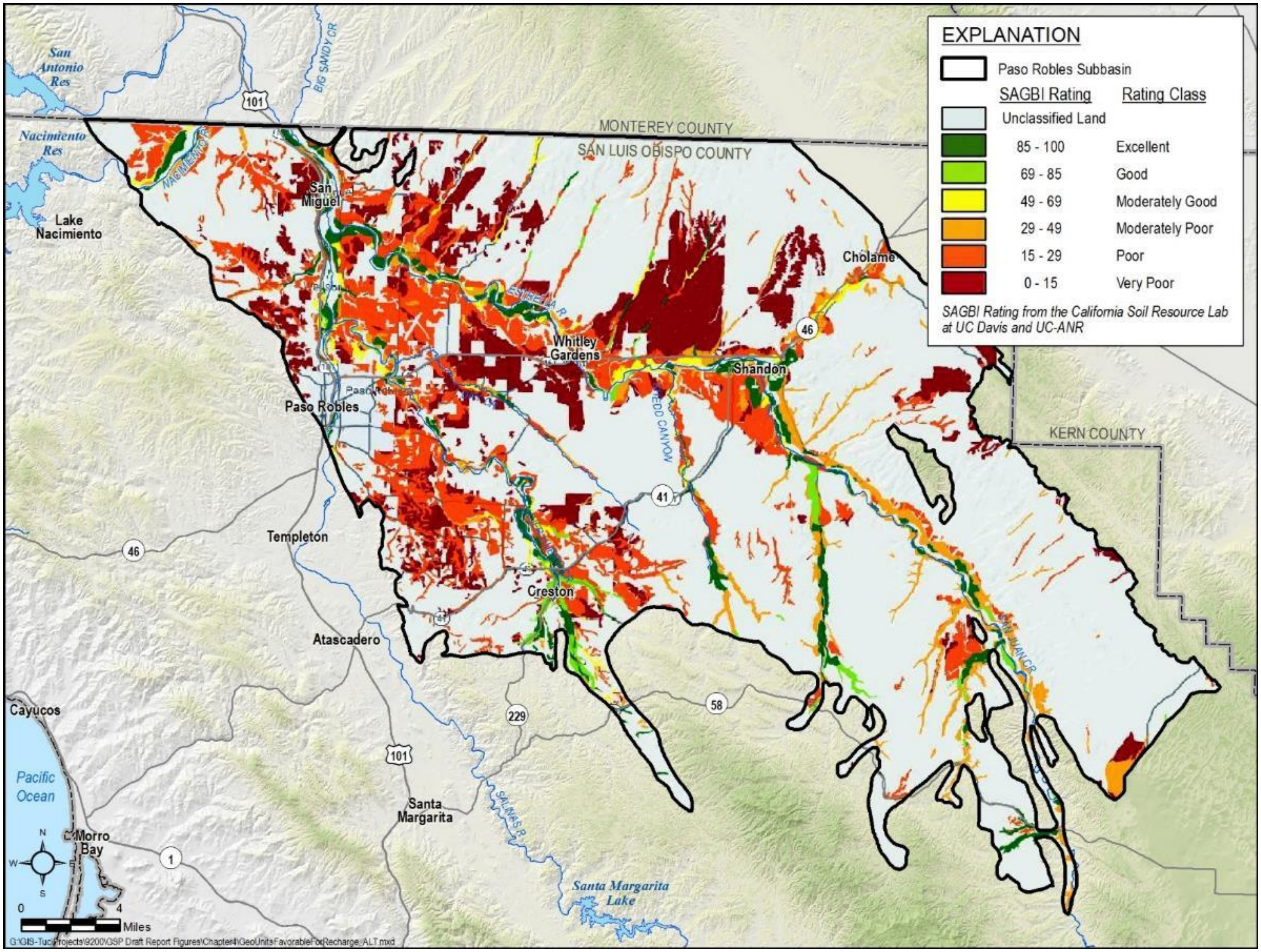


Figure 4-16. Potential Recharge Areas

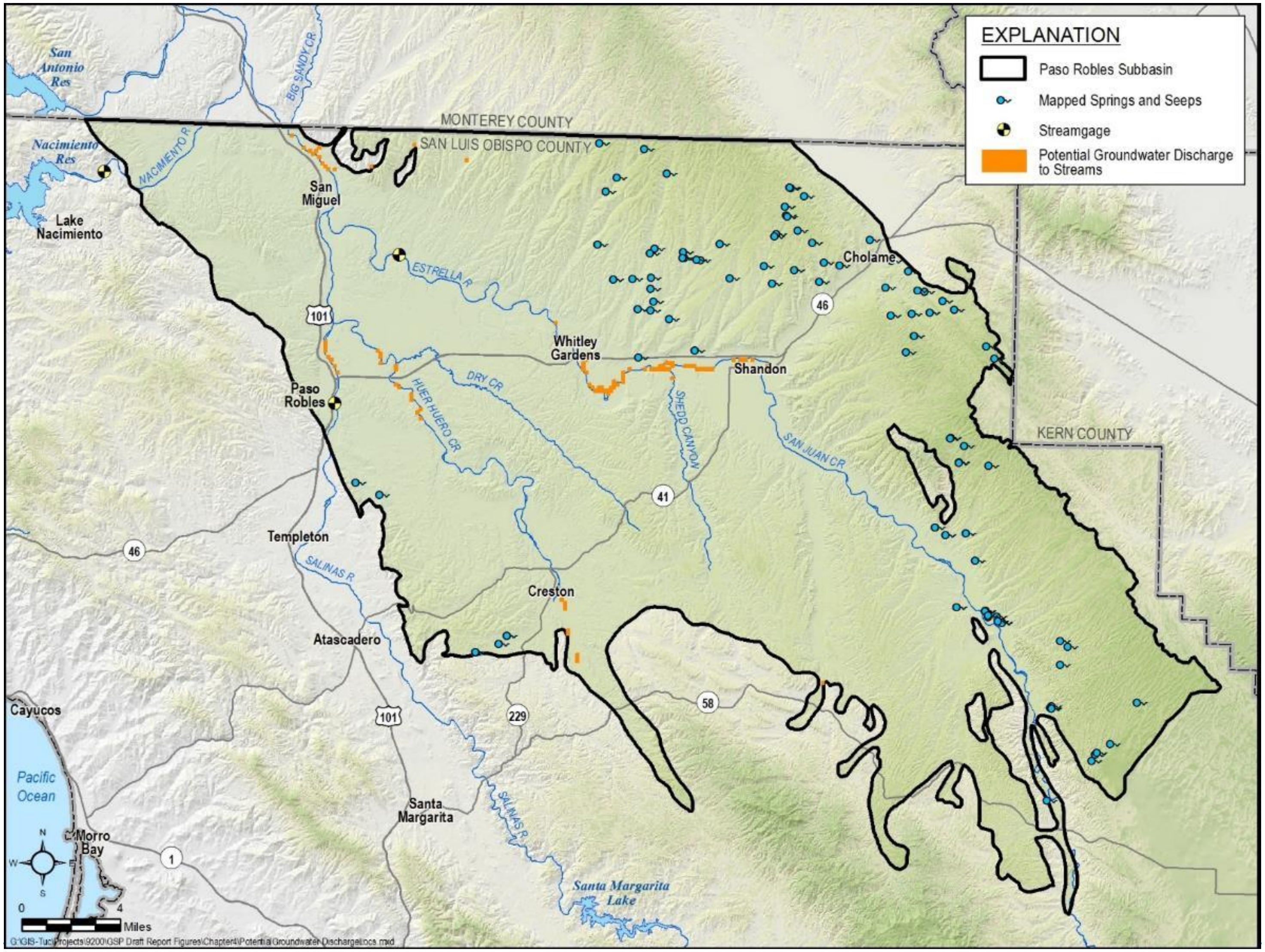
4.7.2 Groundwater Discharge Areas Inside the Subbasin

NaturalAreas that have been identified in previous studies as potential historic natural groundwater discharge areas within the Plan area are shown on Figure 4-17Figure 4-17 and include springs and seeps, groundwater discharge to surface water bodies, and ET by phreatophytes. Phreatophytes are plants with roots that tap into groundwater. Springs and seeps identified in the National Hydrology Dataset (NHD), and shown on Figure 4-17, tend to be located in the foothills of the Santa Lucia and Temblor mountain ranges. Based on the elevation of mapped springs and seeps, it is likely that these discharge groundwater from shallow, and possibly perched aquifer units. The springs and seeps shown in the figure are a subset of the locations identified in the National Hydrology Dataset (NHD). Each of the NHD locations was examined on recent high-resolution (Google Earth©) aerial photographs to assess whether topography, soil color and vegetation at the site were consistent with the presence of groundwater discharge. In many cases they were not, and those locations were removed from the spring and seep data set (Appendix C). Off-channel springs and seeps are almost all located in the foothills of the Santa Lucia and Temblor mountain ranges. Based on their elevations high above the main part of the Subbasin, the springs and seeps may represent discharge of groundwater from perched strata feeding the Paso Robles Formation Aquifer that is forced to the surface locally by subsurface stratigraphy or faults. No efforts were made to ground truth or physically verify the presence of these features and there is no evidence that pumping from the Paso Robles Formation Aquifer is affecting the springs and seeps.

Groundwater discharge to streams – primarily, the Salinas River and Estrella River – has not been mapped to date. Instead, areas of potential groundwater discharge to streams arewere tentatively identified using the conceptual groundwater flow model. OrangeHighlighted purple areas along streams on Figure 4-17Figure 4-17 represent streamsstream cells in the model where simulated average groundwater discharge to the stream reach is at least 10 AFY. In contrast to mapped springs and seeps, which are derived from groundwater in the Paso Robles Formation Aquifer, groundwater discharge to streams is derived from the AlluviumAlluvial Aquifer. No efforts were made to ground truth or physically verify the presence of these features and there is no evidence that pumping from the Paso Robles Formation Aquifer is affecting the Salinas River.

Figure 4-18 shows the distribution of potential groundwater-dependent ecosystems (GDEs) and Natural Communities Commonly Associated with Groundwater (NCCAG) within the Plan area. In areas where the water table is sufficiently high, groundwater discharge may occur as ET from phreatophyte vegetation within these GDEs. Appendix C describes methods used to determine the extent and type of potential GDEs. Figure 4-18 shows only potential GDEs. There has been no verification that the locations shown on this map constitute groundwater dependent

~~ecosystems. Additional field reconnaissance is necessary to verify the existence of these potential GDEs.~~



Phreatophytic vegetation along stream channels also functions as a discharge point for groundwater by removing water directly from the water table. The locations of this type of riparian vegetation are described in Section 5.5.

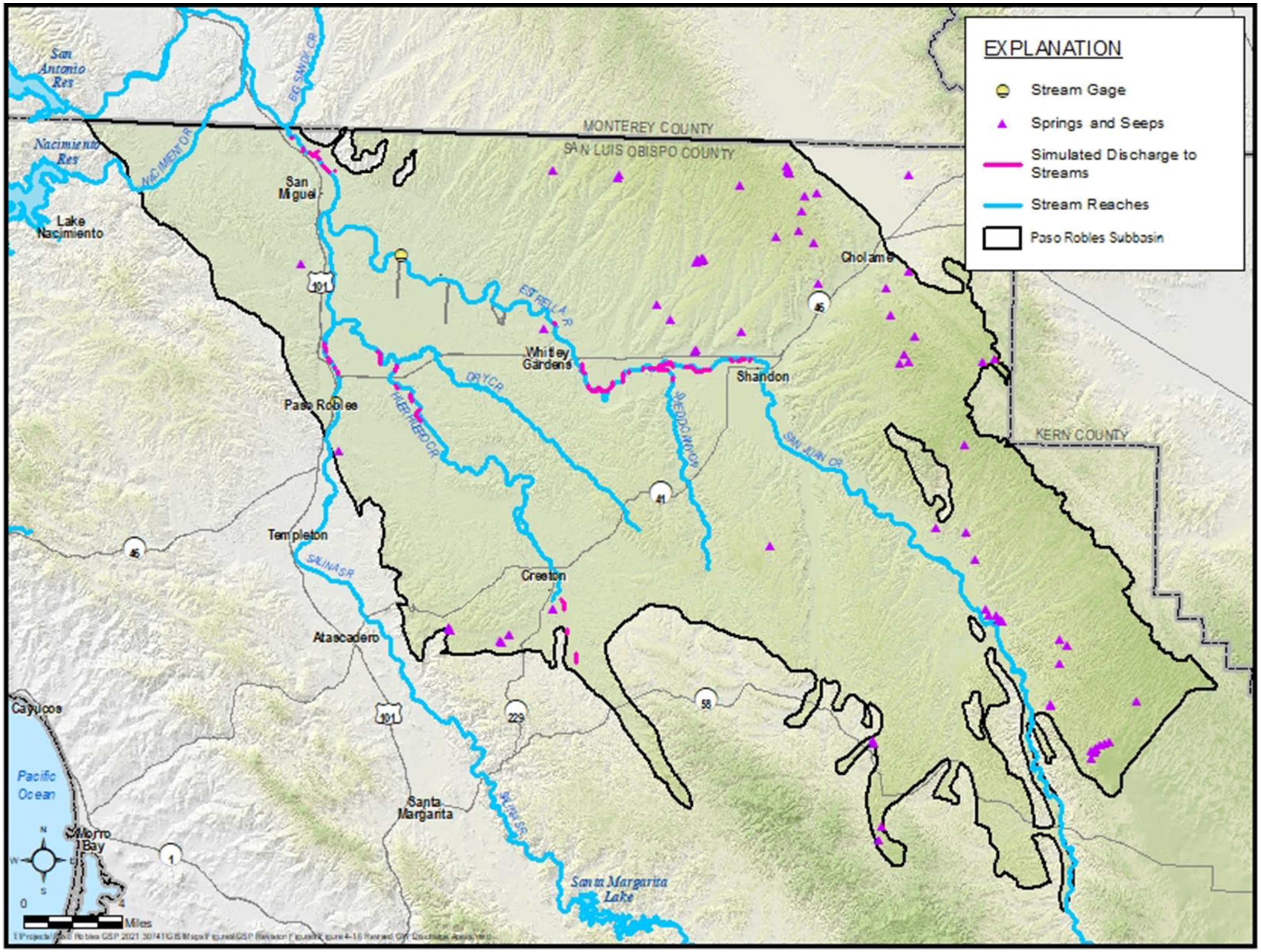


Figure 4-17. Potential Groundwater Discharge Areas

4.8 Surface Water Bodies

Figure 4-19 shows the rivers in the Subbasin that are considered significant to the management of groundwater in the Subbasin. Significant streams that are mostly perennial in the Subbasin include the Nacimiento River, Salinas River, the Estrella River, Huer Huero Creek, San Juan Creek, Dry Creek, and Shedd Canyon. Shell Creek is not included in this list since it is classified as either intermittent or ephemeral with no perennial stretches. These rivers and creeks lose water to the shallow aquifers during most of the year. There are no natural lakes in the Subbasin.

There are no reservoirs within the Subbasin; however, there are two reservoirs in the watershed. The Salinas Dam south of the Subbasin on the Salinas River forms Santa Margarita Lake. The Salinas Dam was constructed in the early 1940s as an emergency measure to provide adequate water supplies for Camp San Luis Obispo. The United States Army Corps of Engineers (USACE) now has jurisdiction over the dam and reservoir facilities. The City of San Luis Obispo has an agreement with USACE to divert the entire yield of Salinas Reservoir (Santa Margarita Lake) for water supply. Nacimiento Reservoir lies just outside of the Subbasin to the northwest. The reservoir discharges to the Nacimiento River, which crosses the northwest corner of the Subbasin.

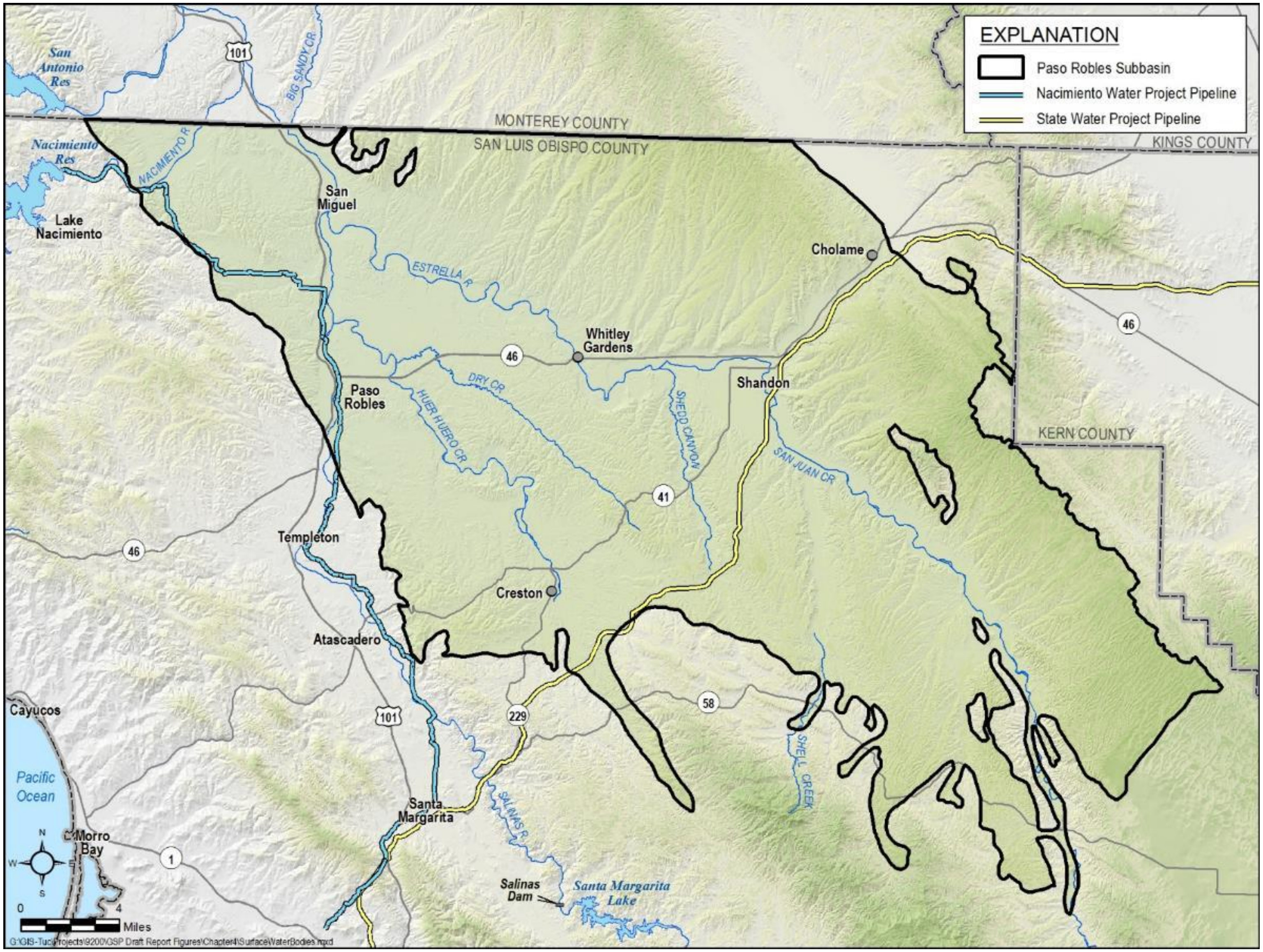


Figure 4-181918. Surface Water Bodies

4.9 Data Gaps in the Hydrogeologic Conceptual Model

All hydrologic conceptual models contain a certain amount of uncertainty, and can be improved with additional data and analysis. The hydrogeologic conceptual model of the Paso Robles Subbasin could be improved with certain additional data and analyses. Several data gaps are identified below.

4.9.1 Aquifer Continuity

Aquifer continuity has a significant impact on how projects and management actions in one part of the Subbasin may influence sustainability in other parts of the Subbasin. As noted earlier, the Paso Robles aquifer comprises many discontinuous sand and gravel beds. However, Figure 4-12 shows a previous interpretation of a deep sand and gravel zone that is relatively continuous across the Subbasin. The continuity of this zone may prove to be important in how effective various projects and programs may promote sustainability. The extent and continuity of the Paso Robles Aquifer should be confirmed through existing or new well logs or other methods such as aerial geophysics. This is particularly important in the areas around Shandon and San Juan. Chapter 10 addresses the implementation plan for addressing data gaps.

4.9.2 Fault Influence on Groundwater Flow

Southeast of Paso Robles is an interbasin fault. It is unknown whether this fault and others are barriers to groundwater flow. If these interbasin faults are barriers to groundwater flow, they could compartmentalize the Subbasin and have a significant impact on where projects must be located in order to achieve sustainability. It may be possible to get a better understanding of the influence of these faults by performing aquifer tests and geophysical surveys in the vicinity of these faults.

4.9.3 Vertical Groundwater Gradients

There are limited data that demonstrate vertical hydraulic gradients across the basin. Data from a single set of nested wells are presented in Chapter 5; the data are inconclusive to establish a consistent upward or downward vertical gradient. More data about vertical gradients are included in Chapter 5. Demonstrating vertical gradients could be important to assess vertical flows between the Alluvium and the Paso Robles Aquifer as well as vertical flows within the Paso Robles Aquifer.

4.9.4 Specific Yield Estimates

The current estimates of specific yield of the various sedimentary layers composing the Paso Robles Aquifer are based on very limited data. This is a data gap that when filled, will improve the ability of the Model to reflect Basin conditions and interactions.

5 GROUNDWATER CONDITIONS

This chapter describes the current and historical groundwater conditions in the Alluvial Aquifer and the Paso Robles Formation Aquifer in the Paso Robles Subbasin. In accordance with the SGMA emergency regulations §354.16, current conditions are any conditions occurring after January 1, 2015. By implication, historical conditions are any conditions occurring prior to January 1, 2015. The chapter focuses on information required by the GSP regulations and information that is important for developing an effective plan to achieve sustainability. The organization of Chapter 5 aligns with the five sustainability indicators applicable to the Subbasin. As required by the regulations, these are:

1. Chronic lowering of groundwater elevations
2. Changes in groundwater storage
3. Subsidence
4. Depletion of interconnected surface waters
5. Groundwater quality

The sixth sustainability indicator, seawater intrusion, is not applicable to the Paso Robles Subbasin.

5.1 Groundwater Elevations

The following assessment of groundwater elevation conditions is largely based on data from the SLOFCWCD's groundwater monitoring program. Groundwater levels are measured by the SLOFCWCD through a network of public and private wells in the Subbasin. Additional groundwater elevation data for wells were obtained from other available data sources, including the CASGEM database, USGS, and other regulatory compliance programs. Locations of the wells (about 50 to 55 depending on year) used for the groundwater elevation assessment are shown on Figure 5-1~~Figure 5-1~~. Data from some of the wells on this figure was collected subject to confidentiality agreements between the SLOFCWCD and well owners. Consistent with the terms of such agreements, the well owner information and specific locations for these wells is not published in this GSP. The set of wells shown on Figure 5-1~~Figure 5-1~~ were selected from a larger set of monitoring wells in the SLOFCWCD database if there was sufficient information to assign the well to either the Alluvial Aquifer or Paso Robles Formation Aquifer. Additionally, in order to create maps showing historical water level changes over an approximately 20-year period, the wells were chosen if there was data from the years 1997 and 2017.

Groundwater elevation data were deemed representative of static conditions based on a check of consistency with nearby wells. Additional information on the monitoring network is provided in Chapter 7 – Monitoring Networks. In accordance with the SGMA Regulations, the following information is presented based on available data, in subsequent subsections for both aquifers in the Subbasin:

- Groundwater elevation contour maps for the seasonal high and low periods for 1997 and 2017
- A map depicting the change in groundwater elevation between 1997 and 2017
- Hydrographs for wells with publicly available data
- Assessments of horizontal and vertical groundwater gradients

5.1.1 Alluvial Aquifer

Groundwater elevation data for the Alluvial Aquifer are limited. The locations of the Alluvial Aquifer monitoring wells with available groundwater elevation data are shown on Figure 5-1~~Figure 5-1~~. Some Alluvial Aquifer wells are all in the Alluvium as mapped in Figure 4-4~~Figure 4-4~~, although some are not adjacent to mapped, named streams.

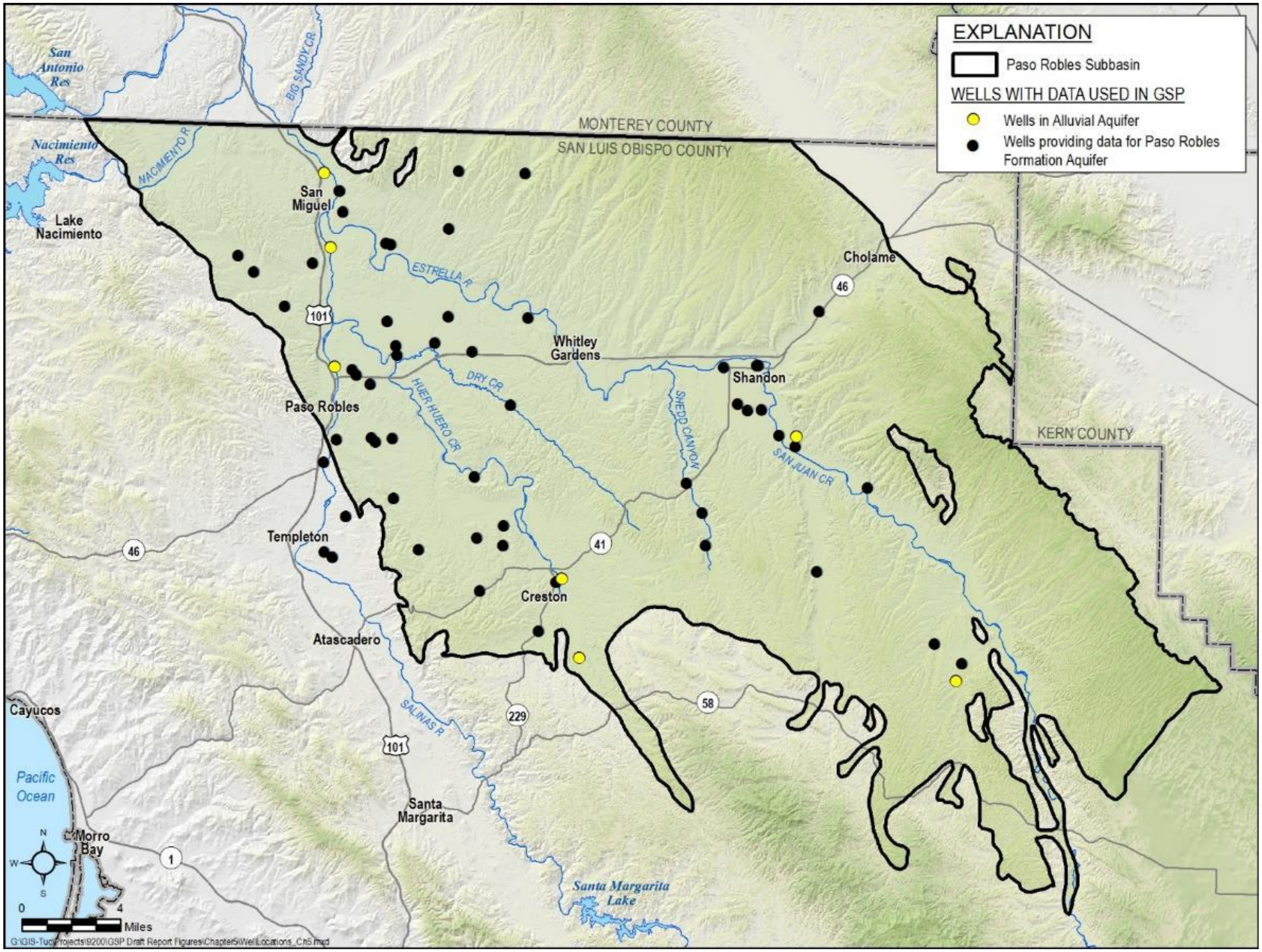


Figure 5-1. Location of Wells Used for Groundwater Elevation Assessments

5.1.1.1 Alluvial Aquifer Groundwater Elevation Contours and Horizontal Groundwater Gradients

Groundwater elevation data for the Alluvial Aquifer are too limited to prepare representative contour maps of the seasonal high and seasonal low groundwater elevations, or to prepare maps of historical groundwater elevations. Figure 5-2Figure 5-2 shows current groundwater elevation contours for the Alluvial Aquifer. The contours were developed using 2017 data when available and the most recent data prior to 2017. Contours are only depicted on the map in areas near the wells that are shown on Figure 5-1Figure 5-1.

Groundwater elevations range from approximately 1,400 feet above mean sea level (ft msl) in the southeastern portion of the Subbasin to approximately 600 ft msl near San Miguel. Groundwater flow direction is inferred as being from high to low elevations in a direction perpendicular to groundwater elevation contours. Groundwater flow direction in the Alluvial Aquifer generally follows the alignment of the creeks and rivers. Overall, groundwater in the Alluvial Aquifer flows from southeast to northwest across the Subbasin. Groundwater elevation data in the Alluvial Aquifer are too sparse to estimate local horizontal groundwater gradients. On a basin-wide scale, the average horizontal hydraulic gradient in the alluvium is about 0.004 ft/ft from the southeastern portion of the Subbasin to San Miguel.

5.1.1.2 Alluvial Aquifer Hydrographs

Groundwater level data for all of the Alluvial Aquifer wells shown on Figure 5-1Figure 5-1 were collected under confidentiality agreements. Therefore, hydrographs for the Alluvial Aquifer are not included in this GSP. The lack of publicly available groundwater level data for the Alluvial Aquifer is a significant data gap. The approach for filling data gaps is presented in Chapter 10.

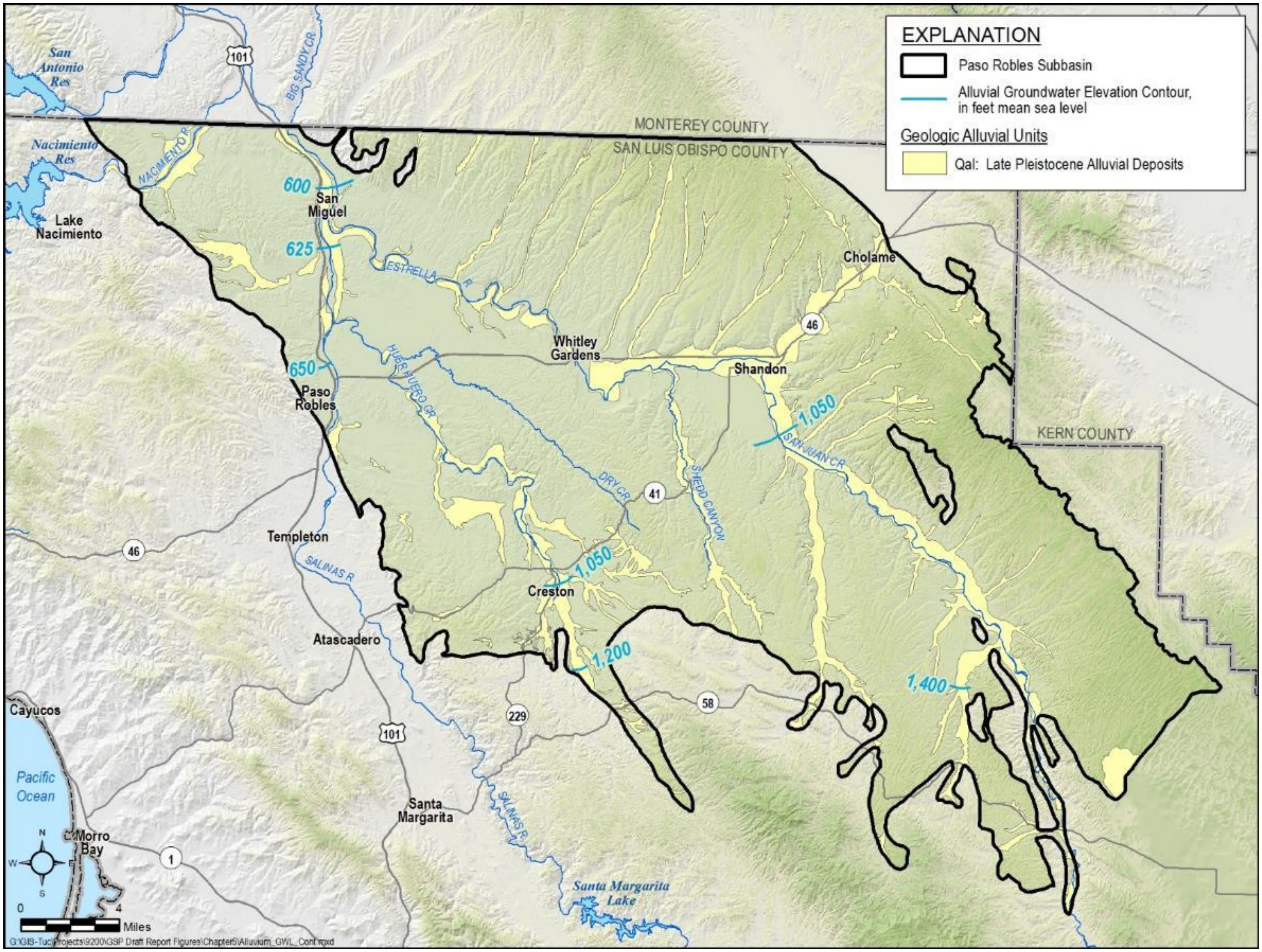


Figure 5-2. Groundwater Elevation Contours for the Alluvial Aquifer

5.1.2 Paso Robles Formation Aquifer

The locations of the Paso Robles Formation Aquifer monitoring wells used to assess the hydrogeologic conditions of the Paso Robles Formation Aquifer are shown on Figure 5-1~~Figure 5-1~~. Groundwater occurs in the Paso Robles Formation Aquifer under unconfined, semi-confined, and confined conditions.

5.1.2.1 Paso Robles Aquifer Groundwater Elevation Contours and Horizontal Groundwater Gradients

Groundwater elevation data for 1997 and 2017, respectively, for the Paso Robles Formation Aquifer were contoured to assess current spatial variations, groundwater flow directions, and horizontal groundwater gradients. Contour maps were prepared for the seasonal high groundwater levels, which is typically in the spring, and the seasonal low groundwater levels, which is typically in the fall. In general, the spring groundwater data are for April and the fall groundwater data are for October. Data from public and private wells were used for contouring; information identifying the owner or detailed location of private wells is not shown on the maps. The contours are based on groundwater elevations measured at the well locations shown on Figure 5-1~~Figure 5-1~~. Contour maps were generated using a computer-based contouring program and checked for representativeness by a qualified hydrogeologist. Groundwater elevation data deemed unrepresentative of static conditions or obviously erroneous were not used for contouring. Similar to groundwater elevation contour maps prepared for previous studies, close inspection of the maps indicates localized areas where interpolated groundwater elevations are above land surface. This typically occurs near streams and incised drainages where land surface tends to be locally lower than surrounding areas. While it is hydrologically possible that groundwater elevations in the Paso Robles Formation Aquifer are above land surface in some local areas, this is more likely an artifact of the computer contouring of sparse groundwater elevation data.

Figure 5-3~~Figure 5-3~~ and Figure 5-4~~Figure 5-4~~ show contours of historical groundwater elevations in the Paso Robles Formation Aquifer for spring 1997 and fall 1997, respectively. Overall, groundwater conditions in the Subbasin in the spring and fall of 1997 are similar, but groundwater elevations are generally lower in the fall than spring. Groundwater elevations ranged from about 1,300 ft msl in the southeast portion of the Subbasin to about 550 ft msl near the City of Paso Robles and the town of San Miguel (Figure 5-3~~Figure 5-3~~ and Figure 5-4~~Figure 5-4~~). Groundwater flow direction is inferred as being from high to low elevations in a direction perpendicular to groundwater elevation contours. Groundwater flow direction is generally to the northwest and west over most of the Subbasin, except in the area north of Paso Robles where groundwater flow is to the northeast. In general, groundwater flow in the western portion of the Subbasin tends to converge toward areas of low groundwater elevations.

Groundwater gradients range from approximately 0.003 ft/ft in the southeast portion of the Subbasin to approximately 0.01 ft/ft in the areas both southeast of Paso Robles and northwest of Whitley Gardens. The steepest groundwater gradients in the Subbasin are on the margins of the pumping depression in the vicinity of the city of Paso Robles and community of San Miguel.

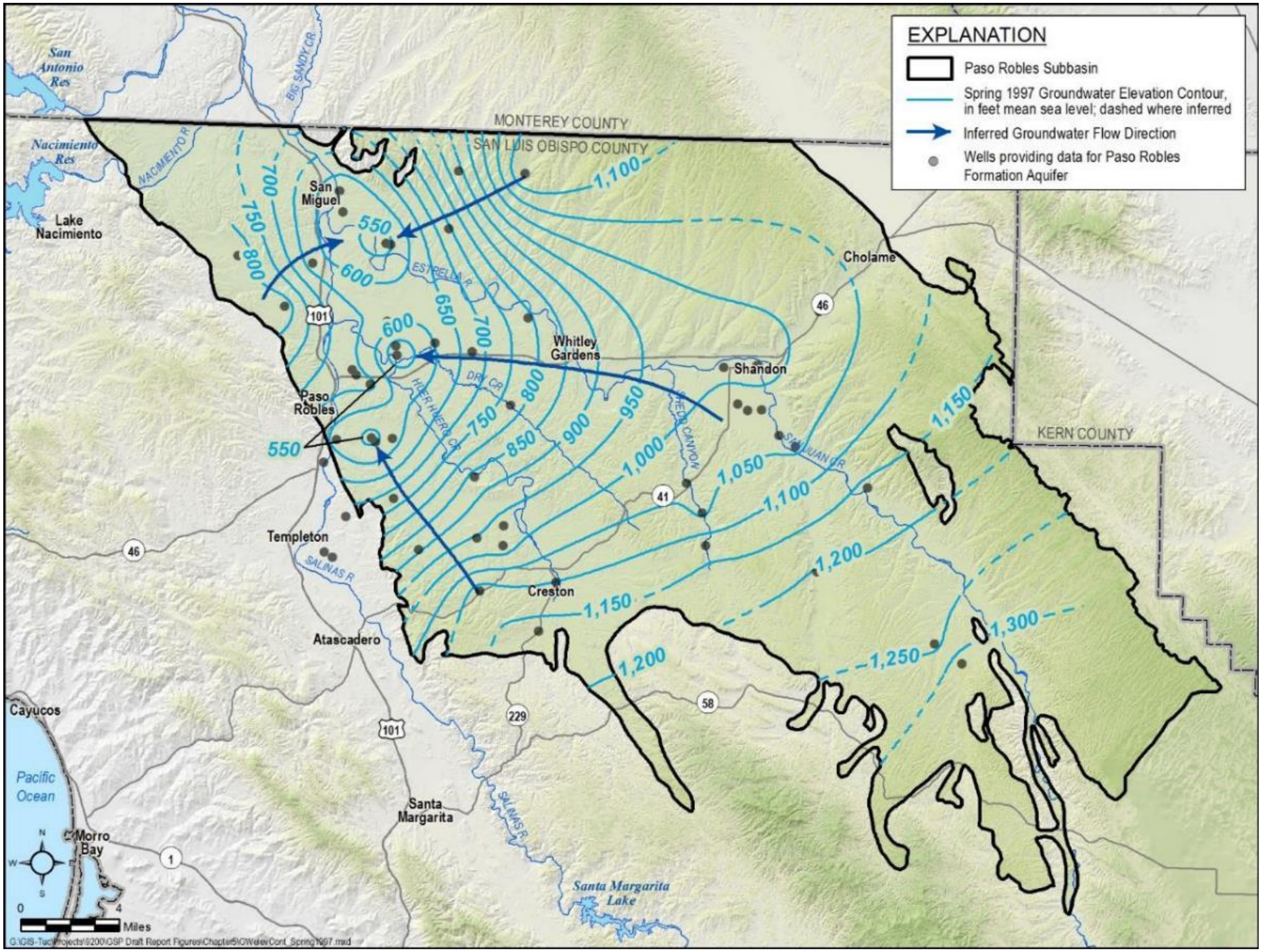


Figure 5-3. Paso Robles Formation Aquifer Spring 1997 Groundwater Elevation Contours

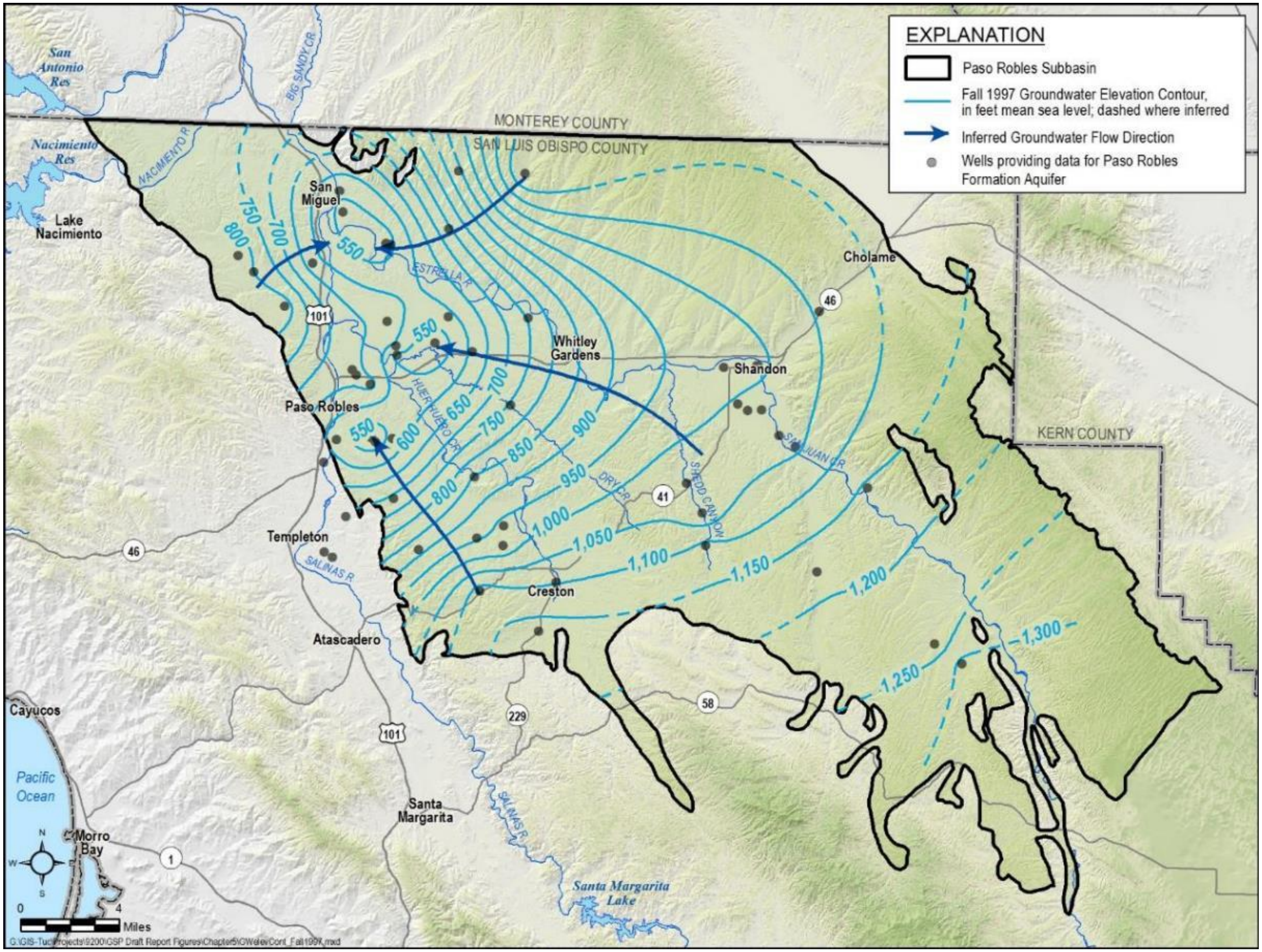


Figure 5-4. Paso Robles Formation Aquifer Fall 1997 Groundwater Elevation Contours

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Figure 5-5

Figure 5-5 and Figure 5-6Figure 5-6 show contours of current groundwater elevations in the Paso Robles Formation Aquifer for spring 2017 and fall 2017, respectively. Overall, groundwater conditions in the Subbasin in the spring and fall of 2017 were similar. Close inspection of the contour maps indicates that groundwater elevations are generally lower in the fall than spring. Groundwater elevations in 2017 are also lower than groundwater elevations in 1997. Groundwater elevations in 2017 ranged from about 1,250 ft msl in the southeast portion of the Subbasin to about 500 ft msl east of the City of Paso Robles (Figure 5-5Figure 5-5 and Figure 5-6Figure 5-6). Groundwater flow direction is inferred as being from high to low elevations in a direction perpendicular to groundwater elevation contours. Groundwater flow direction is generally to the northwest and west over most of the Subbasin, except in the area north of the City of Paso Robles where groundwater flow is to the northeast. In general, groundwater flow in the western portion of the Subbasin tends to converge toward areas of low groundwater elevations. These areas of low groundwater elevation are caused by pumping in the area between the City of Paso Robles and the communities of San Miguel and Whitley Gardens. Horizontal groundwater gradients range from approximately 0.002 foot/foot in the southeast portion of the Subbasin to approximately 0.02 foot/foot in the area southeast of Paso Robles. The steepest horizontal groundwater gradients in the Subbasin in 2017 are on the margins of the pumping depression east of Paso Robles and southeast of the community of San Miguel.

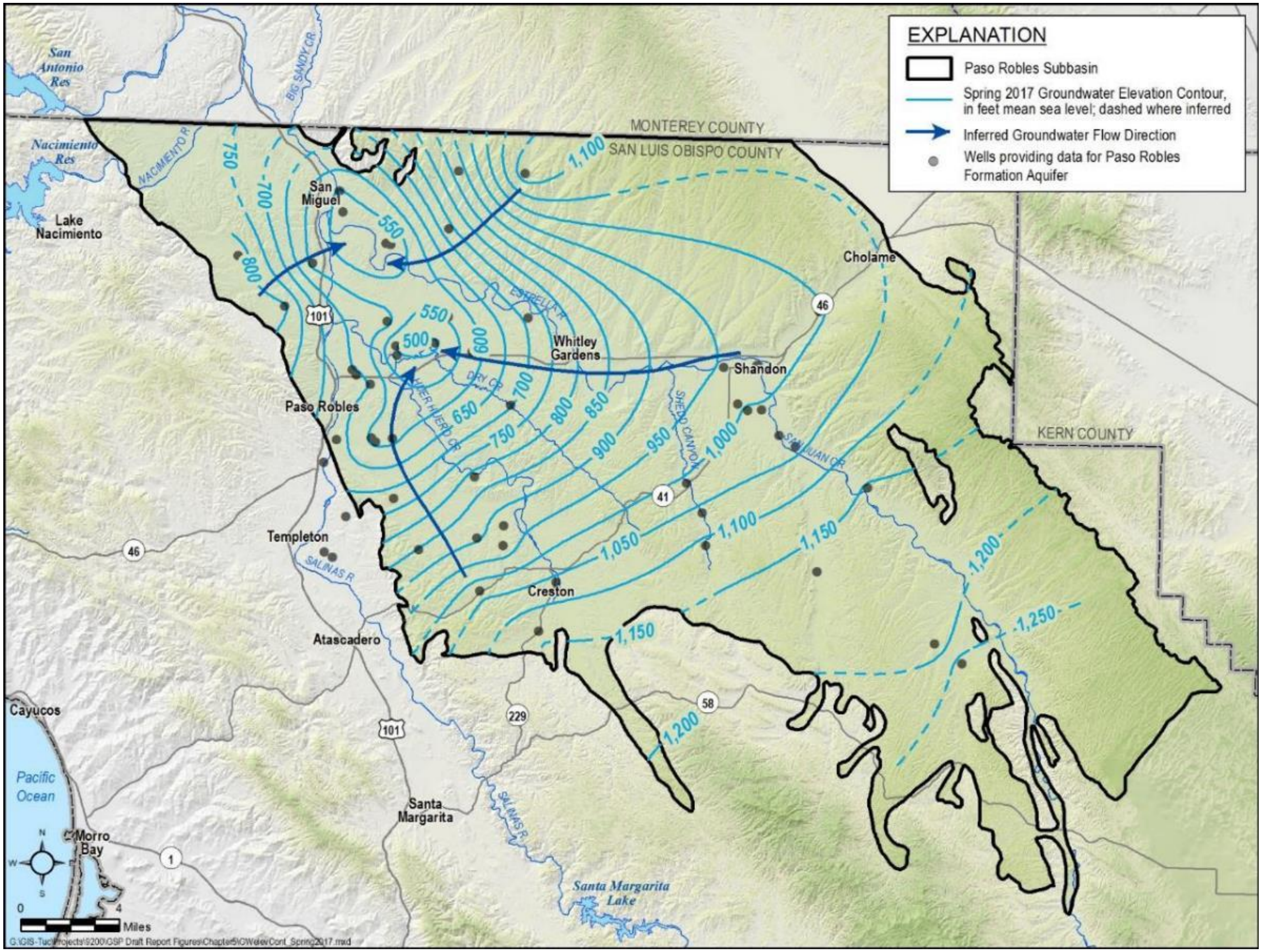

Figure 5-5. Paso Robles Formation Aquifer Spring 2017 Groundwater Elevation Contours

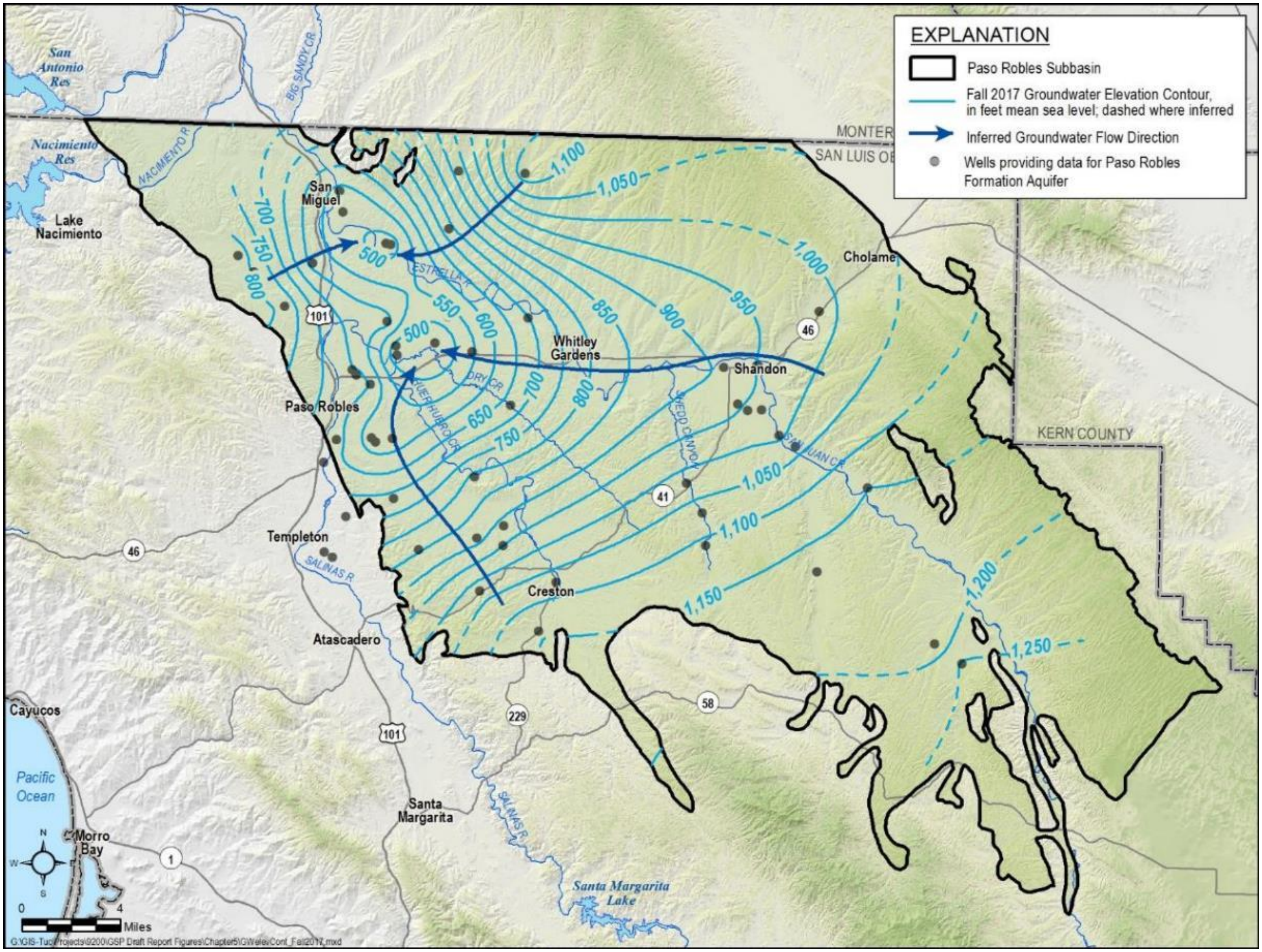

Figure 5-6. Paso Robles Formation Aquifer Fall 2017 Groundwater Elevation Contours

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Figure 5-7

Figure 5-7 depicts the change in spring groundwater elevations in the Paso Robles Formation Aquifer between 1997 and 2017. Figure 5-8Figure 5-8 depicts the change in fall groundwater elevations in the Paso Robles Formation Aquifer between and 1997 and 2017. Groundwater elevations are lower in 2017 than 1997 throughout most of the Subbasin. In general, the pattern of groundwater level decline in the spring and fall are similar, with a more pronounced area of decline extending toward Shandon in the fall. More than 80 feet of decline is observed in places during this period. Areas of largest decline are east of Paso Robles, near Creston, and in the southeastern portion of the basin. Limited data suggest an area of higher groundwater elevations exists in the vicinity of Paso Robles in 2017 compared to 1997. The increase may be related to reductions in groundwater pumping and proximity to the Salinas River. Monitoring data obtained during plan implementation will be used to further evaluate these areas.

The groundwater level contours and groundwater level change maps in this GSP are based on a reasonable and thorough analysis of the currently available data. As discussed in Chapter 8, the monitoring network should be expanded to more completely assess Subbasin conditions and demonstrate compliance with the sustainability goal for the Subbasin. Expanding the monitoring network and acquiring more groundwater elevation data will allow the GSAs to refine and modify this GSP in the future based on a more complete understanding of Subbasin conditions.

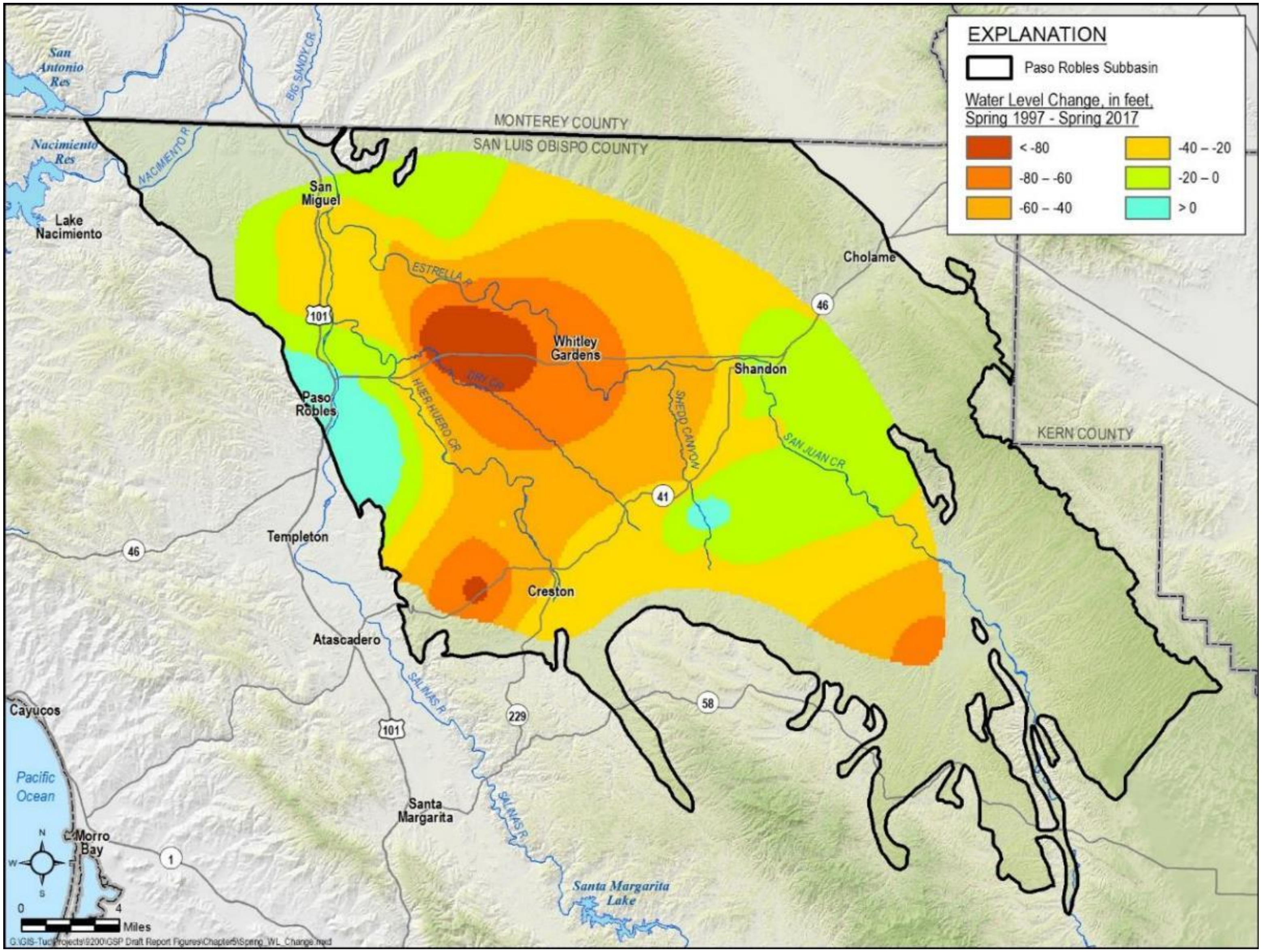


Figure 5-7. Paso Robles Formation Aquifer Change in Groundwater Elevation – Spring 1997 to Spring 2017

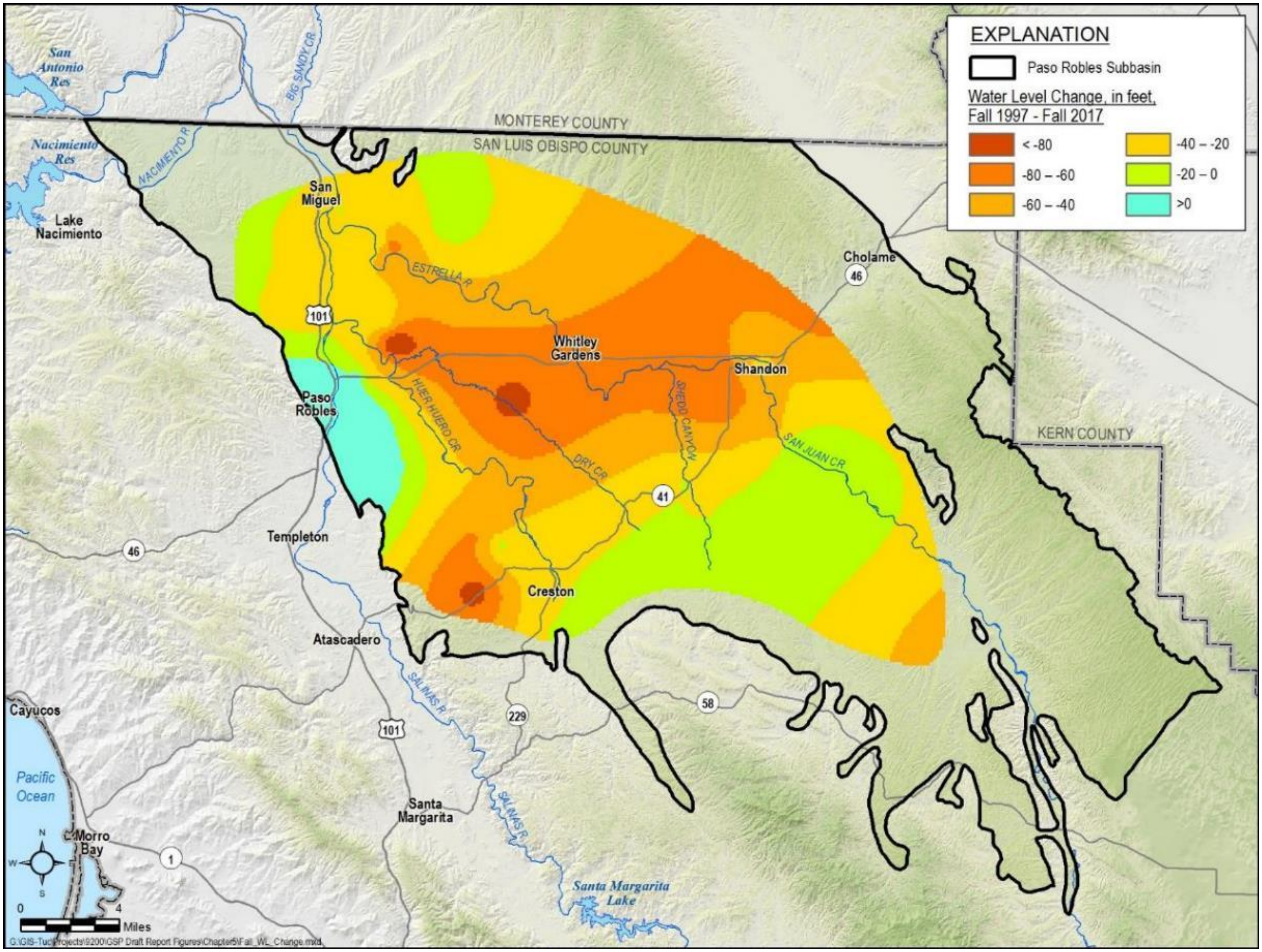


Figure 5-8. Paso Robles Formation Aquifer Change in Groundwater Elevation – Fall 1997 to Fall 2017

5.1.2.2 Paso Robles Formation Aquifer Hydrographs

Appendix D includes hydrographs for wells in the Paso Robles Formation Aquifer that have publicly available data. Only 22 of the monitoring wells have groundwater elevation data that were not collected under confidentiality agreements and sufficient information to confirm that the wells are screened in the Paso Robles Formation Aquifer. The lack of publicly available groundwater level data for the Paso Robles Formation Aquifer is a significant data gap. Long-term groundwater elevation declines are evident on some of the hydrographs shown in Appendix D. The magnitude of measured declines over the period of record is generally more than 50 feet at well 25S/12E-26L01, 26S/15E-20B02, and 27S/13E-28F01. Varying hydrogeology and pumping patterns in these locations leads to variable hydrographs for each of these wells.

The hydrographs show periods of climatic variations grouped by the following designations: wet, dry, or average/alternating wet and dry. Precipitation data were reviewed and analyzed to determine the occurrence and duration of wet and dry periods for the Paso Robles Subbasin. Precipitation from the Paso Robles weather station (NOAA station 46730) was used for this analysis because it is representative of conditions in the Subbasin and has the longest period of record of any station in the Subbasin. Figure 5-9~~Figure 5-9~~ shows total annual precipitation by water year recorded at the Paso Robles station. Mean annual precipitation over the period 1925 to 2017 is 14.6 inches.

Wet and dry periods were determined based on a calculation and review of the Standardized Precipitation Index (SPI), which quantifies deviations from normal precipitation. The SPI was calculated at 1-, 2-, and 5-year time scales using the SPI Generator Tool developed by the National Drought Mitigation Center (NDMC, 2018). The 5-year, or 60-month SPI was selected as representative of multi-year meteorological fluctuations in the basin based on review of the data and computed SPI time series. For a given water year, the 60-month SPI quantifies the wetness or dryness of the preceding 60 months relative to the overall period of record. The annual time-series of the 60-month SPI was reviewed and generalized to determine wet and dry periods from 1930 to 2017 (Figure 5-9~~Figure 5-9~~). A third category, "average/alternating", is included for years during which the preceding 60-month period does not show a strong and persistent deviation from normal precipitation.

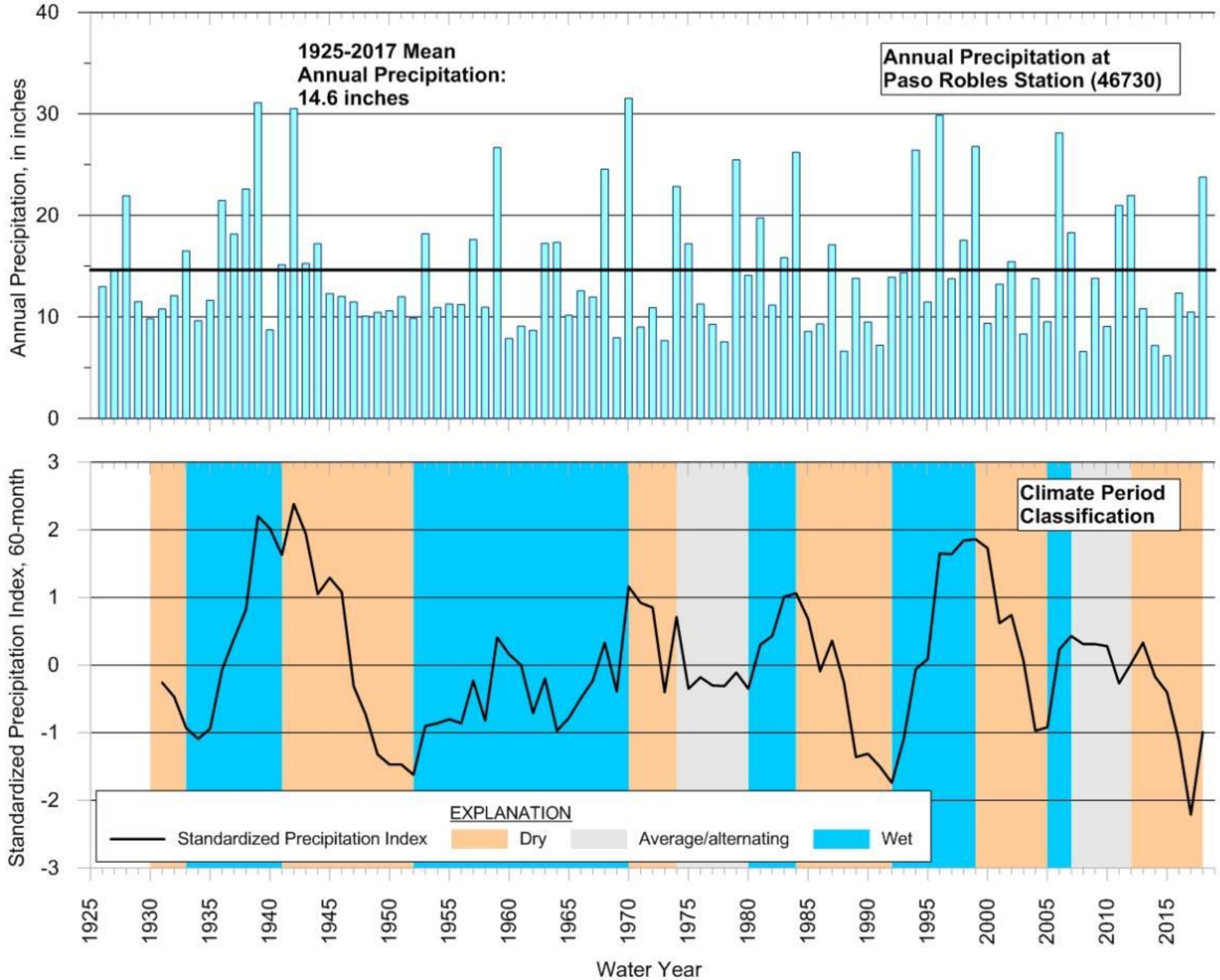


Figure 5-9. Climatic Periods in the Paso Robles Subbasin

5.1.3 Vertical Groundwater Gradients

SGMA regulations require assessment of vertical gradients to evaluate the vertical direction of groundwater movement between and within aquifers. Limited data exist to assess vertical groundwater gradients. Previous hydrologic studies of the Subbasin indicate that groundwater elevations are generally higher in the Alluvial Aquifer than the underlying Paso Robles Formation Aquifer, resulting in groundwater flow from the Alluvial Aquifer to the underlying Paso Robles Formation Aquifer (Fugro, 2005). The *Paso Robles Groundwater Basin Study, Phase II* (Fugro, 2005) stated that there is an assumed upward vertical groundwater gradient within the Paso Robles Formation near the northern portion of the Subbasin, although data were not provided to verify this assumption.

Vertical groundwater gradients can be estimated from nested or clustered wells. Wells 25S/12E-16K04, K05, and K06 are nested and provide groundwater elevation data from different depths in the Paso Robles Formation Aquifer near San Miguel. These wells are adjacent to a water supply well and therefore the vertical groundwater gradients may reflect local pumping conditions rather than broad, regional conditions. Hydrographs for these wells are shown on Figure 5-10~~Figure 5-10~~. Groundwater levels in the shallowest well are shown with a green line, groundwater levels in the middle depth well are shown with a yellow line, and groundwater levels in the deepest well are shown with a red line. Prior to 2002, groundwater levels in the deepest well (red line) were generally higher than the groundwater levels in the middle and shallow wells, indicating an upward vertical groundwater gradient. A consistent vertical groundwater gradient is not apparent between the shallow and middle wells prior to 2002; groundwater elevations in the shallow and middle depth wells fluctuate around each other. After 2012, groundwater elevations in the deepest well were usually similar to or below the groundwater elevations in the shallow and middle depth wells; indicating a change to a downward vertical groundwater gradient.

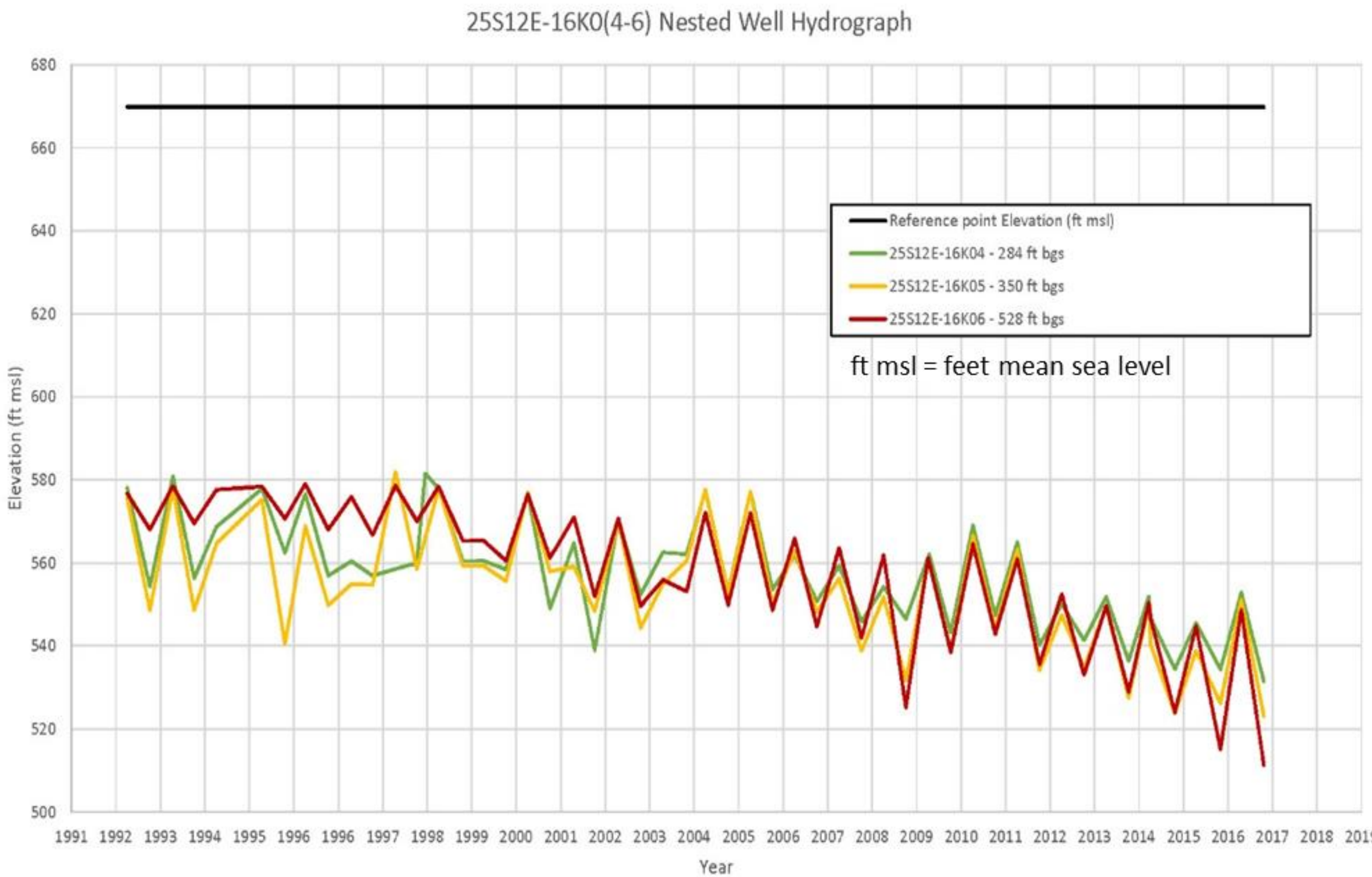


Figure 5-10. Vertical Groundwater Gradients near San Miguel

5.2 Change in Groundwater in Storage

This section summarizes changes in the amount of groundwater stored in the Subbasin. Changes in the amount of groundwater stored in the Subbasin were estimated for water years 1981 through 2016 using the updated Paso Robles Subbasin groundwater model. Chapter 6 provides additional information about the groundwater model.

5.2.1 Alluvial Aquifer

Figure 5-11~~Figure 5-11~~ shows the cumulative change in the amount of groundwater stored in the Alluvial Aquifer for water years 1981 through 2016. The cumulative change is calculated as change since 1981. The period from 1981 through 2011 is considered representative of long-term hydrologic conditions prior to the drought period of 2012 through 2016. In accordance with SGMA Regulations § 354.16 (b), the graph also shows the estimated annual groundwater pumping derived from the updated groundwater model and wet, dry, and average/alternating climatic periods based on the analysis presented in Section 5.1.2.2. The cumulative change in storage is generally a function of both annual pumping and annual climatic conditions.

Over the period 1981 through 2011, the model indicates that approximately 20,000 acre-feet (AF) of storage change occurred in the Alluvial Aquifer. During the drought period 2012 through 2016, the model suggests a loss of groundwater in storage in the Alluvial Aquifer of about 50,000 AF. The loss of groundwater from storage during the drought represents an extreme condition which is not indicative of long-term storage trends in the Alluvial Aquifer.

As indicated on Figure 5-11~~Figure 5-11~~, a decrease in the amount of groundwater stored in the Alluvial Aquifer generally occurs during dry periods and an increase in the amount of groundwater stored in the Alluvial Aquifer generally occurs during wet periods. During the period 1981 through 2011, estimated groundwater pumping from the Alluvial Aquifer decreased from about 6,000 AFY to about 2,000 AFY as indicated by the black bars on Figure 5-11~~Figure 5-11~~. This suggests that the loss in groundwater in storage is not due to increased pumping, but is more likely a result of lack of recharge during low precipitation years.

The projections of groundwater storage loss in the Alluvial Aquifer were made using the groundwater model. Representation of groundwater conditions in the model for the Alluvial Aquifer is based on a relatively sparse groundwater level dataset. Available data suggest that groundwater levels in the Alluvial Aquifer over model period have been generally stable. This suggests that the amount of groundwater in storage has also been relatively stable. Additional groundwater elevation data will be obtained after GSP adoption to improve the understanding of groundwater conditions in the Alluvial Aquifer, update and recalibrate the groundwater model, and further evaluate groundwater storage conditions in the Alluvial Aquifer.

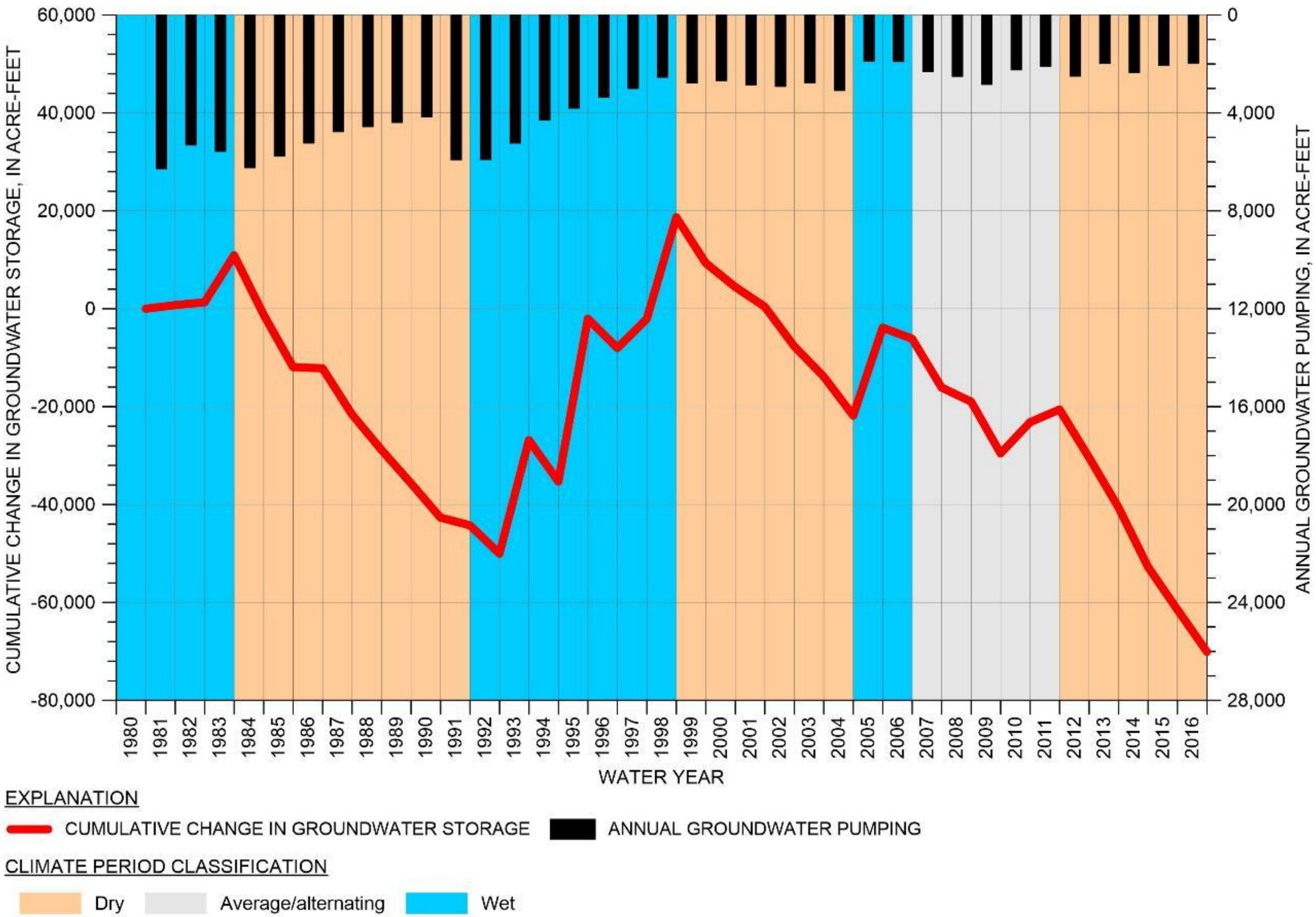


Figure 5-11. Estimated Cumulative Change of Groundwater in Storage in the Alluvial Aquifer

5.2.2 Paso Robles Formation Aquifer

Figure 5-12~~Figure 5-12~~ shows the cumulative change of groundwater in storage in the Paso Robles Formation Aquifer for water years 1981 through 2016. In accordance with SGMA Regulations § 354.16 (b), the graph also shows the annual groundwater pumping and water year type. The climatic variation shown on Figure 5-12~~Figure 5-12~~ is the same climatic variation developed on Figure 5-9~~Figure 5-9~~. The cumulative change in storage is generally a function of both annual pumping and annual climatic conditions. Over the period 1981 through 2011, approximately 369,000 AF were removed from storage in the Paso Robles Formation Aquifer. Over the period 1981 through 2016, approximately 646,000 AF were removed from storage in the Paso Robles Formation Aquifer. Depletion of groundwater in storage generally occurs during dry periods and increases in groundwater in storage generally occur during wet periods, as indicated on Figure 5-12~~Figure 5-12~~. Groundwater pumping decreased during the period from 1981 to 1999 and generally increased from 1999 to 2016. The loss in groundwater in storage in the Paso Robles Formation Aquifer appears to be from a combination of increased pumping since 1999 and a number of dry years with limited recharge.

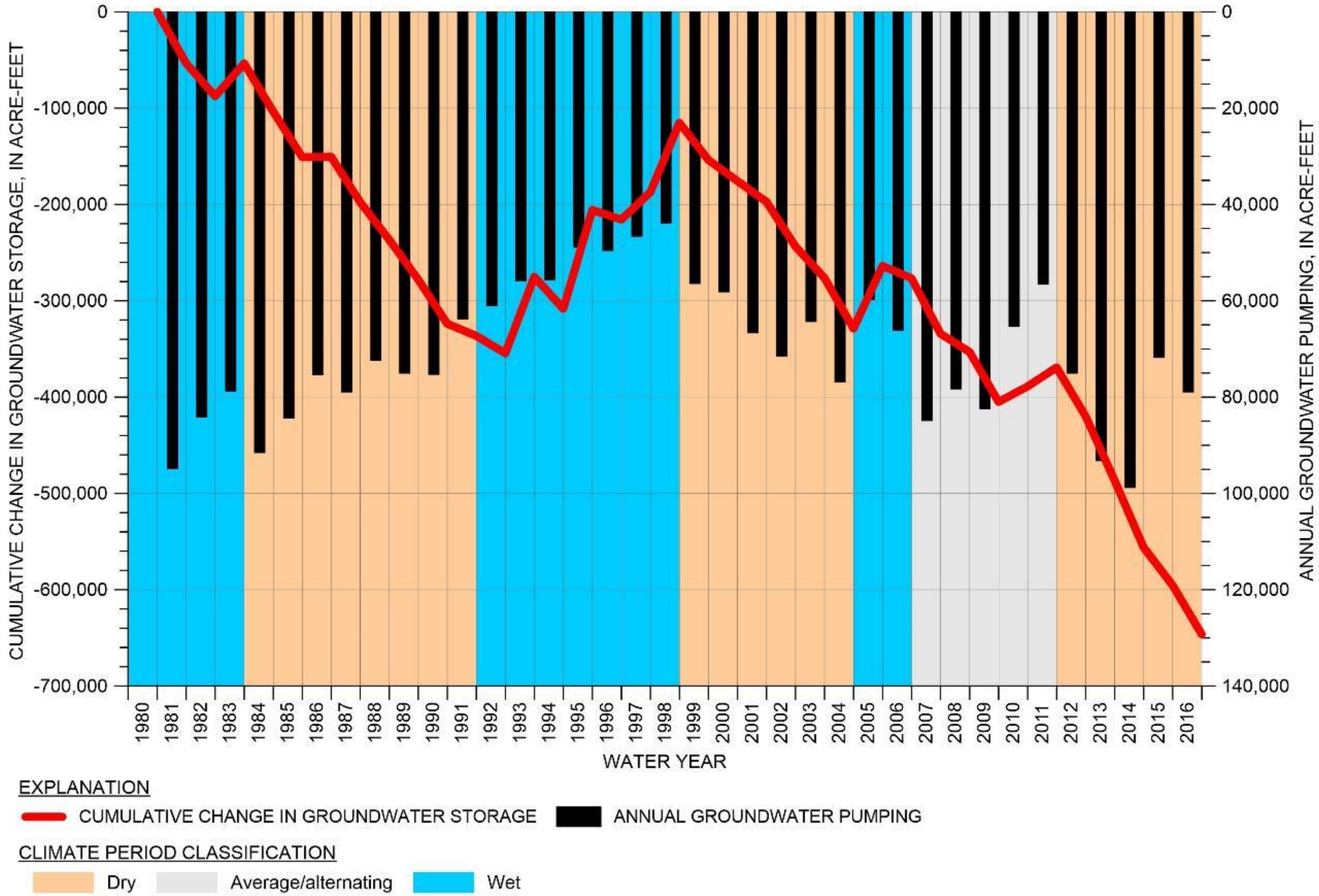


Figure 5-12. Estimated Cumulative Change of Groundwater in Storage in the Paso Robles Formation Aquifer

5.3 Seawater Intrusion

Seawater intrusion is not an applicable sustainability indicator for the Subbasin. The Subbasin is not adjacent to the Pacific Ocean, a bay, or inlet.

5.4 Subsidence

Land subsidence is the lowering of the land surface. While several human-induced and natural causes of subsidence exist, the only process applicable to the GSP is subsidence due to lowered groundwater elevations caused by groundwater pumping.

Historical subsidence can be estimated using Interferometric Synthetic Aperture Radar (InSAR) data provided by DWR. InSAR measures ground elevation using microwave satellite imagery data. DWR provides maps of the Subbasin depicting the difference in InSAR measured ground surface elevation for any two months between June 2015 and June 2018.

The InSAR data provided by DWR is subject to measurement error. DWR has stated that, on a statewide level, the total vertical displacement measurements between June 2015 and June 2018 is subject to two error sources (Brezing, personal communication):

1. The error between InSAR data and continuous GPS data is 16 mm (0.052 feet) with a 95% confidence level
2. The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 feet with 95% confidence level.

Simply adding the errors 1 and 2 results in a combined potential error of 0.1 foot (or 1.2 inches). While this is not a robust statistical analysis, it does provide an estimate of the potential error in the InSAR maps provided by DWR. A land surface change of less than 0.1 feet is therefore within the noise of the data, and is equivalent to no subsidence in this GSP.

Figure 5-13~~Figure 5-13~~ shows the InSAR measured subsidence in the Subbasin. The green area on Figure 5-13~~Figure 5-13~~ is the area with measured ground surface rise or drop of less than 0.1 feet. This is within the measurement error and therefore is an area of no subsidence. The yellow area on Figure 5-13~~Figure 5-13~~ is the area with measured ground surface drop of between 0.1 feet and 0.125 feet. This is slightly outside the measurement area, and may indicate subsidence of up to 0.025 feet over three years, or approximately 0.1 inches per year. This is a minor rate of subsidence and is relatively insignificant and not a major concern for the Subbasin. However, ongoing subsidence over many years could add up to a more significant ground surface drop and the GSAs will continue to monitor annual subsidence.

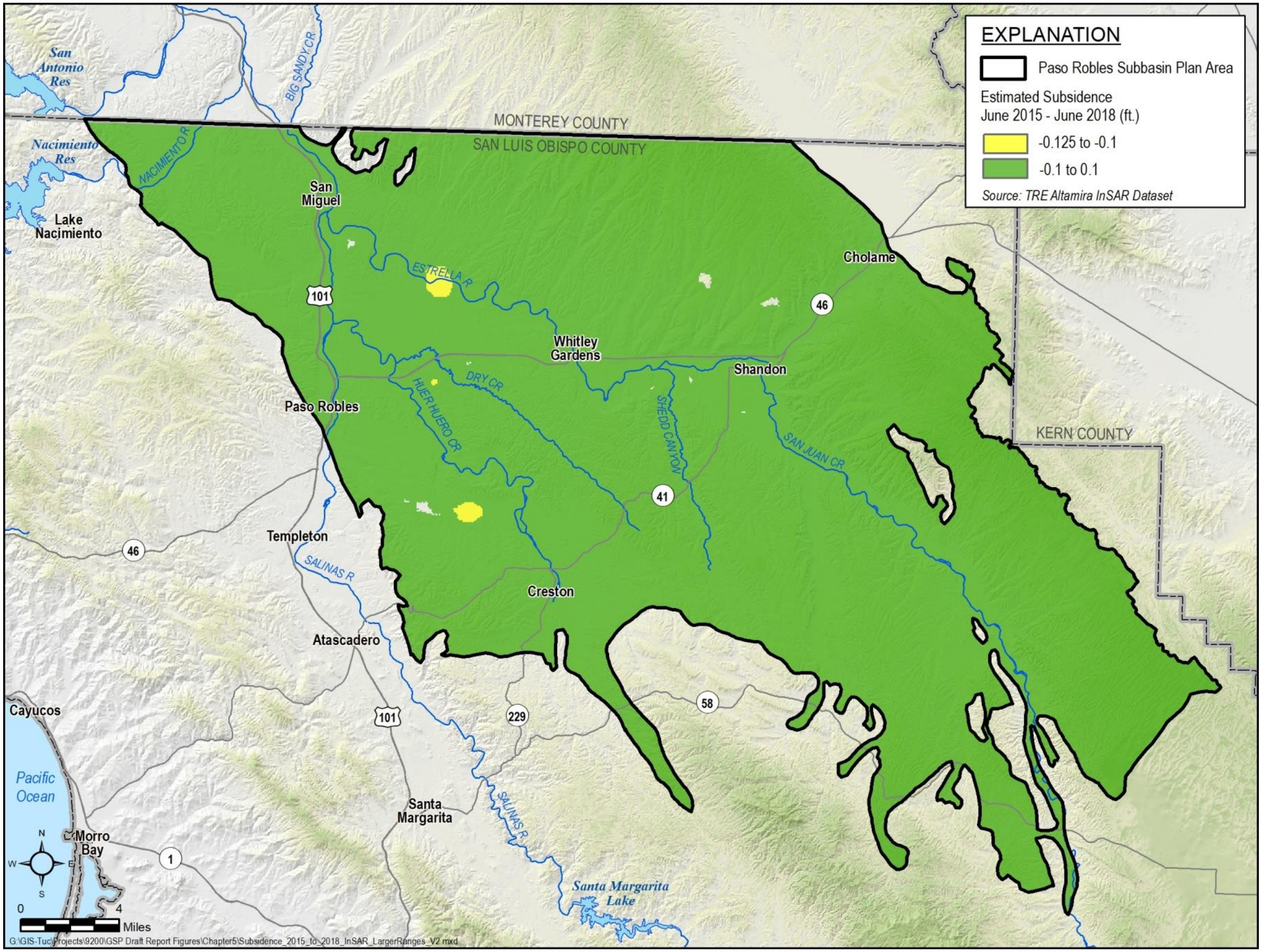


Figure 5-13. Subsidence 2015 to 2018 from InSAR Data

5.5 Interconnected Surface Water

Ephemeral surface water flows in the Subbasin over the last 40 years make it difficult to assess the interconnectivity of surface water and groundwater and to quantify the degree to which surface water depletion has occurred. There are no available data that establish whether or not the groundwater and surface water are connected through a continuous saturated zone in any aquifer. Water elevation contour maps of the Paso Robles Formation wells may suggest that a continuous saturated zone between the surface water and the Paso Robles Formation aquifer does not exist. The potential for interconnected surface water with the alluvial aquifer will be assessed as data are developed and analyzed.

Definitive data delineating any connections between surface water and groundwater or a lack of interconnected surface waters is a data gap that will be addressed during implementation of this GSP.SGMA regulations define interconnected surface water as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (§351 (o)). SGMA requires that GSPs evaluate "impacts on groundwater dependent ecosystems." (Water Code §10727.4(l)). Groundwater dependent ecosystems (GDEs) are defined in the GSP regulations as "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (CCR § 351 (mm)). GDEs can be divided into two groups: plants and animals that depend on surface flow in streams (for example, fish, invertebrates, amphibians) and plants and animals that depend on a shallow water table accessible by plant roots (phreatophytic riparian vegetation and bird or other animal species that inhabit riparian vegetation). In this GSP, GDEs are discussed in the general category of interconnected surface water even though organisms in the second group strictly speaking rely only on a shallow water table, not surface flow in a stream.

Interconnection with stream flow occurs when the water table is near the stream bed elevation, and interconnection with riparian vegetation occurs when the water table is within the root zone, which generally extends to about 25 feet below the ground surface. These two elevation thresholds have different frequencies and durations of occurrence. Along some stream reaches, the water table might reach the stream bed elevation only when there is surface inflow and associated percolation. This connection might be present only during storm runoff events or seasonally in winter. In contrast, the water table may remain within the root zone for months even while water levels are seasonally declining. If the reach is in an area of regional groundwater discharge, the water table can be in the root zone most or all of the time. Thus, the duration of interconnection of groundwater with the riparian root zone is much greater than the duration of interconnection with surface flow in the stream.

In the Paso Robles Subbasin, major streams all overlie alluvial deposits, and interconnection is with alluvial groundwater. The alluvial deposits are relatively thin, and in some parts of the

Basin there are extensive clay layers between the alluvium and the deeper aquifers of the Paso Robles Formation, where most pumping occurs. Accordingly, potential effects of pumping on interconnected surface water are evaluated in two steps: the effects of Paso Robles Formation pumping on alluvial groundwater levels, and the effects of alluvial groundwater levels on vegetation and stream flow. Pumping from the Alluvial Aquifer in the Basin is rare and generally occurs to meet domestic and limited livestock water demands. Large scale irrigation pumping from the Alluvial Aquifer does not typically occur in the Basin.

A generalized conceptual model of interconnection between surface water and groundwater in the Paso Robles Subbasin was articulated in SWRCB Decision 1585, issued in 1982 (SWRCB, 1982). The decision regarded a group of applications for surface diversions from tributaries to the Salinas River between Salinas Dam and the Nacimiento River. By that date, the SWRCB had already determined that groundwater in alluvial deposits along the Salinas River was classified as underflow subject to the rules of surface water appropriation. The Decision described hydrogeologic conditions and recharge processes in the Paso Robles Groundwater Basin, stating that there are "silty clays of low permeability existing within the upper portion of the Paso Robles Formation beneath and adjacent to the Salinas River alluvium… [that] appear to be sufficiently thick and extensive to act as a barrier separating underflow in the river alluvium from groundwater that occurs in the underlying older water-bearing formations." The clays were noted to extend eastward to about the community of Estrella along the Estrella River and the community of Creston along Huer Huero Creek. Upstream of the clays, some percolation from the Estrella River and Huer Huero Creek may directly recharge the Paso Robles Formation.

This hydrogeological conceptual model suggests that groundwater pumping—the preponderance of which is from the Paso Robles Formation—could potentially lower alluvial groundwater levels and deplete stream flows upstream of the clay layers but have only a negligible effect on alluvial water levels and stream flows overlying the clay layers. An additional geographic variation in regional hydrology is that the western part of the watershed surrounding the Subbasin is much wetter than the eastern part. Average annual precipitation over the Coast Ranges along the western side of the watershed is about four times greater than precipitation along the eastern edge of the watershed. As a result, surface runoff into the Salinas River is substantially greater than surface runoff into the Estrella River. The combined effect of greater surface inflow and confining layers beneath the alluvium is to enable the Salinas River to maintain relatively steady groundwater levels in the Alluvial Aquifer that support the establishment and growth of riparian vegetation. Except during major droughts, river recharge has been able to outpace leakage across the confining layers, even after water levels in deep wells have declined. In contrast, some stream reaches in the eastern half of the Subbasin do not appear to be buffered from the effects of pumping. Over several decades, pumping has lowered groundwater levels in localized areas within the Paso Robles Formation Aquifer, which may have potentially depleted stream flow in the past and may have decreased the extent and health of riparian vegetation. Throughout the majority of the Basin, these conditions occurred prior to

2015, and subsequent pumping has not exacerbated the depletion of stream flow. SGMA does not require that GDEs be restored to any condition that occurred prior to 2015.

The identification of interconnected stream reaches was based on a joint evaluation of multiple data sets related to interconnected surface water and GDEs, including precipitation, stream flow, groundwater levels, stream bed elevation, vegetation maps, aerial photographs of vegetation, satellite mapping of vegetation health, and results of groundwater modeling. A preponderance of evidence approach was used in delineating interconnected stream reaches, including subjective assessment of whether the frequency and duration of shallow water table conditions were sufficient to classify a reach as mostly or sometimes interconnected.

Many of the data used in the analysis pre-date 2015, which was the start of the SGMA management period. SGMA does not require that GDEs be restored to any condition that occurred prior to 2015. However, long-term data sets provide greater opportunity for differentiating the separate effects of variables that are often correlated. For example, precipitation, stream flow and groundwater levels are all potential sources of water for riparian vegetation, and all three are low during droughts. The extensive use of pre-2015 data in the analysis does not mean that this GSP intends to restore any conditions to a pre-2015 level.

Evaluation of the multiple data sets is summarized in subsections 5.5.1 through 5.5.4. Subsection 5.5.5 presents the delineated interconnected stream reaches while Subsection 5.5.6 addresses groundwater dependent animals. The technical studies addressing interconnected surface water and GDEs are all provided in Appendix C.

5.5.1 Groundwater Levels

Historical measurements of groundwater levels in wells can be used to identify where and to what extent Alluvial Aquifer water levels are different from Paso Robles Formation Aquifer water levels. The approach used to identify Alluvial Aquifer wells for this interconnected surface water analysis is not the same as the well-log based approach used for the groundwater elevation analysis in Section 5.1.1. The water-level database compiled for the GSP was screened to select wells with long periods of record located near streams. Thirty-one wells met these criteria. For the interconnected surface water analysis, the wells were classified as Alluvial Aquifer or Paso Robles Formation Aquifer based on the historical water level patterns. In Alluvial Aquifer wells, water levels remain relatively steady year after year at an elevation close to that of the nearby stream, and seasonal fluctuations are small. In wells completed in the Paso Robles Formation Aquifer, water levels exhibit seasonal fluctuations, have multiple-year trends in some areas of the Basin and are commonly substantially lower (rarely higher) than the nearby stream. Figure 5-14~~Figure 5-14~~ shows sample hydrographs illustrating the two characteristic patterns.

Three of the five wells with an alluvial water table pattern are along the Salinas River, which is consistent with the conceptual model for interconnected surface water with the associated

Alluvial Aquifer. One is near the Estrella River near the town of Estrella (Jardine Road), which the conceptual model suggests is still within the region of extensive clay layers beneath the alluvium. The final well is next to San Juan Creek about 7 miles upstream of Shandon. Its hydrograph is not as strongly alluvial, but the water levels are close to the creek bed elevation and fairly steady. In these locations, there is no evidence of alluvial water level declines as a consequence of pumping from the Paso Robles Formation Aquifer.

Two new pairs of monitoring wells installed in 2021 provided additional confirmation of the conceptual model (Cleath-Harris Geologists, 2021). One shallow-deep pair is next to the Salinas River at the 13th Street bridge. Water levels in both wells were within 3 feet of the riverbed elevation, indicating interconnection with surface water with the Alluvial Aquifer and a local absence of drawdown in the Paso Robles Formation Aquifer. The other pair was next to the Estrella River at Airport Road. These wells were constructed in 2021 as part of a Supplemental Environmental Project (SEP) which was implemented by the City of Paso Robles. This site is within the region where extensive shallow clay layers are thought to be present, and the water levels appear to confirm this. The shallower well was screened down to 40 feet below the ground surface and had a depth to water of 29.5 feet. The top of the screen in the second well was 160 feet deeper and its water level was 158 feet lower. This represents a vertical water-level gradient close to unity, which means the shallow aquifer is perched above the clay layers and there is an unsaturated zone between the shallow and deep aquifers.

It is recommended that pairs of shallow and deep monitoring wells be installed along the Estrella River upstream of Estrella and along San Juan Creek to provide a better understanding of the relationship between the Alluvial Aquifer and the underlying Paso Robles Formation Aquifer in these areas. Installation of additional monitoring wells is described in the monitoring discussion in Section 7.6.

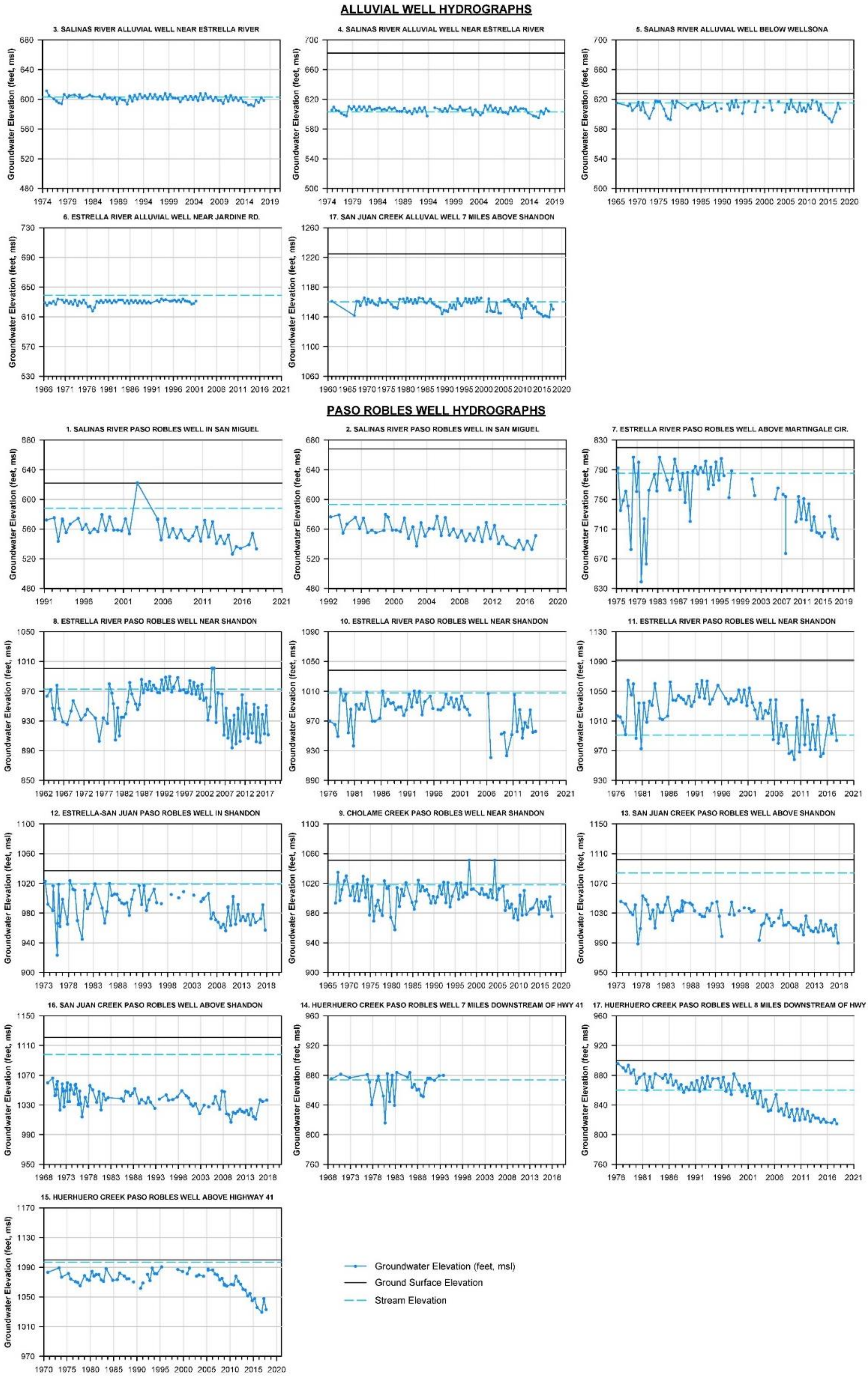
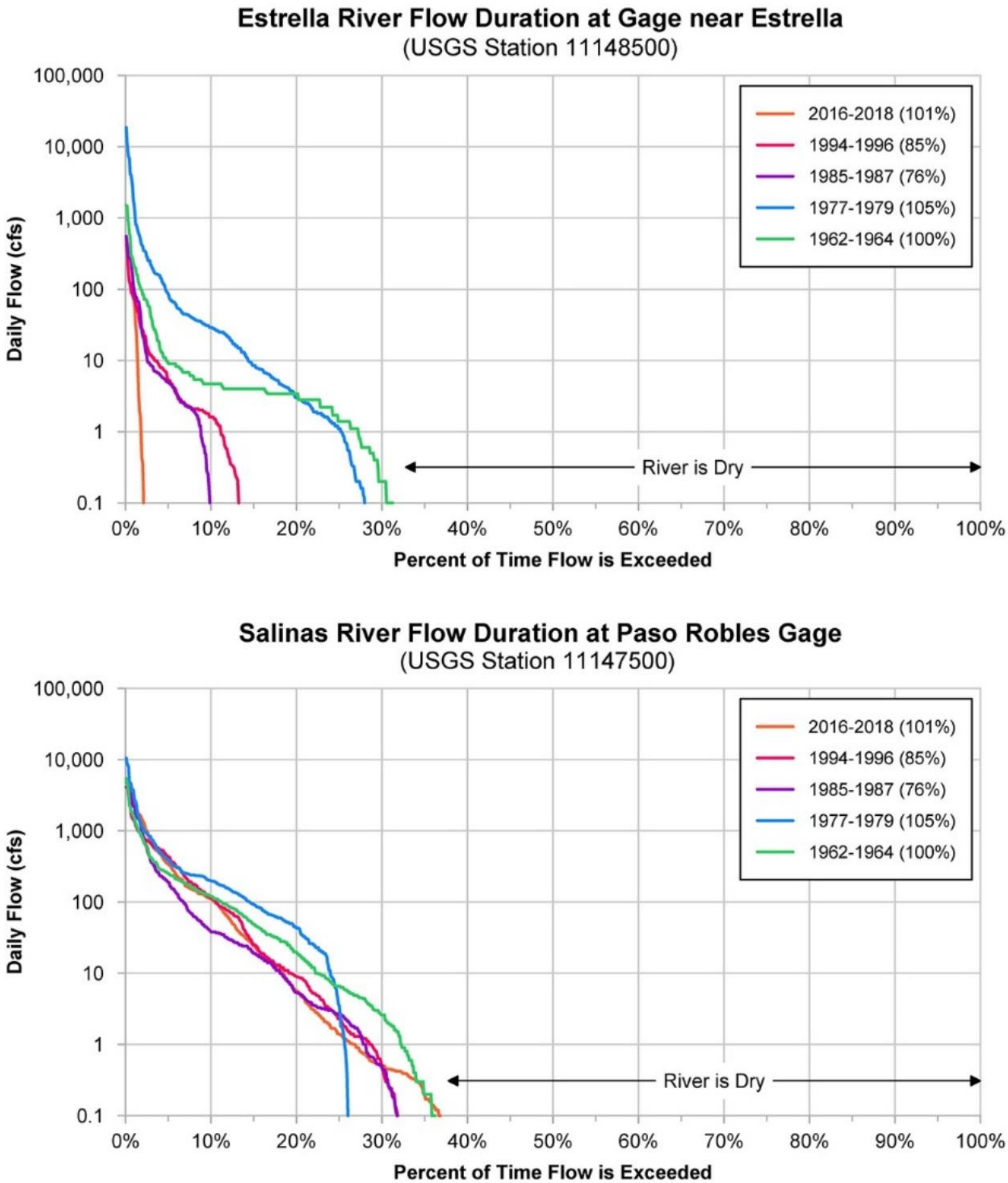


Figure 5-14. Alluvial and Paso Robles Well Hydrographs

5.5.2 Stream Flow

Differences between the low-flow regimes in the Salinas and Estrella Rivers are generally consistent with the hydrologic conceptual model and provide some evidence of flow depletion historically due to pumping along the Estrella River, although the flow record indicates that flow in the Estrella River are infrequent and typically only occur in response to seasonal wet weather conditions. Based on a review of the available stream flow records, any depletion of surface flow within the Estrella River occurred prior to 2015, and subsequent pumping has not resulted in the depletion of stream flow. SGMA does not require that GDEs be restored to any condition that occurred prior to 2015. The Salinas River gage is at Paso Robles, at the upstream edge of the Subbasin. Flows at that location do not reflect percolation or pumping effects within the Subbasin. The Estrella River gage is at Airport Road, downstream of the reaches potentially impacted by pumping. The gage was out of service from 1997-2015, but low-flow data for 2016-2018 was compared with data for 1955-1996.

Figure 5-15~~Figure 5-15~~ shows flow-duration curves for both rivers for four three-year time intervals, roughly a decade apart from the 1960s to 2010s. Each curve displays all daily flows during a three-year period sorted from largest to smallest. The horizontal X axis shows the percentage of time each flow magnitude is exceeded. For perennial streams, the curves would extend across the entire width of the graph because flow exceeds zero 100 percent of the time. For seasonally intermittent streams, the curve bends down and crosses the X axis indicating the percentage of time flow is greater than zero. By plotting the vertical Y axis on a logarithmic scale, changes in low flows are visually expanded. If stream flow depletion is occurring, the effect is to curtail the duration of low flows (bend the curve downward) and shift the X axis intercept to the left.



Note: Percentages in legend indicate precipitation at Paso Robles as percent of 1910-2021 average

Figure 5-15. Flow-Duration Curves for Estrella and Salinas Rivers

As documented in Figure 5-15~~Figure 5-15~~, low flows in the Estrella River have become progressively shorter in duration over the past five decades, indicated by the curves shifting progressively to the left. In contrast, the curves for the Salinas River have remained in a cluster, with no trend to the right or left. These curves suggest that flows upstream of the Estrella gage may have historically been interconnected with groundwater and subject to depletion by groundwater pumping and lowered groundwater levels. Based on a review of the available stream flow records, any depletion of surface flow within the Estrella River occurred prior to 2015, and subsequent pumping has not resulted in the depletion of stream flow. SGMA does not require that GDEs be restored to any condition that occurred prior to 2015.

Low flows and/or damp channel sediments visible in historical aerial photographs provide additional evidence of interconnection between surface water and groundwater. Along the Salinas River, flows as low as 5-8 cfs at the Paso Robles gage produced continuous surface flow all the way to the Nacimiento River, indicating negligible percolation due to a high water table. At other times, flow became discontinuous even when flow at the gage was considerably higher, probably indicating refilling of the Alluvial Aquifer after a period without surface flow.

Air photos indicate a potential for variable interconnection along the Estrella River upstream of the gage. Open water or ribbons of very damp soil along the channel were commonly present at various locations from about 4 miles upstream of Whitley Gardens to about 0.5 mile downstream of Whitley Gardens and along about a 1-mile reach near Martingale Circle (about 5 channel miles downstream of Whitley Gardens) prior to 2012. This reach is referred to in this analysis as the “middle reach” of the Estrella River. Since 2012, those apparent gaining conditions along the middle reach have not been visible in dry season air photos, possibly due to the 2012-2016 drought or to long-term declines in groundwater levels. No efforts were made to ground truth or physically verify the presence of these features. Although there is no evidence that pumping from the Paso Robles Formation Aquifer is affecting Salins River flows, it is recommended that additional investigations be undertaken to further characterize this area.

5.5.3 Riparian Vegetation

Vegetation patterns along streams can also be used to map potential interconnection of surface water and groundwater because growth is more vigorous where plant roots can reach the water table. There are limitations to this approach, however. First, some plant species are facultative phreatophytes, which means they will establish and grow with or without continuous access to the water table. A second limitation is that riparian vegetation in shallow water table areas is subject to mechanical removal by flood scour In spite of these limitations, broad patches of dense riparian vegetation stand out in aerial photographs and provide an indication of where the water table is shallow and interconnected with the root zone and possibly also the stream channel.

A source of vegetation mapping often used for preparing GSPs is the Natural Communities Commonly Associated with Groundwater (NCCAG) mapping provided in georeferenced digital formats on DWR's SGMA Data Portal. The NCCAG maps of potential riparian and wetland vegetation are statewide compilations of numerous local vegetation mapping studies, mostly from the early 2000s. However, a detailed comparison of vegetation and wetland polygons in the NCCAG maps with aerial photographs revealed that the accuracy of the NCCAG vegetation delineations is poor in the Subbasin (Appendix C).

For the purposes of the interconnected surface water analysis for this GSP, a new map of riparian and wetland vegetation was created by digitally outlining areas of visibly dense riparian trees or shrubs more than about 50 feet wide along river and creek channels based on May 2017 aerial photography. The photography represents non-drought conditions in a year close to the start of the SGMA management era (January 2015). For isolated wetlands, mapped polygons in the NCCAG data set were compared with the 2017 aerial photographs and retained as groundwater dependent wetlands if they exhibited open water or bright green herbaceous vegetation in the dry season and were natural features (as opposed to constructed stock ponds).

The resulting map of groundwater-dependent vegetation is shown in Figure 5-16~~Figure 5-16~~. In-channel riparian and wetland vegetation is mapped as polygons accurately delineating the perimeter of the vegetation patch. Isolated wetlands are shown using symbols because many of them would otherwise be too small to see on a basin-scale map. The vegetation distribution is generally consistent with the conceptual model for interconnected surface water. Dense riparian vegetation is most abundant along the Salinas River, which has relatively large and persistent surface flows as well as consistently shallow depth to groundwater in the adjacent Alluvial Aquifer. These conditions also result in a relatively high abundance of in-channel wetlands. Riparian vegetation along the Estrella River is generally sparser but is more abundant along the middle reach than the upper and lower reaches. Patches of sparse and dense riparian vegetation and even potential wetlands are present along San Juan Creek at locations more than about 10 miles upstream of Shandon. No efforts were made to ground truth or physically verify the presence of these features and there is no evidence that pumping from the Paso Robles Formation Aquifer is affecting these areas.

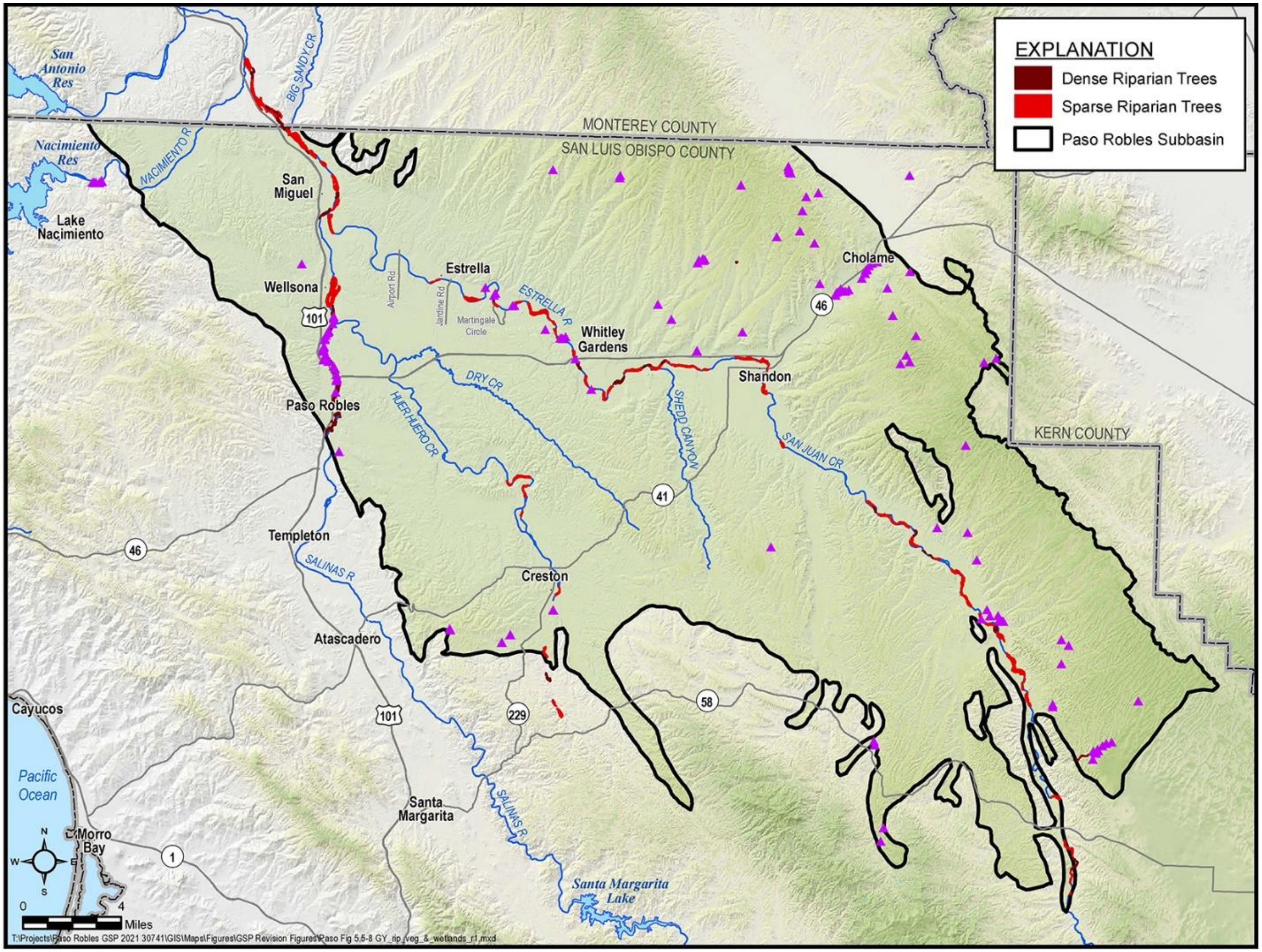


Figure 5-16. Groundwater Dependent Vegetation in Paso Robles Subbasin

Riparian vegetation conditions in 2018 was compared with conditions in 1994 along the entire lengths of the Salinas River, Estrella River, Huer Huero Creek and San Juan Creek using aerial photographs. Both of those dates were 2-4 years after the end of a major drought, and the droughts were of similar intensity and duration. In other words, precipitation and stream flow conditions during the years immediately preceding the two photographs were similar, but groundwater levels were different. Between those two periods, there were cumulative water-level declines in Paso Robles Formation Aquifer wells of 25-70 feet in the eastern part of the Subbasin. Water levels in Alluvial Aquifer wells along the Salinas River remained stable until 2011, declined 12-18 feet during 2012-2016 and then recovered (see Figure 5-14Figure 5-14). The density and extent of patches of riparian vegetation along the waterways in 2018 was visually classified as "more", "the same" or "less" than in 1994.

The results of the vegetation comparison are shown in Figure 5-17Figure 5-17. Where there were differences along the Salinas River, they were all decreases in vegetation coverage. Review of additional photographs between 1994 and 2018 indicated that the decrease in vegetation occurred almost entirely during 2013-2017. This suggests that the relatively small and temporary declines in alluvial water levels during 2012-2016 were large enough to adversely impact vegetation. Along the Estrella River, vegetation coverage mostly declined near Shandon and along the downstream end toward the Salinas River, and the declines occurred over a longer period. Along the middle reach, however, vegetation coverage unexpectedly increased in a number of locations. This is the same river segment where gaining flow could be seen in aerial photographs up until 2012, indicating a near-surface water table. Although that river segment is thought to be east of the extensive near-surface clay layers in the Paso Robles Formation Aquifer, some aspect of hydrogeology and recharge appears to be sustaining a high water table in spite of large water-level declines in deeper wells in that region. No efforts were made to ground truth or physically verify the river geology in this area and additional investigations would be required to further characterize this area.

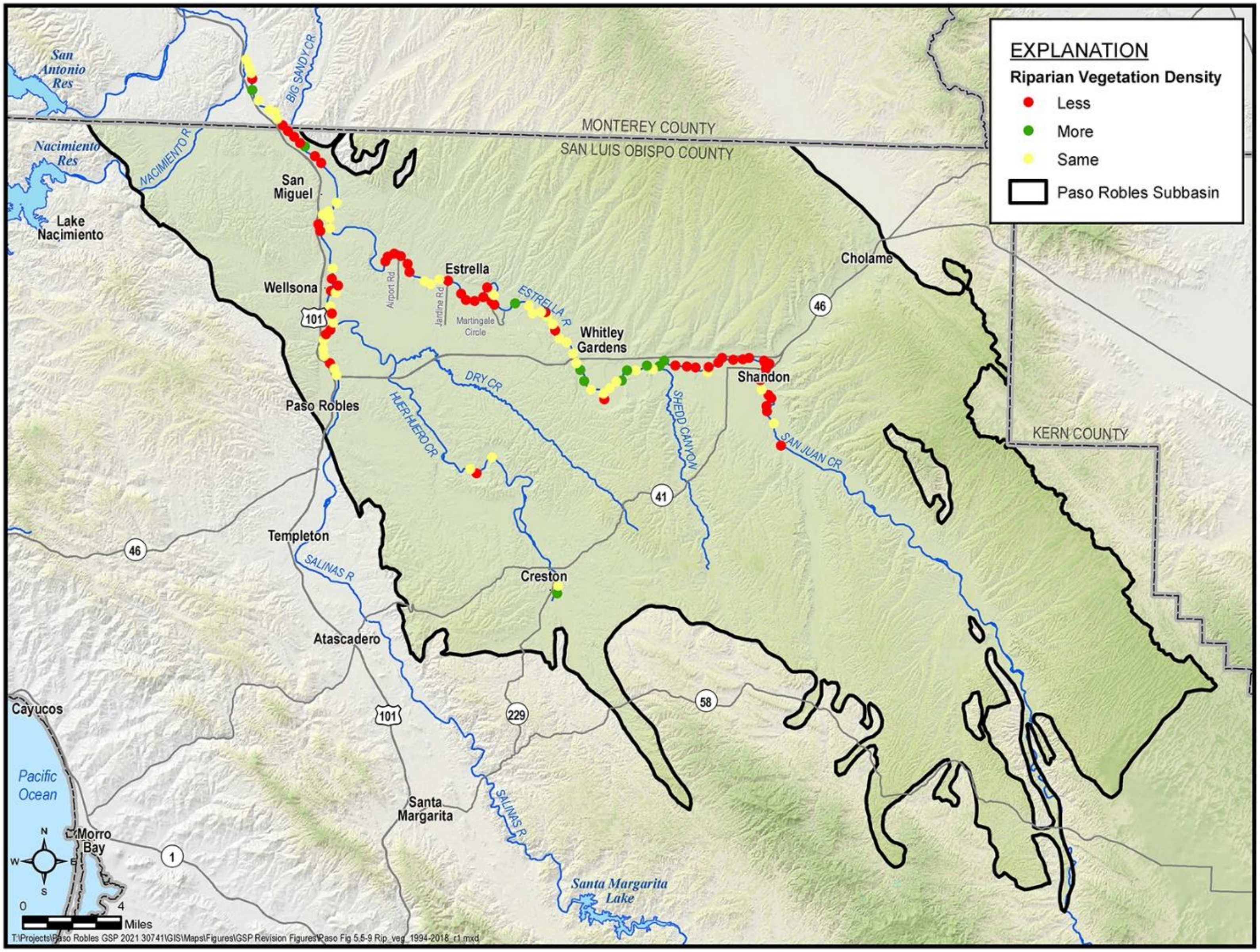


Figure 5-17. Density of Riparian Vegetation, Paso Robles Subbasin

Additional vegetation data were evaluated for indications of changes related to groundwater levels (Appendix C). Briefly, high-resolution aerial photographs for 2013 and 2017 were inspected to identify four limited locations where riparian trees appear to have died during the recent drought. These locations generally occur where Paso Robles Formation Aquifer groundwater levels had been declining for a few decades or where Alluvial Aquifer groundwater levels declined by over 10 feet for a few years between 2013 and 2017.

An Enhanced Vegetation Index (EVI) trend analysis was performed for the sparse and dense riparian vegetation areas presented on Figure 5-16~~Figure 5-16~~ for the purpose of identifying and evaluating trends in riparian vegetation health as an indicator of potential long-term trends in surface water-groundwater interactions within stream reaches. EVI data provide an indicator of healthy, well-watered vegetation. It is calculated from the proportions of visible and near-infrared sunlight reflected by vegetation. EVI values typically range from zero to over 0.7. Healthy, or well-watered, vegetation absorbs most of the visible light that hits it and reflects a large portion of near-infrared light, resulting in a high EVI value. Unhealthy, dry, or dormant vegetation reflects more visible light and less near-infrared light, leading to a lower EVI value.

The EVI analysis was processed in Climate Engine (Huntington et al., 2017) using Landsat data from January 2009 through present. This analysis period is considered representative of recent hydrologic conditions as it begins and ends with similar hydrologic conditions and includes dry, wet, and average periods. The results of this study indicate that riparian vegetation health has generally remained stable over the analysis period suggesting that Alluvial Aquifer groundwater levels have remained a reliable water source within the rooting zone depth of the established riparian communities. Observed cyclical patterns of increasing and decreasing riparian vegetation health correlate strongly with water year type indicating that water levels in the Alluvial Aquifer operate independently from the long-term declining water levels induced by groundwater pumping in the underlying Paso Robles Formation Aquifer (Appendix C).

5.5.4 Simulated Groundwater-Surface Water Interconnection

Results of groundwater modeling provide additional clues regarding the location and timing of interconnected surface water. Stream cells where annual groundwater discharge into the stream averaged 10 AFY or more were shown on Figure 4-17~~Figure 4-17~~. Those locations included the Salinas River above Huer Huero Creek and along a 3-mile reach below San Miguel. They also included the middle reach of the Estrella River. Those locations are consistent with the water level and vegetation data presented above. However, the model also had gaining stream reaches along Huer Huero Creek and parts of the upper reach of the Estrella River (from Shandon down to Shedd Canyon), where historical vegetation does not indicate the presence of shallow groundwater. This might indicate a bias in modeling results toward slightly high Alluvial Aquifer groundwater levels along those rivers. Conversely, the model did not simulate gaining flow where the San Juan Fault crosses San Juan Creek, where a perennial spring is located in the channel.

The locations of simulated gaining and losing reaches were also compared for 1998 and 2016, representing years with relatively high and low groundwater levels, respectively. The locations of simulated gaining reaches in 1998 closely matched the locations of simulated groundwater inflow shown in Figure 4-17~~Figure 4-17~~. As expected, the lengths of the gaining reaches were much shorter in 2016 but still included part of the middle reach of the Estrella River near Whitley Gardens, where a dense patch of riparian vegetation is present.

5.5.5 Delineation of Interconnected Surface Water

Stream reaches where groundwater may potentially be interconnected with surface flow or the riparian vegetation root zone are shown in Figure 5-18~~Figure 5-18~~. The delineation is based on an interpretation of the data and analyses described in the preceding sections. This involved some subjective assessments such as differentiating “dense” from “sparse” riparian vegetation or estimating how frequent and persistent interconnection may be designated “interconnected”. Along stream channels, two categories of interconnection were assigned: interconnection with surface water and interconnection with riparian vegetation. The former requires higher water levels and typically occurs less frequently or for shorter periods of time. The latter includes areas where the water table is less than about 25 feet below the stream bed most of the time. Empirically, this is the root zone depth associated with the presence of dense riparian vegetation. These considerations are discussed by stream reach below. No efforts were made to ground truth or physically verify the presence of actual interconnection and there is no evidence that pumping from the Paso Robles is currently affecting these areas.

The entire length of the Salinas River from Paso Robles to the confluence with the Nacimiento River was classified as interconnected with surface water and shallow groundwater in the Alluvial Aquifer. The presence of very stable water levels close to the riverbed elevation in all Alluvial Aquifer wells along that reach supports this designation, as does the presence of sparse to dense riparian vegetation along most of the reach. Even small inflows to the upper end of the reach commonly extend along the entire length of the reach, which also indicates that the water table is at or near the riverbed elevation along the entire length of the reach.

The Estrella River below Estrella (near Jardine Road) was classified as not interconnected. This classification reflects the very small amount of riparian vegetation along the entire reach throughout the analysis period (1989-2021). Although shallow clay layers are thought to be present in this area and the new shallow monitoring well at Airport Road confirms the presence of a water table 30 feet below the ground surface, this depth to water appears to be too great for vegetation to readily establish given the low frequency and duration of surface flow in the river.

The middle reach of the Estrella River, from Jardine Road up to Shedd Canyon contains alternating segments that appear to be not connected or are potentially connected to the vegetation root zone. These segments were classified primarily on the density of riparian vegetation. The only confirmation of groundwater levels is at a single well near the downstream end of the middle reach, where the depth to water was consistently about 10 feet below the riverbed. Emergent flow appeared to be present in some dry-season aerial photographs along a segment below Shedd Canyon, about 2.5 to 4 miles upstream of Highway 46. Open water or wet channel sediments appear to be present in some aerial photos in winter or spring but not during the dry season since about 2012. Thus, that segment was not classified as interconnected with surface water as of the start of the SGMA management period (2015).

The Estrella River from Shedd Canyon up to Shandon and the lowermost 10 miles of San Juan Creek were classified as not interconnected. Although sparse riparian vegetation is present in places, the depth to groundwater in Paso Robles Formation Aquifer wells has been declining for decades and now exceeds the rooting depth of riparian vegetation. The vegetation that remains probably consists of facultative phreatophytes or is vestigial mature vegetation that has managed to survive declining water levels. In any case, recruitment of new phreatophytic riparian vegetation is very unlikely under current conditions. Many of the data used in the analysis pre-date 2015, which was the start of the SGMA management period. SGMA does not require that GDEs be restored to any condition that occurred prior to 2015.

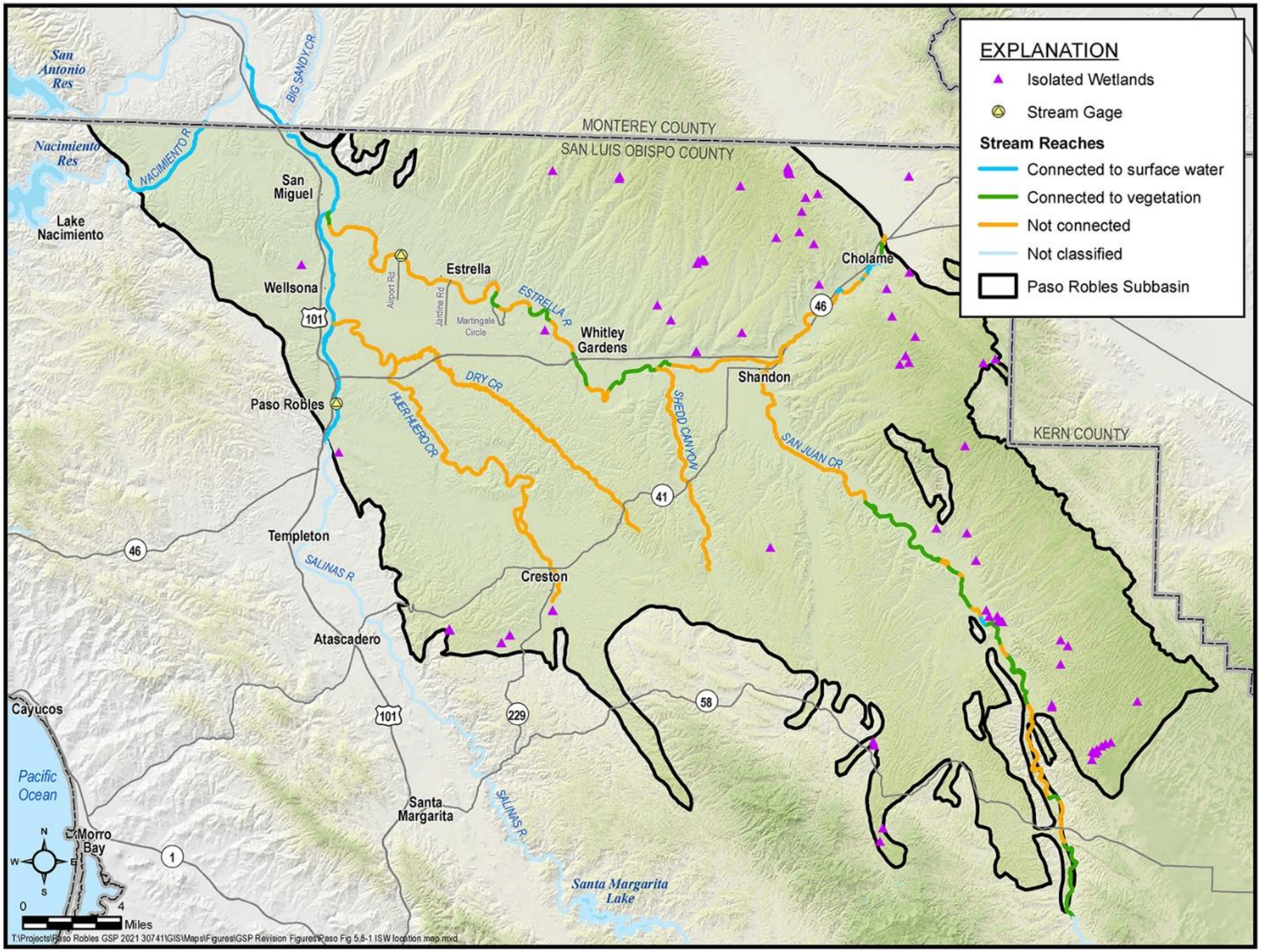


Figure 5-18. Locations of Interconnection Between Groundwater and Surface Water

Much of San Juan Creek more than 10 miles upstream of Shandon appears to be potentially interconnected to riparian vegetation based on the presence of sparse or dense vegetation along most of the reach. One short reach where the San Juan Fault crosses the creek was classified as interconnected to surface water because it usually has emerging groundwater along a low-flow channel bordered by wetland vegetation. The one well with water-level data along this reach has water levels that are usually within 10 feet of the creek bed elevation.

The lowermost 5 miles of Cholame Creek were delineated as not connected based on the absence of significant riparian vegetation and water levels in the sole monitoring well that average about 30 feet below the ground surface. Farther up the creek, however, is a reach several miles long that has open water or wetland vegetation in most historical aerial photographs. Shallow groundwater along that reach could be caused by faults that pass through the area (see Figure 4-4). For unknown reasons, the shallow water table and surface flow conditions have not caused the establishment of dense riparian vegetation.

Riparian vegetation is generally absent along Huer Huero Creek, Dry Creek and Shedd Canyon and is typically sparse where it is present. The depth to water in wells in those parts of the Subbasin is uniformly too deep to support riparian vegetation. Accordingly, those waterways were all classified as not connected to groundwater.

The reach of the Nacimiento River that traverses the northwest corner of the Subbasin was classified as interconnected to surface water because reservoir releases during the dry season are more than sufficient to sustain a high water table adjacent to the river. That reach is far from major pumping centers in the Paso Robles Subbasin and hence unlikely to be significantly depleted by pumping.

Isolated, off-channel wetlands shown on the interconnected surface water map (Figure 5-14~~Figure 5-14~~) are the subset of the NCCAG wetlands where distinctly green vegetation was visible in dry season aerial photographs and the feature appeared to be a natural depression, not a constructed stockpond. These areas are far from major pumping centers in the Paso Robles Subbasin and are not subject to depletion by pumping.

5.5.6 Groundwater Dependent Animals

Many fish and wildlife species use aquatic and riparian habitats that are supported by groundwater. For the purpose of this GSP, beneficial use for habitat is limited to native species present in the Subbasin as of 2015, when SGMA took effect. The focus was on species that are state or federally listed as threatened, endangered or of special concern. This implicitly assumes that non-listed species will probably also be sustained if hydrologic conditions are suitable for sustaining the rarer species.

The reference document entitled Methodology for Identifying Groundwater Dependent Ecosystems documents a review of several sources of habitat information. Those sources often disagreed regarding which species are present within the Paso Robles Subbasin. For GSP purposes, it was concluded that animals that depend on riparian vegetation will probably be in good condition if the vegetation is in good condition. The one listed aquatic species seasonally present in streams that cross the Subbasin is southern steelhead which migrates up and down the Salinas River in winter and spring. Analysis in the above-mentioned reference document shows that groundwater pumping does not materially impact passage opportunity for steelhead because passage is only possible during relatively high flows and pumping from the Paso Robles Formation Aquifer has little effect on Salinas River flows because of clay layers beneath the alluvium along the Salinas River.

5.6 Groundwater Quality Distribution and Trends

Although groundwater quality is not a primary focus of SGMA, actions or projects undertaken by GSAs to achieve sustainability cannot degrade water quality to the extent that they would cause undesirable results. Therefore, the groundwater quality distribution and trends discussed in this section do not identify conditions that must be addressed by the GSP, but rather identify conditions that should not be exacerbated by this GSP.

Groundwater quality samples have been collected and analyzed throughout the Subbasin for various studies and programs. Water quality samples have been collected on a regular basis for compliance with regulatory programs. Additionally, a broad survey of groundwater quality sampling was conducted for the *Paso Robles Groundwater Basin Study, Phase I* (Fugro, 2002), and most recently by the USGS in 2018. Historical groundwater quality data were compiled for use in the SNMP (RMC, 2015).

This GSP focuses only on constituents that might be impacted by groundwater management activities. The constituents of concern are chosen because:

1. The constituent has either a drinking water standard or a known effect on crops
2. Concentrations have been observed above either the drinking water standard or the level that affects crops.

5.6.1 Groundwater Quality Suitability for Drinking Water

Groundwater in the basin is generally suitable for drinking water purposes. The *Paso Robles Groundwater Basin Study, Phase I* (Fugro 2002) reviewed water quality data from public supply wells to identify exceedances of drinking water standards. The drinking water standards Maximum Contaminant Levels (MCLs) and Secondary MCLs (SMCLs) are established by Federal and State agencies. MCLs are legally enforceable standards, while SMCLs are guidelines established for nonhazardous aesthetic considerations such as taste, odor, and color. The most common water quality standard exceedance in the Subbasin was exceedance of the SMCL for TDS, which exceeded the standard in 14 samples from the 74 samples. Nitrate also exceeded the MCL in four samples. One exceedance of mercury was found in the San Miguel area in a 1990 sample. There have been no recorded exceedances of mercury in any samples collected since that date.

5.6.2 Groundwater Quality Suitability for Agricultural Irrigation

Groundwater in the basin is generally suitable for agricultural purposes. Fugro (2002) evaluated the agricultural suitability of groundwater using three metrics:

1. Salinity as indicated by electrical conductivity
2. Soil structure as indicated by sodium absorption ratio and electrical conductivity
3. Presence of toxic salts as indicated by concentrations of sodium, chloride, and boron

Of the 74 samples evaluated 37 had no restrictions on irrigation use (Fugro, 2002) based on these criteria. This does not mean that half of the groundwater in the basin is unsuitable for irrigation; only that half of the samples had some constituent that may restrict unlimited irrigation use. Most cases of slight to moderate restriction on irrigation use were due to sodium or chloride toxicity. Severe restrictions for 13 samples were generally the result of high sodium, chloride, or boron toxicity.

5.6.3 Distribution and Concentrations of Point Sources of Groundwater Constituents

As noted in the SNMP (RMC, 2015), groundwater constituents of concern derive from point sources such as spill or leaks as well as diffuse sources, including:

- Irrigation water (e.g., potable water, groundwater, and future recycled water);
- Agricultural inputs (e.g., fertilizer and amendments);
- Septic system recharge;
- Infrastructure (e.g., percolation from treated wastewater ponds, leaking pipes); and
- Rainfall infiltration, mountain front recharge, and natural stream losses.

Potential point sources of groundwater quality degradation were identified using the State Water Resources Control Board (SWRCB) Geotracker website. Waste Discharge permits were also reviewed from on-line regional SWRCB websites. Table 5-1~~Table 5-1~~ summarizes information from these websites. Figure 5-19~~Figure 5-14~~19 shows the location of potential groundwater contaminant point sources. Based on available information there are no mapped groundwater contamination plumes at these sites, although investigations are ongoing.

Table 5-1. Potential Point Sources of Groundwater Contamination

Site Name	Site Type	Constituents of Concern (COCs)	Status
Former Chevron 9-0750	LUST Cleanup Site	petroleum hydrocarbons	remedial action plan submitted Q2 2018
Kirkpatrick Property (Unocal Portion)	Cleanup Program Site	crude oil	impacted soil; health risk assessment prepared in 2016
Lucy Brown Road Pipeline Site (Former ConocoPhillips Site #3469)	Cleanup Program Site	crude oil, diesel, gasoline	Initial groundwater monitoring data no significant impacts to groundwater.
Estrella Airfield (Paso Robles Municipal Airport)	Military Cleanup Site	unknown	unknown
Camp Roberts Solid Waste Site	Land Disposal Site	metals, cyanide, sulfide, herbicides, volatile organic compounds (VOCs), pesticides, PCBs, phthalate esters, phenols, semi-VOCs	TDS, nitrate and manganese detected in wells at concentrations above regulatory standards.
Camp Roberts South and Closed Landfill	Land Disposal Site	VOCs, chloride, sulfate, nitrate, sodium, manganese, TDS, total organic carbon	carbon tetrachloride detected at concentrations exceeding MCL.
Paso Robles Solid Waste Site	Land Disposal Site	chloride, total alkalinity, manganese, nitrate, sodium, sulfate, temperature, TDS, VOCs, Pesticides, PCBs, organophosphorus compounds, herbicides, semi-VOCs	COCs not detected in groundwater; sulfate and barium locally elevated; no remedial activities.

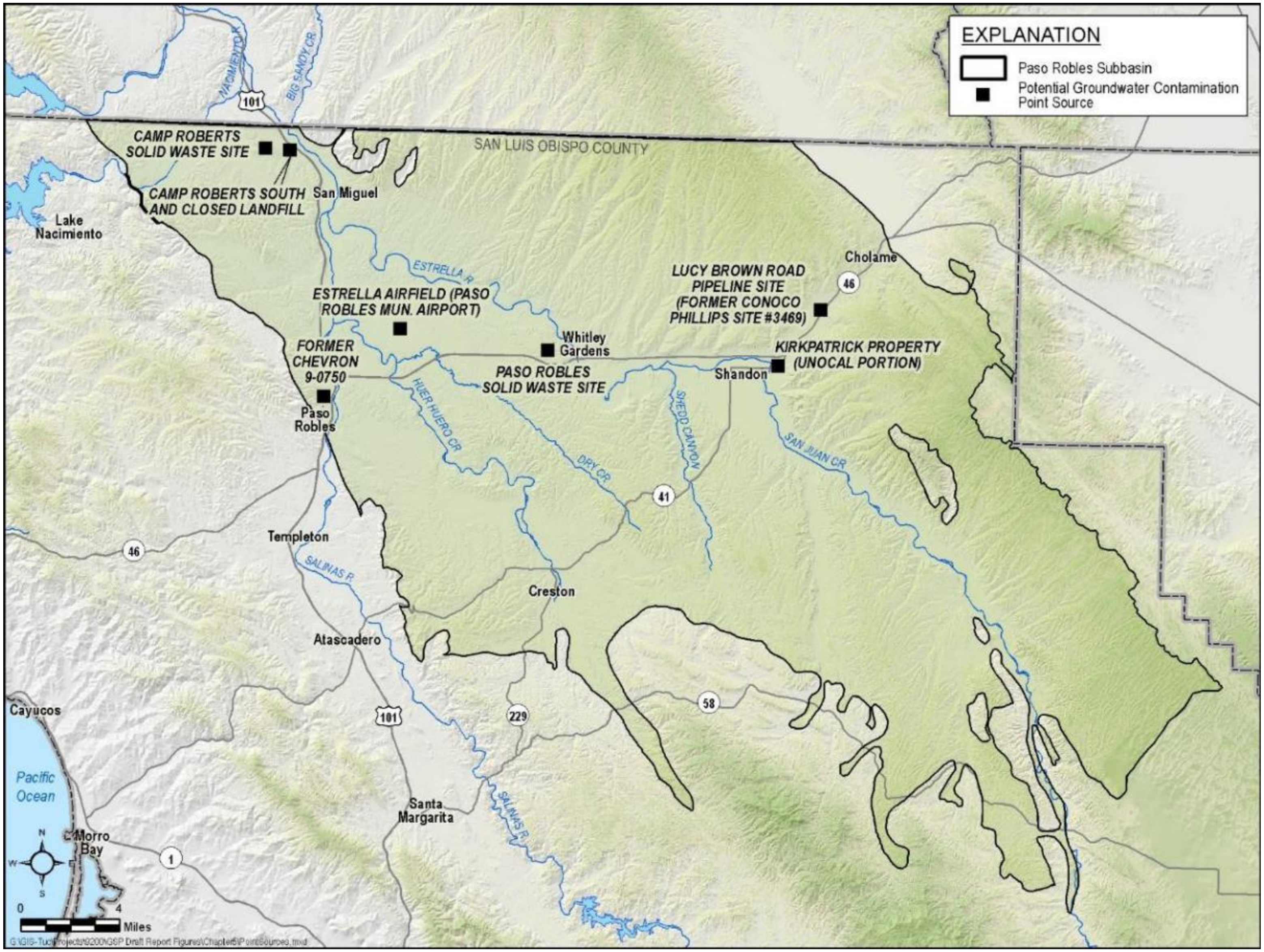


Figure 5-191419. Location of Potential Point Sources of Groundwater Contaminants

5.6.4 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents

Fugro (2002) identified a number of constituents of concern that are broadly distributed throughout the Subbasin. The SNMP (RMC, 2015) provides additional data on the distribution of certain constituents. The data from these previous reports are presented in terms of the informal subareas that have been used in previous studies to refer to various regions within the Subbasin. These seven subareas are not part of this GSP; RMC, 2015 shows the approximate location of these areas.

5.6.4.1 Total Dissolved Solids

TDS is a constituent of concern in groundwater because it has been detected at concentrations greater than its SMCL of 500 milligrams per liter (mg/L). Table 5-2~~Table 5-2~~ shows the range and average TDS concentrations by subarea as reported in the SNMP (RMC, 2015). This table shows the average TDS concentrations are greater than the SMCL of 500 mg/L in parts of the Subbasin. This table includes data for portions of the Bradley, North Gabilan, and South Gabilan subareas that are outside the Subbasin.

Table 5-2. TDS Concentration Ranges and Averages

Hydrogeologic Subarea	TDS Concentration Range (mg/L)	Average TDS Concentration (mg/L)
Estrella	350 – 1,560	552
Shandon	270 – 3,160	563
Creston	190 – 1,620	388
San Juan	160 – 2,170	425
Bradley	400 – 1,280	751
North Gabilan	370 – 1,320	856
South Gabilan	370 – 1,320	451

Source: RMC, 2015

The distribution and trends of TDS in the Subbasin are shown on Figure 5-20~~Figure 5-15~~20. This figure is from the SNMP (RMC, 2015) and includes portions of the Subbasin north of the Monterey County line which are outside the Subbasin. The study area for the SNMP also did not extend to the southeastern edge of the Subbasin. TDS distribution shown on this figure is not differentiated by aquifer or well depth. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause TDS concentrations in groundwater in a well that would otherwise remain below the SMCL to increase above the SMCL.

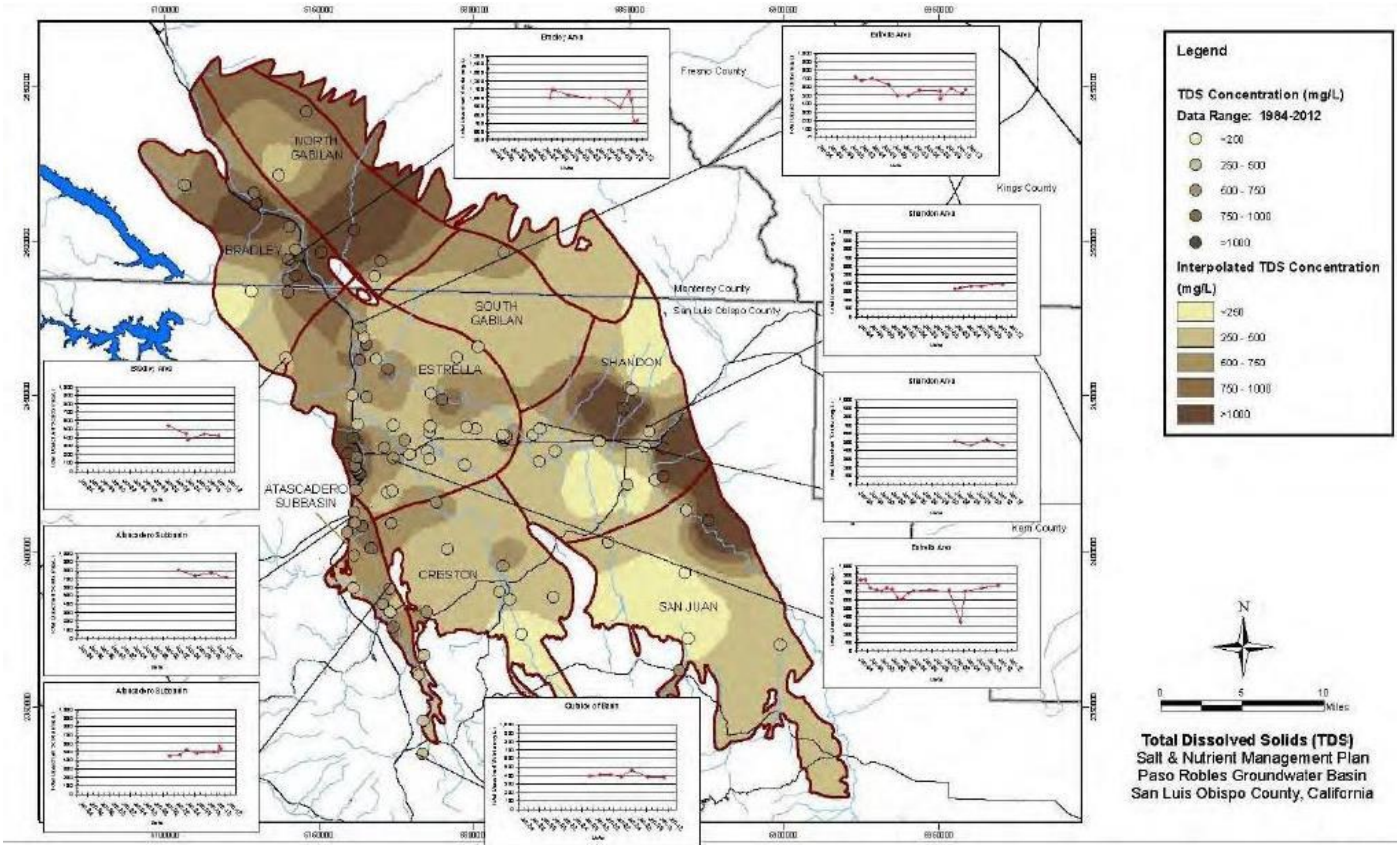


Figure 5-201520. TDS Regional Distribution and Trends

Source: RMC, 2015

5.6.4.2 Chloride

Chloride is a constituent of concern in groundwater because it has been detected at concentrations greater than its SMCL of 250 mg/L. Elevated chloride concentrations in groundwater can damage crops and affect plant growth. Fugro (2002) reported that slight to moderate restrictions on irrigating trees and vines may occur when chloride concentrations exceed 100 mg/L. Severe restrictions on irrigating trees and vines may occur when chloride concentrations exceed 350 mg/L.

Table 5-3~~Table 5-3~~, which was compiled based on various tables and related information in the SNMP (RMC, 2015), shows the range and average chloride concentrations by subarea. This table indicates that average chloride concentrations are less than the SMCL of 250 mg/L throughout Subbasin. This table includes data for areas of the Bradley, North Gabilan, and South Gabilan subareas that are outside the Subbasin.

Table 5-3. Chloride Concentration Ranges and Averages

Hydrogeologic Subarea	Chloride Concentration Range (mg/L)	Average Chloride Concentration (mg/L)
Estrella	32 - 572	94
Shandon	31 - 550	80
Creston	25 - 508	69
San Juan	13 - 699	64
Bradley	40 - 400	84
North Gabilan	35 - 209	113
South Gabilan	35 - 209	37

Source: RMC, 2015

The distribution and trends of chloride in the Subbasin are shown on Figure 5-21~~Figure 5-16~~21. This figure is from the SNMP (RMC, 2015) and includes portions of the Subbasin north of the Monterey County line which are outside the Subbasin. Chloride distribution shown on this figure is not differentiated by aquifer or well depth. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause chloride concentrations in groundwater in a well that would otherwise remain below the SMCL to increase above the SMCL.

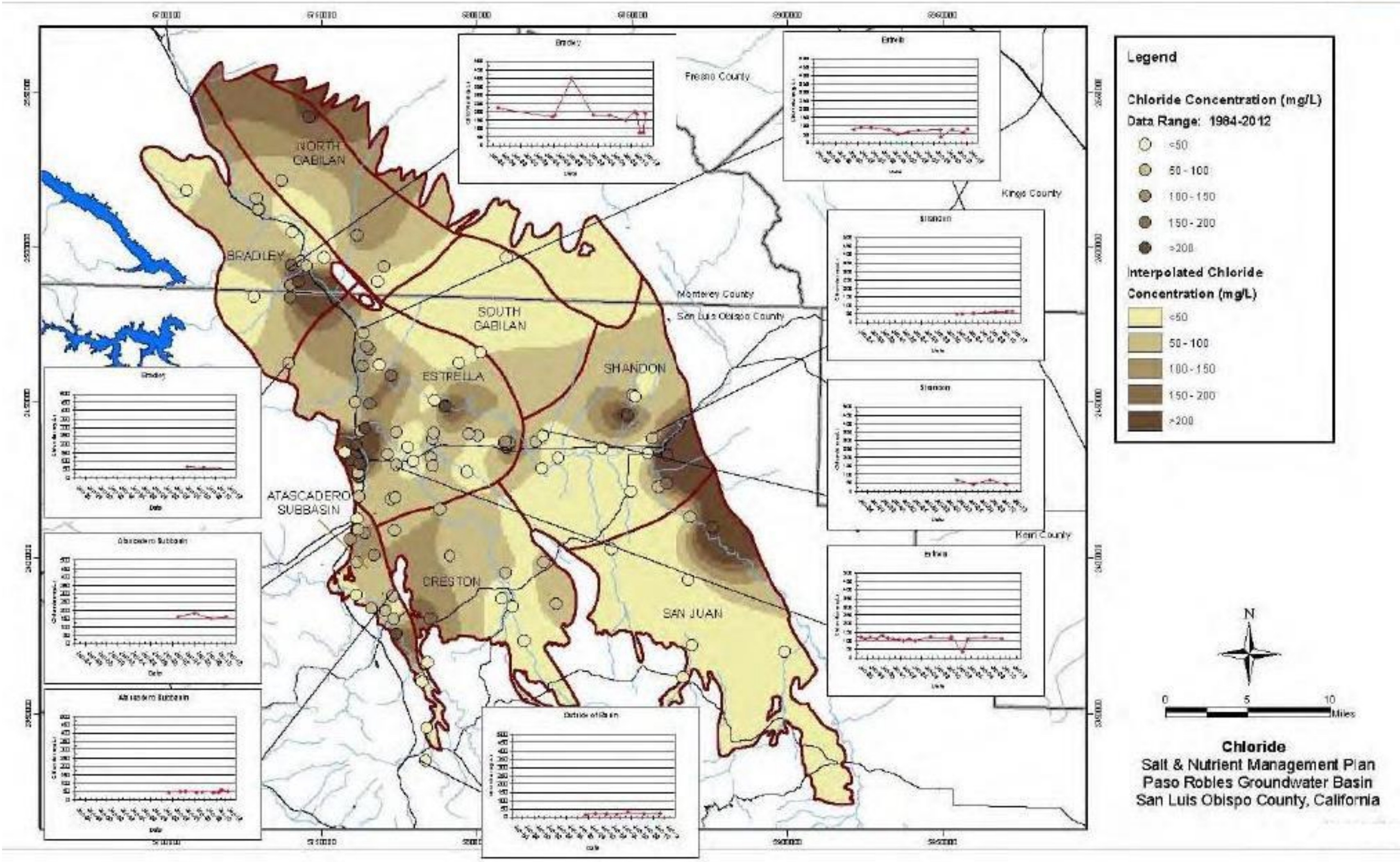


Figure 5-211621. Chloride Regional Distribution and Trends

Source: RMC, 2015

5.6.4.3 Sulfate

Sulfate is a constituent of concern in groundwater because it has been observed at concentrations above its SMCL of 250 mg/L. Table 5-4~~Table 5-4~~ shows the range and average sulfate concentrations by subarea as reported in the SNMP (RMC, 2015). This table shows the average sulfate concentrations are greater than the SMCL of 250 mg/L in many areas of the Subbasin. This table includes data for areas of the Bradley, North Gabilan, and South Gabilan subareas that are outside the Subbasin.

Table 5-4. Sulfate Concentration Ranges and Averages

Hydrogeologic Subarea	Sulfate Concentration Range (mg/L)	Average Sulfate Concentration (mg/L)
Estrella	11 - 375	129
Shandon	14 – 2,010	360
Creston	7 - 353	67
San Juan	24 - 722	248
Bradley	30 - 704	296
North Gabilan	9 - 648	194
South Gabilan	9 - 648	194

Source: RMC, 2015

Maps of sulfate distribution in the Subbasin were not found in previous studies. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause sulfate concentrations in groundwater in a well that would otherwise remain below the SMCL to increase above the SMCL.

5.6.4.4 Nitrate

Nitrate is a constituent of concern in groundwater because concentrations have been detected greater than its MCL of 10 mg/L (measured as nitrogen). Nitrate concentrations in excess of the MCLs can result in health impacts.

Table 5-5~~Table 5-5~~ shows the range and average nitrate concentrations by subarea as reported in the SNMP (RMC, 2015). This table shows the average nitrate concentrations are less than the MCL of 10 mg/L throughout Subbasin. The range of measured nitrate concentrations however exceeds the MCL of 10 mg/L in every subarea. This table includes data for areas of the Bradley, North Gabilan, and South Gabilan subareas that are outside the Subbasin.

Table 5-5. Nitrate Concentration Ranges and Averages

Hydrogeologic Subarea	Nitrate Concentration Range (mg/L)	Average Nitrate Concentration (mg/L)
Estrella	0 – 16.2	2.5
Shandon	1.2 – 12.1	4.6
Creston	0.8 – 9.2	3.2
San Juan	0.1 – 5.8	2.8
Bradley	0.0 – 5.8	2.7
North Gabilan	5.0 – 9.8	8.4
South Gabilan	15.8	6.3

Source: RMC, 2015; the range of nitrate concentration in the South Gabilan subarea is uncertain

The distribution and trends of nitrate in the Subbasin are shown on Figure 5-22~~Figure 5-17~~22. This figure is from the SNMP (RMC, 2015) and includes portions of the Subbasin north of the Monterey County line which are outside the Subbasin. This nitrate distribution shown on this figure is not differentiated by aquifer or well depth. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause nitrate concentrations in groundwater in a well that would otherwise remain below the SMCL to increase above the SMCL.

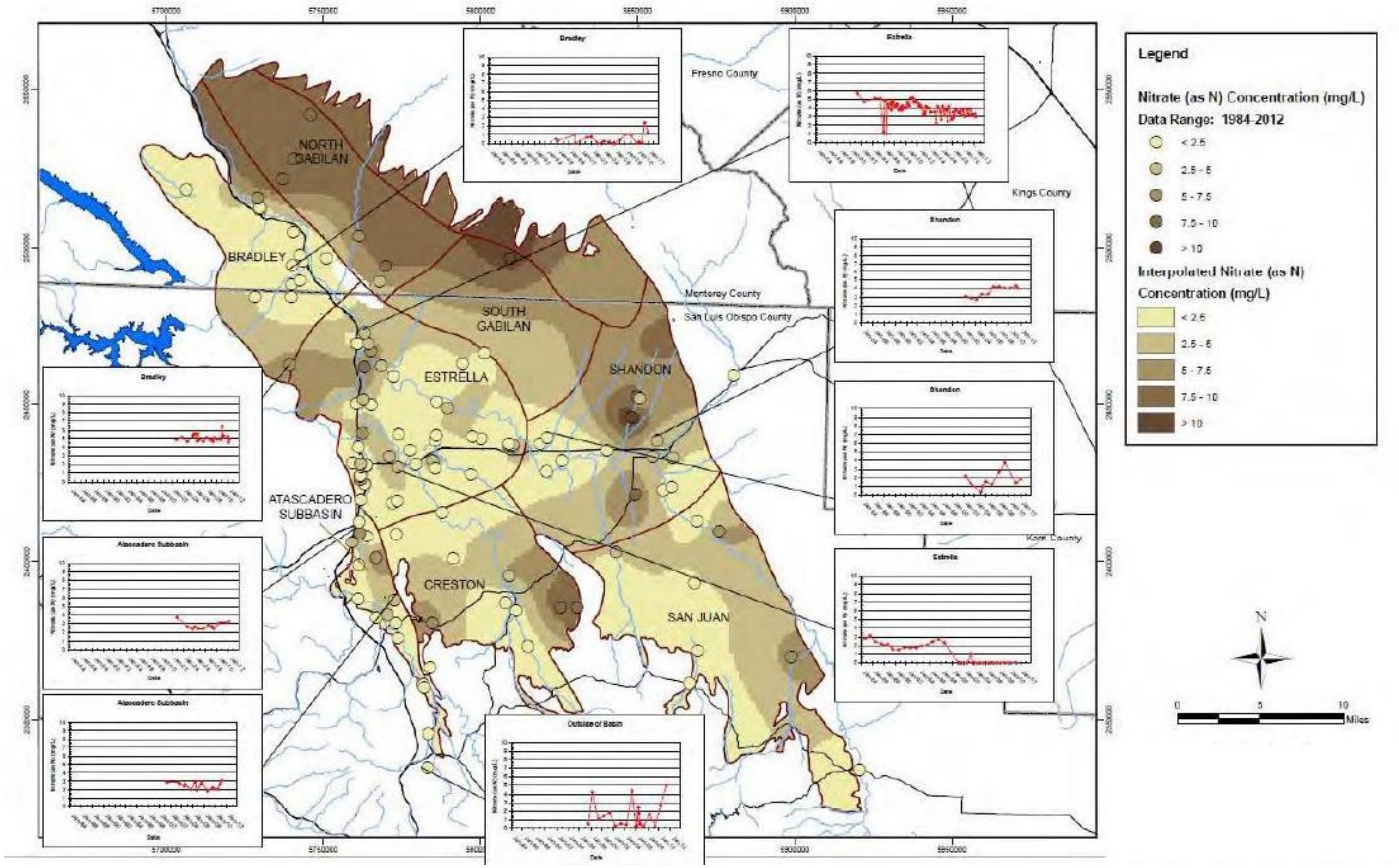


Figure 5-221722. Nitrate Regional Distribution and Trends

Source: RMC, 2015

5.6.4.5 Boron

Boron is an unregulated constituent and therefore does not have a regulatory standard. However, boron is a constituent of concern because elevated boron concentrations in water can damage crops and affect plant growth. Fugro (2002) reported that severe restrictions on irrigating trees and vines may occur when boron concentrations exceed 0.5 mg/L.

Table 5-6~~Table 5-6~~ shows the range and average boron concentrations by subarea as reported in the SNMP (RMC, 2015). Average boron concentration exceeds the severe irrigation restriction level of 0.5 mg/L in the Estrella, Shandon, and San Juan subareas. The table includes data for areas of the Bradley, North Gabilan, and South Gabilan subareas that are outside the Subbasin.

Table 5-6. Boron Concentration Ranges and Averages

Hydrogeologic Subarea	Boron Concentration Range (mg/L)	Average Boron Concentration (mg/L)
Estrella	0.13 – 5.66	1.8
Shandon	0.08 – 2.97	0.81
Creston	0.06 – 0.31	0.14
San Juan	0.08 – 2.29	0.74
Bradley	0.12 – 0.18	0.15
North Gabilan	0.11 – 0.44	0.24
South Gabilan	0.11 – 0.44	0.24

Source: RMC, 2015

No maps exist of boron distribution in the Subbasin. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause boron concentrations in groundwater in a well that would otherwise remain below the SMCL to increase above the SMCL.

5.6.4.6 Gross Alpha Radiation

Gross alpha radiation is a constituent of concern because it has been detected at concentrations greater than the MCL of 15 picocuries per liter (pCi/L). Fugro (2002) reports that gross alpha radioactivity is present in most areas of the basin. Gross alpha particle count activity in groundwater exceeded the MCL for drinking water in the Estrella and Bradley areas. Gross alpha data included in Fugro's 2002 report are summarized in Table 5-7~~Table 5-7~~.

Table 5-7. Gross Alpha Concentration Ranges and Averages

Hydrogeologic Subarea	Gross Alpha Maximum Concentration (pCi/L)	Gross Alpha Average Concentration (pCi/L)
Estrella	31	20
Shandon	3	3
Bradley	23	2

Source: Fugro, 2002

No maps exist of the gross alpha distribution in the Subbasin. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause gross alpha radiation concentrations in groundwater in a well that would otherwise remain below the SMCL to increase above the SMCL.

5.6.5 Groundwater Quality Surrounding the Paso Robles Subbasin

Poor quality groundwater has been documented in wells that screen sediments and rocks below the Paso Formation as well as sediments and rocks surrounding the Subbasin. Based on limited observations, there is a concern that this poor quality groundwater may be drawn into wells in the Subbasin and degrade the groundwater quality if groundwater levels are allowed to fall too low. Groundwater levels must be maintained at elevations that prevent migration of poor quality groundwater from beneath or around the Subbasin.

6 WATER BUDGETS

This chapter summarizes the estimated water budgets for the Paso Robles Subbasin, including information required by the SGMA Regulations and information that is important for developing an effective plan to achieve sustainability. In accordance with the SGMA Regulations §354.18, the GSP should include a water budget for the basin that provides an accounting and assessment of the total annual volume of surface water and groundwater entering and leaving the basin, including historical, current, and projected water budget conditions, and the change in the volume of water stored. Water budgets should be reported in graphical and tabular formats, where applicable.

6.1 Overview of Water Budget Development

This chapter is subdivided into three sections: (1) historical water budgets, (2) current water budgets, and (3) future water budgets. Within each section, a surface water budget and groundwater budget are presented. Water budgets were developed using computer models of the Subbasin hydrogeologic conditions. Before presenting the water budgets, a brief overview of the models is presented. Appendix E provides additional information about the models and compares previously reported water budgets to water budgets developed for the GSP.

The water budgets reported herein are for the Subbasin defined in Section 1.2 and depicted on Figure 1-1Figure 1-1. Prior to this GSP, water budgets reported for the Paso Robles groundwater Subbasin were often for a larger area that included area within Monterey County and the Atascadero Subbasin. Because the Subbasin boundary was redefined by DWR in 2019, the area within Monterey County and the Atascadero Subbasin are no longer part of the Subbasin and therefore are not considered in water budgets reported in the GSP. The revised Subbasin area results in water budget inflow components, outflow components, and estimates of sustainable yield that are different from previously reported water budgets.

Sustainable yield is defined in SGMA as “the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus that can be withdrawn annually from a groundwater supply without causing an undesirable result.” Actual sustainable yield will be determined once data show undesirable results have not occurred. Thus, the sustainable yield estimate will be revised in the future as new data become available from monitoring data that evaluate the presence or absence of undesirable results.

In accordance with Section 354.18 of the SGMA Regulations, one integrated groundwater budget was developed for the combined inflows and outflows for the two principal aquifers - Alluvial Aquifer and Paso Robles Formation Aquifer – for each water budget period. Groundwater is pumped from both aquifers for beneficial use. Available groundwater elevation data suggest that most of the historic reduction in groundwater storage has occurred in the Paso Robles Formation Aquifer. Due to limitations in available groundwater elevation data for the

Alluvial Aquifer, water budgets for this aquifer are uncertain. Monitoring of hydrologic conditions in both aquifers will be conducted in the future to ensure that aquifer-specific Sustainable Management Criteria are being achieved and undesirable results are being avoided.

Figure 6-1 presents a general schematic diagram of the hydrologic cycle. The water budgets include the components of the hydrologic cycle.

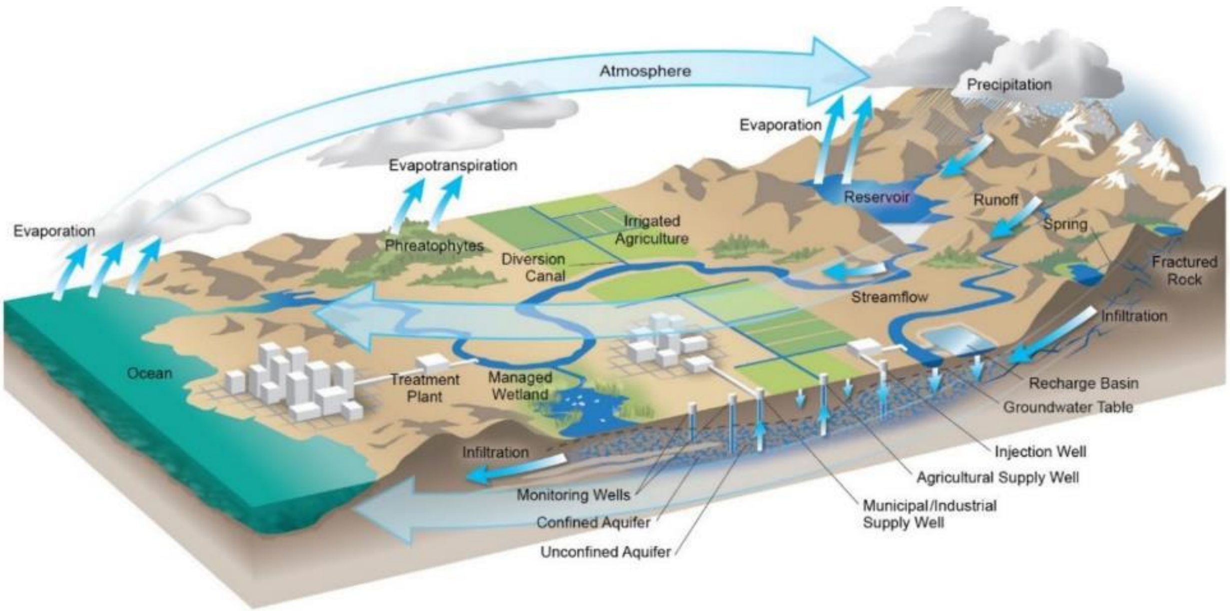


Figure 6-1. Hydrologic Cycle

A few components of the water budget can be measured, like streamflow at a gaging station or groundwater pumping from a metered well. Other components of the water budget are estimated, like recharge from precipitation or unmetered groundwater pumping. The water budget is an inventory of surface water and groundwater inflows (supplies) and outflows (demands) from the Subbasin, including:

Surface Water Inflows:

- Runoff of precipitation and reservoir releases into streams and rivers that enter the Subbasin from the surrounding watershed and that occurs inside the Subbasin
- Groundwater discharge to streams and rivers Surface Water Outflows:
- River flows exiting the Subbasin
- Percolation of streamflow to the groundwater system
- Evaporation (negligible compared to other surface water outflows)

Groundwater Inflows:

- Recharge from precipitation
- Subsurface inflow (including percolation of irrigation return flow, precipitation, and streamflow outside the Subbasin)
- Irrigation return flow (water not consumed by crops)
- Percolation of surface water from streams
- Infiltration of treated wastewater from disposal ponds

Groundwater Outflows:

- Evapotranspiration
- Groundwater pumping
- Discharge to streams and rivers
- Subsurface outflow to the next downgradient groundwater basin

The difference between inflows and outflows is equal to the change in storage.

6.2 Water Budget Data Sources and Basin Model

Water budgets for the Paso Robles Subbasin were estimated using an integrated system of three hydrologic models (collectively designated herein as the “basin model”), including:

1. A watershed model
2. A soil water balance model
3. A groundwater flow model

The groundwater model was originally developed by Fugro (2005). The watershed and soil water balance models were developed and integrated with an updated version of the groundwater model by Geoscience Support Services, Inc. (GSSI) (GSSI, 2014 and 2016). These models were developed for San Luis Obispo Flood Control and Water Conservation District (SLOFCWCD). The original models are documented in the following reports:

- Final Report, Paso Robles Groundwater Basin Study Phase II, Numerical Model Development, Calibration, and Application: Fugro, February 2005
- Paso Robles Groundwater Basin Model Update: Geoscience Support Services, Inc., December 2014

- Refinement of the Paso Robles Groundwater Basin Model and Results of Supplemental Water Supply Options Predictive Analysis: Geoscience Support Services, Inc., December 2016

The 2016 version of the basin model was updated for the GSP. The update included incorporating hydrologic data for the period 2012 through 2016 into the models. Appendix E includes a brief summary of the model update process, including:

- A summary of data sources used for the update (Table E-1)
- A summary of modifications made to the basin model to address computational refinements, data processing issues, and conceptual application of the model codes
- A comparison of the water budgets from the updated model and the original 2016 GSSI model.

The updated versions of the basin models are referred to herein collectively as the “GSP model”.

Numerous sources of raw data were used to update the basin models for the GSP. Examples of raw data include reported pumping rates from the City of Paso Robles, precipitation data obtained from weather stations in the Subbasin, and crop acreage from the office of the San Luis Obispo County Agricultural Commissioner, among many others. Data sources are listed in Table E-1. Raw data were compiled, processed, and used to develop model input files. Model results were used to develop estimates of the individual inflow and outflow components of the surface water and groundwater budgets. Thus, all of the estimated flow components herein were extracted from the GSP model.

6.2.1 Model Assumptions and Uncertainty

The GSP model is based on available hydrogeologic and land use data from the past several decades, previous studies of Subbasin hydrogeologic conditions, and earlier versions of the basin models. The GSP model gives insight into how the complex hydrologic processes are operating in the Subbasin. During previous studies, available data and a peer-review process were used to calibrate the basin model to Subbasin hydrogeologic conditions. Results of the previous calibration process demonstrated that the model-simulated groundwater and surface water flow conditions were similar to observed conditions. The GSP model was not recalibrated. However, after updating it for the GSP, calibration of the model was reviewed and found to be similar to the previous model. Therefore, the GSP model was considered appropriate for the GSP.

Projections made with the GSP model have uncertainty due to limitations in available data and limitations from assumptions made to develop the models. Model uncertainty has been considered when developing and using the reported GSP water budgets for developing sustainability management actions and projects (Chapter 9).

During early implementation of the GSP, additional data will be collected to refine Subbasin understanding. These new data will be used to recalibrate the GSP model after the GSP is adopted. New hydrologic data and the calibrated model will be used to adaptively implement sustainability management actions, and possibly projects, to ensure that progress toward the sustainability goal is being achieved.

6.3 Historical Water Budget

The SGMA Regulations require that the historical surface water and groundwater budget be based on at least the most recent 10 years of data. For the Paso Robles Subbasin GSP, the period 1981 to 2011 was selected as the time period for the historical water budget (referred to as the historical base period) because it is long enough to capture typical climate variations, it corresponds to the period simulated in the basin model, and it ends at about the time the recent drought period began. Estimates of the surface water and groundwater inflows and outflows, and changes in storage for the historical base period are provided below.

6.3.1 Historical Surface Water Budget

The SGMA Regulations (§354.18) require development of a surface water budget for the GSP. The surface water budget quantifies important sources of surface water and evaluates their historical and future reliability. The water budget Best Management Practice (BMP) document states that surface water sources should be identified as one of the following (DWR, 2016c):

- Central Valley Project
- State Water Project
- Colorado River Project
- Local imported supplies
- Local supplies

The Paso Robles Subbasin relies on two of these surface water source types: local imported supplies and local supplies.

6.3.1.1 Historical Local Imported Supplies

During the historical base period, local imported water supplies were not used in the Subbasin. Use of local imported supplies began in 2014; information about these supplies is presented in Section 6.4 – Current Water Budget.

6.3.1.2 Historical Local Supplies

Local surface water supplies include surface water flows that enter the Subbasin from precipitation runoff within the watershed, Salinas River inflow to the Subbasin (including releases from the Salinas Reservoir), Nacimiento River inflow to the Subbasin (including releases from Nacimiento Reservoir), and discharge of groundwater to streams from the Alluvial Aquifer. Table 6-1 summarizes the annual average, minimum, and maximum values for these inflows.

Table 6-1. Estimated Historical (1981-2011) Annual Surface Water Inflows to Subbasin

Surface Water Inflow Component	Average	Minimum	Maximum
Nacimiento River Inflow to Subbasin	214,400	5,500	734,100
Precipitation Runoff within Watershed	96,900	400	606,900
Salinas River Inflow to Subbasin	41,800	1,600	179,900
Groundwater Discharge to Rivers and Streams from Alluvial Aquifer	7,300	4,300	11,800
Total	360,400		

Note: All values in AF

The estimated annual average total inflow from these sources over the historical base period is about 360,400 AF. The largest component of this average inflow is releases and flow in the Nacimiento River. While average inflows are large from the Nacimiento River, nearly all of this inflow leaves the Subbasin as surface water outflow because the length of the Nacimiento River within the Subbasin is short. The large difference between the minimum and maximum inflows reflects the difference between dry and wet years in the Subbasin.

6.3.1.3 Historical Surface Water Outflows

The estimated annual average total surface water outflow leaving the Subbasin as flow in the Salinas River, flow in the Nacimiento River, and percolation into the groundwater system over the historical base period is summarized in Table 6-2.

Table 6-2. Estimated Historical (1981-2011) Annual Surface Water Outflows from Subbasin

Surface Water Outflow Component	Average	Minimum	Maximum
Salinas River Outflow from Subbasin	119,100	5,300	646,300
Nacimiento River Outflow from Subbasin	214,400	5,500	734,000
Percolation of Surface Water to Groundwater	26,900	2,000	126,000
Total	360,400		

Note: All values in AF

The estimated annual average total outflow from these sources over the historical base period is about 360,400 AF. Of this 360,400 AFY, approximately 26,900 AFY of the outflow is percolation from streams into the groundwater system. Of this 26,900 AFY of percolation, 7,300 AFY returns to streamflow as groundwater discharge.

6.3.1.4 Historical Surface Water Budget

Figure 6-2 summarizes the historical water budget for the Subbasin.

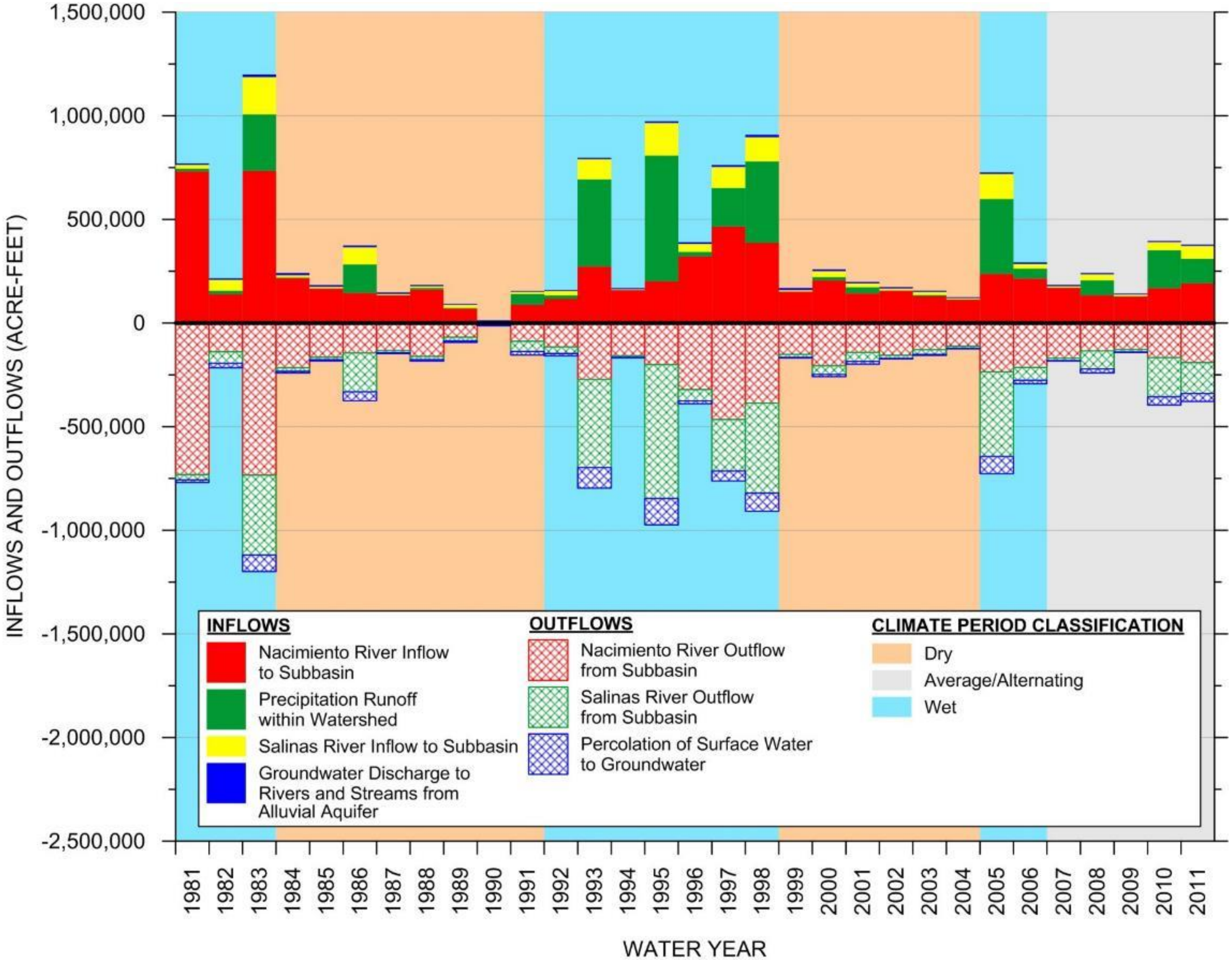


Figure 6-2. Historical (1981-2011) Surface Water Inflows and Outflows

Figure 6-2 shows the strong correlation between precipitation and streamflow in the Subbasin. In wet periods, shown with a blue background, surface water inflows and outflows are large. In contrast, in dry periods, shown with an orange background, surface water inflows and outflows are small. As shown on the graph, several years during the historical base period had total surface water inflows greater than 500,000 AFY. Assuming diversion permits could be obtained, future high flow years may provide opportunities to capture and use excess storm water as a new water supply in the Subbasin. This concept is discussed in more detail in Chapter 9 – Projects and Management Actions.

6.3.2 Historical Groundwater Budget

Groundwater supplied most of the water used in the Subbasin over the historical base period. The historical groundwater budget includes a summary of the estimated groundwater inflows, groundwater outflows, and change in groundwater in storage.

6.3.2.1 Historical Groundwater Inflows

Groundwater inflow components include streamflow percolation, agricultural irrigation return flow, deep percolation of direct precipitation, subsurface inflow into the Subbasin, wastewater pond percolation, and urban irrigation return flow. Estimated annual groundwater inflows for the historical base period are summarized in Table 6-3. Values reported in the table were estimated or derived from the GSP model using data sources reported in Table E-1 in Appendix E.

Table 6-3. Estimated Historical (1981-2011) Annual Groundwater Inflows to Subbasin

Groundwater Inflow Component [1]	Average	Minimum	Maximum
Streamflow Percolation	26,900	2,000	126,000
Agricultural Irrigation Return Flow	17,800	10,700	29,100
Deep Percolation of Direct Precipitation	12,000	300	45,400
Subsurface Inflow into Subbasin	10,100	4,900	14,300
Wastewater Pond Percolation	3,400	2,400	4,400
Urban Irrigation Return Flow	1,200	300	2,200
Total	71,400		

Note: All values in AF

(1) Percolation from septic systems is not directly accounted for because it is subtracted from the total estimated rural-domestic pumping to simulate a net rural-domestic pumping amount.

For the historical base period, estimated total average groundwater inflow ranged from 25,700 AFY to 201,700 AFY, with an average inflow of 71,400 AFY. The largest groundwater inflow component is streamflow percolation, which accounts for approximately 38% of the total annual average inflow. Streamflow percolation, agricultural irrigation return flow, and deep percolation of direct precipitation account for approximately 79% of the estimated total annual average inflow to the Subbasin. The large difference between the minimum and maximum inflows from streamflow percolation and direct precipitation reflect the variations in precipitation over the historical base period.

6.3.2.2 Historical Groundwater Outflows

Groundwater outflow components include total groundwater pumping from all water use sectors, groundwater discharge to streams and rivers from the Alluvial Aquifer, subsurface flow out of the Subbasin, and riparian evapotranspiration. Estimated annual groundwater outflows for the historical base period are summarized in Table 6-4.

Table 6-4. Estimated Historical (1981-2011) Annual Groundwater Outflow from Subbasin

Groundwater Outflow Component	Average	Minimum	Maximum
Total Groundwater Pumping	72,400	48,200	102,900
Groundwater Discharge to Streams and Rivers from Alluvial Aquifer	7,300	4,300	11,800
Subsurface Flow Out of Subbasin	2,600	2,300	3,000
Riparian Evapotranspiration	1,700	1,700	1,700
Total	84,000		

Note: All values in AF

The largest groundwater outflow component from the Subbasin is groundwater pumping. Estimated annual groundwater pumping by water use sector for the historical base period is summarized in Table 6-5.

Table 6-5. Estimated Historical (1981-2011) Annual Groundwater Pumping by Water Use Sector from Subbasin

Water Use Sector	Average	Minimum	Maximum
Agricultural	65,300	40,600	95,800
Municipal	3,200	1,700	6,000
Rural-Domestic [1]	2,500	1,700	3,400
Small Commercial	1,400	1,200	1,700
Total	72,400		

Notes: All values in AF

(1) Assumed to be net amount of pumping based on an analysis conducted by GSSI (2016). Net pumping was computed as total pumping amount minus septic return flow.

Agricultural pumping was the largest component of total groundwater pumping, accounting for about 90% of total pumping over the historical base period. Municipal, rural-domestic, and small commercial pumping account for 4%, 4%, and 2%, respectively, of total average annual pumping over the historical base period.

6.3.2.3 Historical Groundwater Budget and Changes in Groundwater Storage

Groundwater inflows and outflows for the historical base period are summarized on Figure 6-3. This graph shows groundwater inflow and outflow components for every year of the historical period. Inflow components are graphed above the zero line and outflow components are graphed below the zero line. Groundwater outflow by pumping (green bars) includes pumping from all water use sectors (Table 6-5).

Figure 6-4 shows annual and cumulative change in groundwater storage during the historical base period. Annual increases in groundwater storage are graphed above the zero line and annual decreases in groundwater storage are graphed below the zero line. The red line shows the cumulative change in groundwater storage over the historical base period.

The GSP uses the best available information to quantify the water budget for the Subbasin while recognizing the limitations inherent from existing data gaps. The water budget identifies and tracks changing inflows and outflows to the Subbasin and therefore is an important tool for local water resources management. The GSP contains a plan to gather more and better data in the future, which will be used to further refine the water budget. The GSP is designed to adapt to an increasing data set and expanding understanding of Subbasin conditions and water budget.

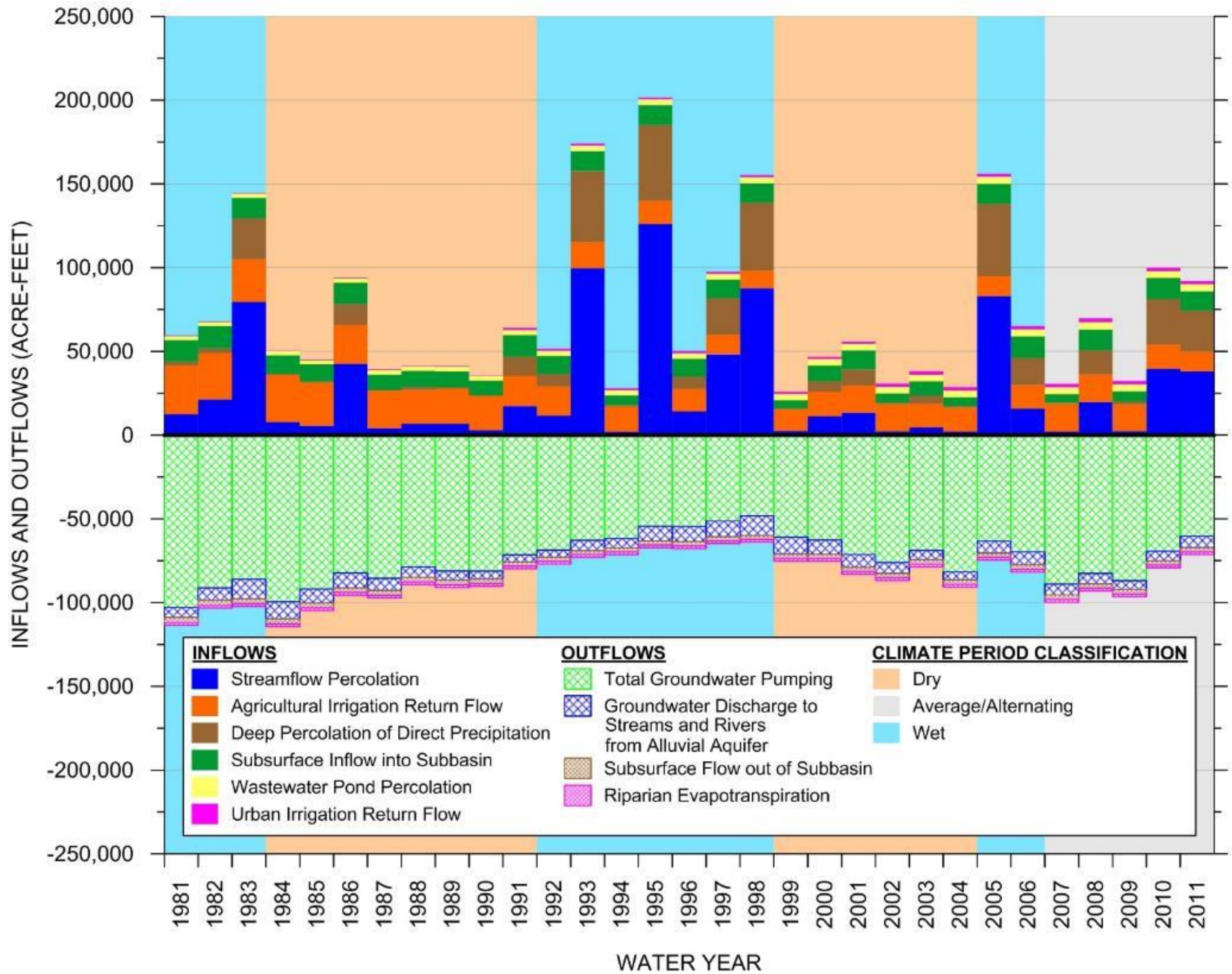


Figure 6-3. Historical (1981-2011) Groundwater Inflows and Outflows

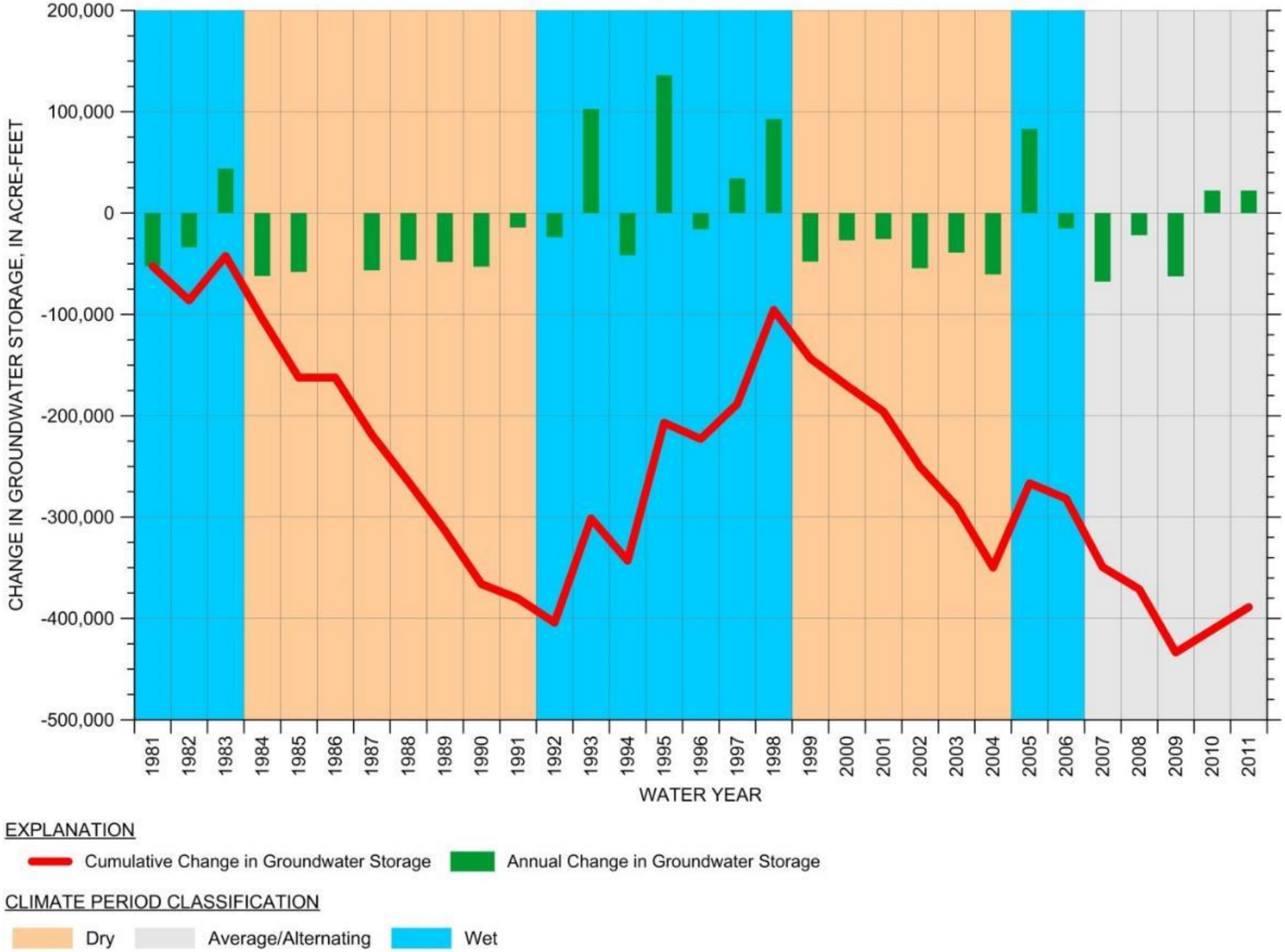


Figure 6-4. Historical (1981-2011) Annual and Cumulative Change in Groundwater Storage

The historical groundwater budget is strongly influenced by the amount of precipitation. During the historical base period, dry conditions prevailed from 1984 through 1991 and 1999 through 2004, as depicted by the orange areas on Figure 6-3 and Figure 6-4. During these dry periods, the amount of recharge and streamflow percolation was relatively low and the amount of pumping was relatively high. The net result was a loss of groundwater from storage. In contrast, wet conditions prevailed in the early 1980s, 1992 through 1998, and 2005 and 2006, as shown by blue areas on Figure 6-3 and Figure 6-4. During these wet periods, the amount of recharge and streamflow percolation was relatively high and the amount of pumping was relatively low. The net result was a gain of groundwater in storage. The period from 2007 through 2011 had generally alternating years of average precipitation. During this period, the amount of recharge and streamflow percolation was average and the amount of groundwater pumping was relatively high. The net result was a loss of groundwater from storage.

The historical groundwater budget is also influenced by the amount of groundwater pumping. Over the historical base period, the total amount of groundwater pumping showed two distinct trends (Figure 6-3). From the early 1980s through the late 1990s, groundwater pumping declined from about 100,000 AFY to about 50,000 AFY. In general, this decline in groundwater pumping corresponded to a period when irrigation of alfalfa and pasture acreage declined and irrigated vineyard acreage increased (Fugro, 2002). The transition from alfalfa and pasture to vineyard resulted in a net decrease in groundwater pumping because the irrigation demand of vineyards is less than alfalfa and pasture. This decrease in pumping contributed to the increase in groundwater in storage during the 1990s. After the late 1990s, groundwater pumping increased to about 100,000 AFY in 2007, largely due to continued expansion of irrigated vineyard acreage. The increase in groundwater pumping during this period contributed to the reductions in groundwater in storage that occurred after the late 1990s.

Over the 31 year historical base period, a net loss of groundwater storage of about 390,000 AF occurred. The annual average groundwater storage loss was approximately 12,600 AF. The average groundwater storage loss of 12,600 AFY is about 18% of the average total groundwater inflow of 71,400 AFY (Table 6-3) and about 15% of the average total groundwater outflow of 84,000 AFY (Table 6-4).

6.3.2.4 Historical Water Balance of the Subbasin

The computed long-term depletion of groundwater in storage indicates that total groundwater outflow exceeded the total inflow in the Subbasin from 1981 through 2011; this depletion is consistent with observed groundwater elevation declines (for example, see groundwater elevation change maps and hydrographs in Chapter 5). As summarized in Table 6-5, total groundwater pumping averaged approximately 72,400 AFY during the historical base period.

Section 354.18(b)(7) of the SGMA Regulations requires a quantification of sustainable yield for the Subbasin for the historical base period. Sustainable yield is the maximum quantity of groundwater, calculated over a base period representative of long-term conditions in the Subbasin and including any temporary surplus that can be withdrawn annually from a groundwater supply without causing an undesirable result. The historical sustainable yield was estimated by subtracting the estimate of average groundwater storage deficit of 12,600 AFY from the estimate of total average amount of groundwater pumping of 72,400 AFY for the historical base period. This results in a historical sustainable yield of about 59,800 AFY. This estimated value reflects historical climate, hydrologic and water resource conditions and provides insight into the amount of groundwater pumping that could be sustained in the Subbasin to maintain a balance between groundwater inflows and outflows and avoid undesirable results. However, it differs from estimates of future sustainable yield, which will be developed for representative average future climate and hydrologic conditions and will be used to plan management actions and projects needed to avoid undesirable results under SGMA.

6.4 Current Water Budget

The SGMA Regulations require that the current surface water and groundwater budget be based on the most recent hydrology, water supply, water demand, and land use information. For the Paso Robles Subbasin GSP, the period 2012 to 2016 was selected as the time period for the current water budget. The current water budget period corresponds to a drought period when the average annual precipitation averaged about 62% of the historical average annual precipitation and the average streamflow percolation was 10% of the historical average percolation. As a result, the current water budget period represents a more extreme condition in the Subbasin and is not appropriate for sustainability planning in the Subbasin. Estimates of the surface water and groundwater inflow and outflow, and changes in storage for the current water budget period are provided below.

6.4.1 Current Surface Water Budget

The current surface water budget quantifies important sources of surface water. Similar to the historical surface water budget, the current surface water budget includes two surface water source types: local imported supplies and local supplies.

6.4.1.1 Current Local Imported Supplies

As reported in the City of Paso Robles' 2016 Urban Water Management Plan, the most significant source of imported surface water in the Paso Robles Subbasin is the City's entitlement for Nacimiento water through a SLOFCWCD contract (Todd Groundwater, 2016). The total Nacimiento entitlement is about 6,500 AFY. Use of the Nacimiento water by the City began in 2014. Recently the Subbasin has begun to receive relatively small deliveries of up to 100 AFY of State Water Project water to Shandon CSA 16 for residential use. Currently, the City can treat up to about 2,700 AFY of Nacimiento water and deliver it for potable use (Todd Groundwater, 2016). Approximately another 270 AFY of Nacimiento water can be discharged to the Salinas River and recovered by a dedicated recovery well. In times of drought, Nacimiento water can be discharged to the Salinas River to improve reliability of the City's river recovery wells.

Only a small portion of the total water demand in the Subbasin during the current water budget period was met by the City's entitlement of imported surface water from Nacimiento Reservoir. According to records provided by the City, the amounts of Nacimiento water used in 2014, 2015, and 2016 were 227, 622, and 799 AF, respectively. The limited use is not an indication of the reliability of Nacimiento water, but rather a choice by the City regarding how to operate its water supply portfolio. Nacimiento water is expected to be a stable water supply given the favorable contractual priority of SLOFCWCD for the reservoir supply (Todd Groundwater, 2016).

Given the limited amount of imported Nacimiento water used compared to the amount of other local surface water supplies, the Nacimiento water supply is not aggregated into the surface water budget discussed below.

6.4.1.2 Current Local Supplies

Local surface water supplies include surface water flows that enter the Subbasin from precipitation runoff within the watershed, Salinas River inflow to the Subbasin (including releases from the Salinas Reservoir), Nacimiento River inflow to the Subbasin (including releases from Nacimiento Reservoir), and discharge of groundwater to streams from the Alluvial Aquifer. Table 6-6 summarizes the annual average, minimum, and maximum values for these inflows.

Table 6-6. Estimated Current (2012-2016) Annual Surface Water Inflows to Subbasin

Surface Water Inflow Component	Average	Minimum	Maximum
Precipitation Runoff	2,900	1,300	7,500
Salinas Reservoir Releases to Salinas River	6,600	5,200	8,500
Nacimiento Reservoir Releases	73,200	29,400	163,600
Groundwater Discharge to Rivers and Streams	4,300	3,000	6,100
Total	87,000		

Note: All values in AF

The estimated average total inflow from both precipitation runoff and reservoir releases over the current water budget period was approximately 87,000 AFY, or 25% of the 360,400 AFY over the historical base period. Approximately 84% of the local surface water supply was from Nacimiento Reservoir releases, most of which flows out of the Subbasin as surface flow. As a result, Nacimiento River flows do not result in appreciable amounts of surface water percolation to groundwater. If Nacimiento releases are not considered in the surface water inflows, surface water inflows during the current water budget period were less than 10% of the surface water inflows for the historical base period. The substantial reduction in surface water inflows reflects the drought conditions that prevailed during the current water budget period.

6.4.1.3 Current Surface Water Outflows

The estimated annual average, minimum, and maximum surface water outflow leaving the Subbasin as flow in the Salinas River, flow in the Nacimiento River, and percolation into the groundwater system over the current base period is summarized in Table 6-7.

Table 6-7. Estimated Current (2012-2016) Annual Surface Water Outflows from Subbasin

Surface Water Outflow Component	Average	Minimum	Maximum
Salinas River Flow	11,100	8,500	14,100
Nacimiento River Flow	73,200	29,400	163,300
Percolation of Surface Water to Groundwater	2,700	2,100	4,100
Total	87,000		

Note: All values in AF

.

Reductions in surface water outflow for the current water budget period were similar to those reported above for the surface water inflows.

6.4.1.4 Current Surface Water Budget

Figure 6-5 summarizes the current surface water budget for the Subbasin. Figure 6-5 is on the same scale as Figure 6-2 and shows the effects of the drought conditions that prevailed during the period 2012 through 2016. During this period, precipitation was well below average, which resulted in very little surface water flow.

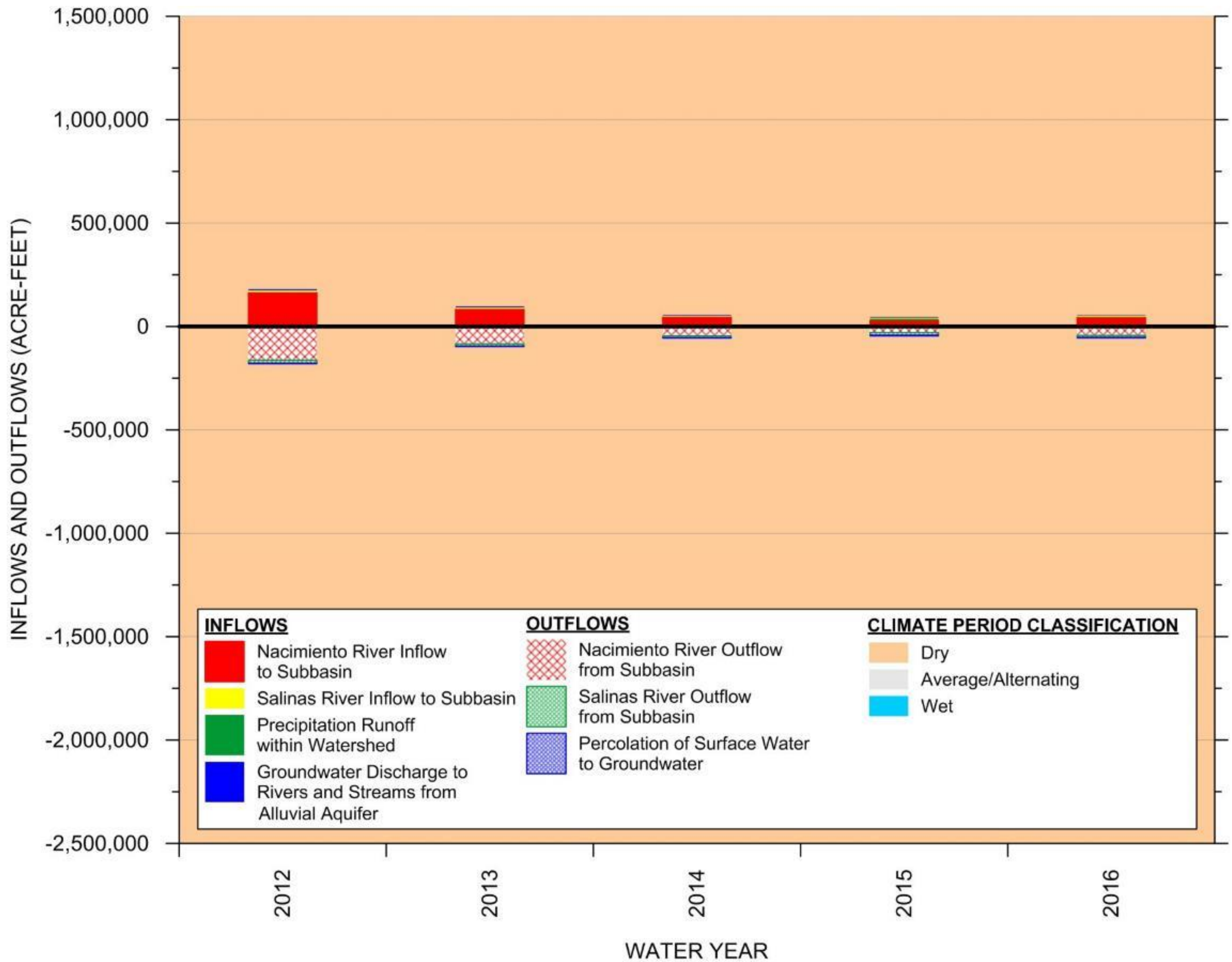


Figure 6-5. Current (2012 – 2016) Surface Water Inflows and Outflows

6.4.2 Current Groundwater Budget

Groundwater supplied most of the water used in the basin during the current water budget period. The current water budget includes a summary of the estimated groundwater inflows, groundwater outflows, and change in groundwater in storage.

6.4.2.1 Current Groundwater Inflows

Groundwater inflow components include streamflow percolation, agricultural irrigation return flows, deep percolation of direct precipitation, subsurface inflow into the Subbasin, wastewater pond percolation, and urban irrigation return flow. Estimated annual groundwater inflows for the current water budget period are summarized in Table 6-8.

Table 6-8. Estimated Current (2012-2016) Annual Groundwater Inflows to Subbasin

Groundwater Inflow Component [1]	Average	Minimum	Maximum
Streamflow Percolation	2,700	2,100	4,100
Agricultural Irrigation Return Flow	13,100	12,400	13,800
Deep Percolation of Direct Precipitation	1,400	500	3,800
Subsurface Inflow into Subbasin	4,900	4,400	6,000
Wastewater Pond Percolation	4,700	4,600	4,900
Urban Irrigation Return Flow	2,100	2,000	2,200
Total	28,900		

Note: All values in AF

(1) – Percolation from septic systems is not directly accounted for because it is subtracted from the total estimated rural-domestic pumping to simulate a net rural-domestic pumping amount.

For the current water budget period, estimated total average groundwater inflow ranged from 27,500 AFY to 33,100 AFY, with an average inflow of 28,900 AFY. Notable observations from the summary of groundwater inflows for the current water budget period included:

- Average total inflow during the current water budget period was about 40% of the historical base period.
- Unlike the historical base period, when the largest inflow component was streamflow percolation, the largest groundwater inflow component for the current water budget is agricultural irrigation return flow, which accounts for approximately 45% of the total average inflow.

- The relatively small difference between the minimum and maximum inflows reflects the drought condition that prevailed during the current water budget period, when precipitation and runoff were continuously low.
- Total annual average streamflow percolation in the current water budget period was approximately 10% of the streamflow percolation in the historical base period. This reflects the very low streamflows during the drought. The low streamflows had a significant impact on the groundwater basin because streamflow percolation was the most significant source of groundwater recharge during the historical period.
- Total annual average recharge from direct precipitation for the current water budget period was about 12% of the recharge from direct precipitation for the historical base period.

6.4.2.2 Current Groundwater Outflows

Groundwater outflow components include total groundwater pumping from all water use sectors, groundwater discharges to streams and rivers from the Alluvial Aquifer, subsurface flow out of the Subbasin, and riparian evapotranspiration. Estimated annual groundwater outflows for the current water budget period are summarized in Table 6-9.

Table 6-9. Estimated Current (2012-2016) Annual Groundwater Outflow from Subbasin

Groundwater Outflow Component	Average	Minimum	Maximum
Total Groundwater Pumping	85,800	73,900	101,200
Discharge to Streams and Rivers from Alluvial Aquifer	4,300	3,000	6,100
Subsurface Flow Out of Subbasin	2,500	2,300	2,600
Riparian Evapotranspiration	1,700	1,700	1,700
Total	94,300		

Note: All values in AF

For the current water budget period, estimated total average groundwater outflows ranged from 81,200 AFY to 109,300 AFY, with an average annual outflow of 94,300 AF. Notable observations from a comparison of the historical (Table 6-4) and current groundwater outflows include:

- Total annual average groundwater pumping was about 19% higher during the current water budget period.

- Groundwater discharge from the Alluvial Aquifer to streams was about 40% lower during the current water budget period, reflecting lower precipitation and lower groundwater levels.

The largest groundwater outflow component from the Subbasin in the current water budget period is pumping. Estimated annual groundwater pumping by water use sector for the current water budget period is summarized in Table 6-10.

Table 6-10. Estimated Current (2012-2016) Annual Groundwater Pumping by Water Use Sector

Water Use Sector	Average	Minimum	Maximum
Agricultural	77,000	65,600	92,300
Municipal	3,800	3,200	4,300
Rural-Domestic [1]	3,500	3,400	3,600
Small Commercial	1,500	1,500	1,500
Total	85,800		

Note: All values in AF

(1) Assumed to be net amount of pumping based on an analysis conducted by GSSI (2016). Net pumping was computed as total pumping amount minus septic return flow.

For the current water budget period, estimated total average groundwater pumping ranged from 73,900 AFY to 101,200 AFY, with an average pumping of 85,800 AFY. Agricultural pumping was the largest component of total groundwater pumping and accounts for about 90% of total pumping during the current water budget period. Municipal, rural-domestic, and small commercial pumping account for 4%, 4%, and 2%, respectively, of total average pumping during the current water budget period.

Notable observations from a comparison of the historical (Table 6-5) and current total annual average groundwater pumping include:

- Total annual average agricultural groundwater pumping was about 18% higher during the current water budget period when compared to the historical period (increase of 11,700 AFY)
- Total annual average rural-domestic groundwater pumping was about 40% higher during the current water budget period when compared to the historical period (increase of 1,000 AFY)

6.4.2.3 Current Groundwater Budget and Change in Groundwater Storage

Groundwater inflows and outflows for the current base period are summarized on Figure 6-6. This graph shows inflow and outflow components for every year of the current water budget period. Inflow components are graphed above the zero line and outflow components are graphed below the zero line. Groundwater outflow by pumping (green bars) includes pumping from all water use sectors (Table 6-10).

Figure 6-7 shows annual and cumulative change in groundwater storage during the current water budget period. Annual decreases in groundwater storage are graphed below the zero line. The red line shows the cumulative change in groundwater storage over the historical base period.

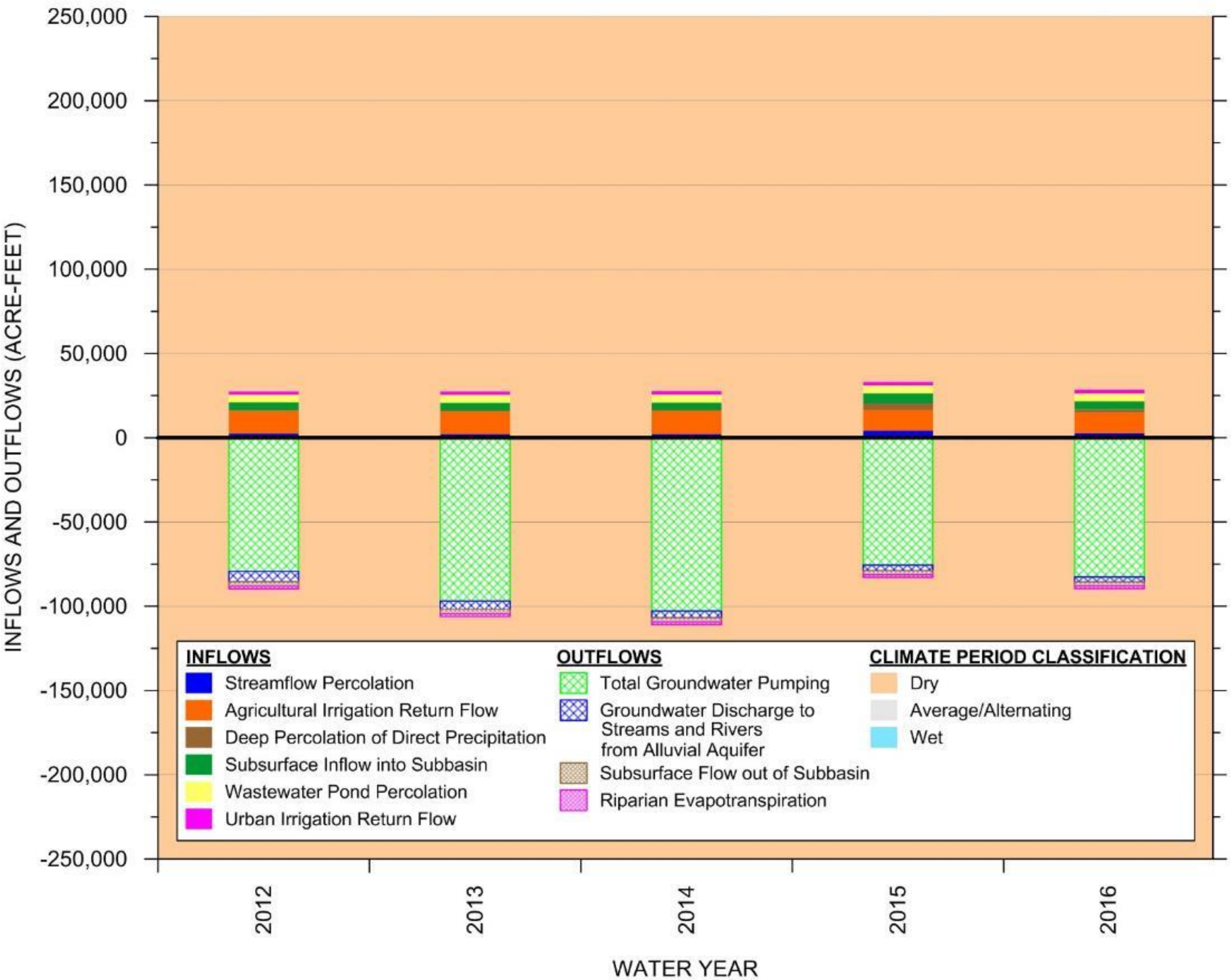


Figure 6-6. Current (2012-2016) Groundwater Inflows and Outflows

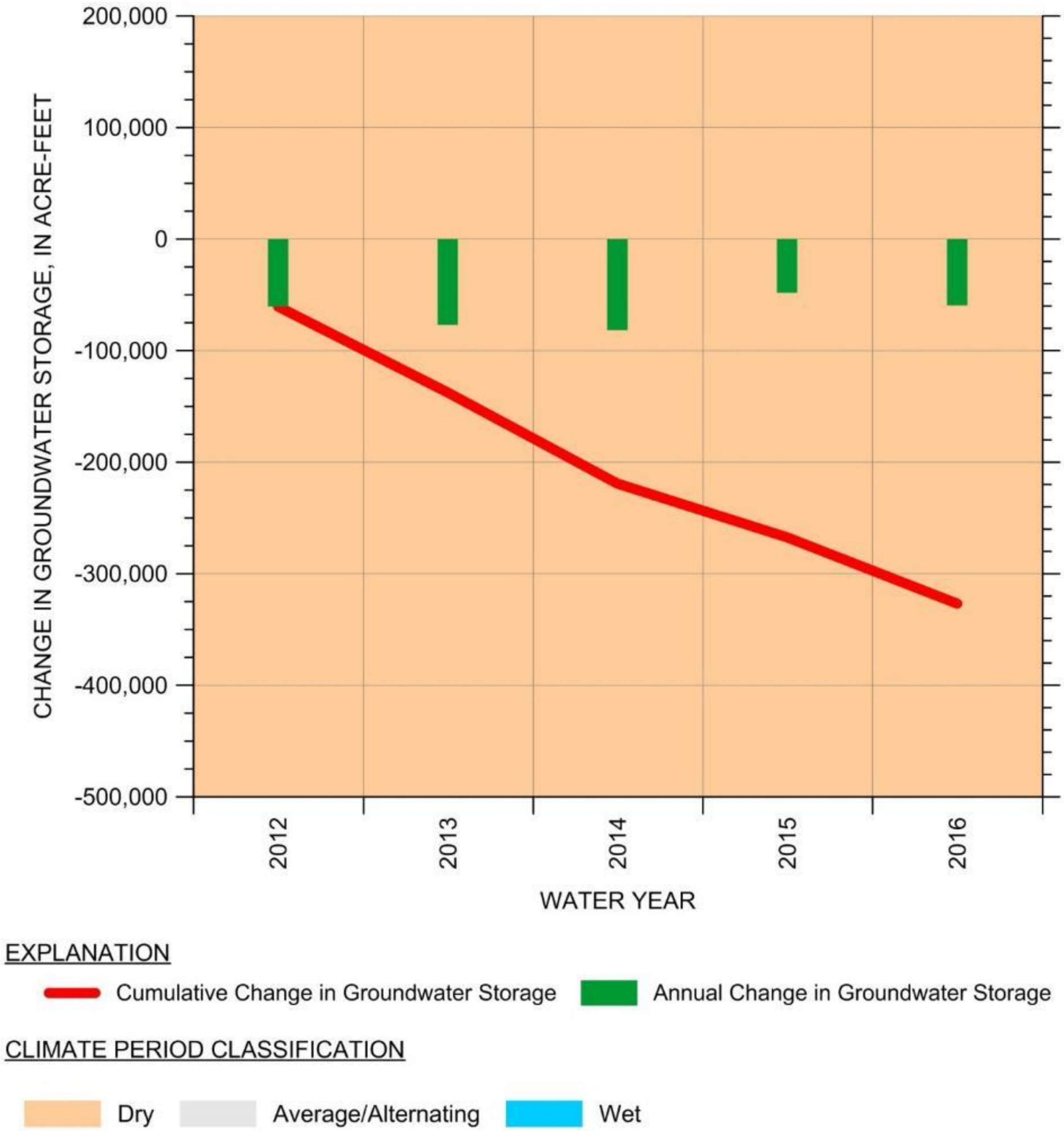


Figure 6-7. Current (2012-2016) Annual and Cumulative Change in Groundwater Storage

The current groundwater budget is strongly influenced by the drought; total groundwater pumping shows no trend over the five years that might be related to any continuing land use change. During the current water budget period, the amounts of recharge and streamflow percolation were very low and the average amount of pumping was slightly greater than the historical water budget period. Over the five-year current water budget period, an estimated net loss of groundwater in storage of about 327,000 AF occurred (Figure 6-7). The annual average groundwater storage loss, or the difference between outflow and inflow to the Subbasin, was approximately 65,400 AF.

6.4.2.4 Current Water Balance

The substantial short-term depletion of groundwater in storage indicates that total groundwater outflows exceeded the total inflows over the current water budget period. As summarized in Table 6-9, total groundwater pumping averaged approximately 85,800 AFY during the current period. A quantification of the current sustainable yield for the Subbasin is be estimated by subtracting the average groundwater storage deficit (65,400 AFY) from the total average amount of groundwater pumping (85,800 AFY) to yield about 20,400 AFY. Due to the drought conditions, the current water budget period is not appropriate for long-term sustainability planning.

6.5 Future Water Budget

SGMA Regulations require the development of a future surface water and groundwater budget to estimate future baseline conditions of supply, demand, and aquifer response to GSP implementation. The future water budget provides a baseline against which management actions will be evaluated over the GSP implementation period from 2020 to 2040. Future water budgets were developed using the GSP model.

In accordance with Section 354.18 (c)(3)(A) of the SGMA Regulations, the future water budget should be based on 50 years of historical precipitation, evapotranspiration, and streamflow information. The GSP model includes only 31 years of historical precipitation, evapotranspiration, and streamflow data. Therefore, the future water budget is based on 31 years of historical data rather than 50 years of historical data. It is believed that this time period is representative and is the best available information for groundwater sustainability planning purposes.

6.5.1 Assumptions Used in Future Water Budget Development

Assumptions about future groundwater supplies and demands are described in the following subsections. An overarching assumption is that any future increases in groundwater use within the Subbasin will be offset by equal reductions in groundwater use in other parts of the Subbasin, or in other words, groundwater neutral through implementation of the GSP.

Future water budgets were developed using the GSP model. During the update process for the GSP model, all model components (e.g., groundwater pumping) of the entire original 2016 GSSI model area were updated, including components with Monterey County and the Atascadero Subbasin. However, information provided for the future water budget only pertains to the GSP Subbasin (Figure 1-1), thus do not include areas within Monterey County or the Atascadero Subbasin.

6.5.1.1 Future Non-Agricultural Water Demand Assumptions

Future non-agricultural water demands were estimated for the City of Paso Robles (City) and San Miguel Community Services District (SMCSD) based on the following available planning documents:

- Paso Robles 2015 Urban Water Management Plan (UWMP) (Todd Groundwater, 2016)
- San Miguel Community Services District Water & Wastewater Master Plan Update (Monsoon Consultants, 2017)

Projections of the City's groundwater demand were obtained from the City's UWMP. A portion of the City's future groundwater demand will be offset by imported Nacimiento water. The projected water demand for SMCSD was assumed to be satisfied solely by groundwater. Projections for non-agricultural water demand for entities other than those listed above, such as residential wells and smaller commercial water users, were not available. Water demand for these users was assumed to remain constant into the future to be consistent with the overarching assumption that future growth will be groundwater neutral through the implementation of this GSP.

Total non-agricultural groundwater demand in the Subbasin is projected to increase from about 8,500 AFY in 2020 to about 8,700 AFY in 2040.

6.5.1.2 Future Wastewater Discharge Assumptions

Discharge of treated wastewater to the Salinas River provides a source of recharge to the Alluvial Aquifer. Rates of future wastewater discharge were estimated as a percentage of total water demand. Wastewater discharge as a percentage of water demand was calculated separately for each water provider. Projected annual wastewater discharge for San Miguel CSD is about 200 AFY, and projected annual wastewater discharge for the City of Paso Robles increases from about 2,900 AFY in 2020 to about 3,600 AFY by 2040. If the future wastewater discharge amounts differ from the estimated values cited above the GSP model and future water budgets will be adjusted during implementation to account for these changes.

6.5.1.3 Future Crop Acreage and Irrigation Efficiency Assumptions

In accordance with Section 354.18 (c)(3)(B) of the SGMA Regulations, the most recently available land use (in this case, crop acreage) and crop coefficient information should be used as the baseline condition for estimating future water demand. For the GSP, the 2016 crop acreage data obtained from the office of the San Luis Obispo County Agricultural Commissioner were used. These crop acreage data were the most recently available. To account for irrigation efficiency in the future water budget, the reported crop coefficient information from GSSI (GSSI, 2016) was used.

Projections for agricultural water demand are not available. Agricultural water demand was assumed to remain constant into the future to be consistent with the overarching assumption that future growth will be groundwater neutral through the implementation of this GSP.

6.5.1.4 Future Climate Assumptions

The SGMA Regulations require incorporating future climate estimates into the future water budget. To meet this requirement, DWR developed an approach for incorporating reasonably expected, spatially gridded changes to monthly precipitation and reference ETo (DWR, 2018b). The approach for addressing future climate change developed by DWR was used in the future water budget modeling for the Subbasin. The changes are presented as separate monthly change factors for both precipitation and ETo, and are intended to be applied to historical time series within the climatological base period through 2011. Specifically, precipitation and ETo change factors were applied to historical climate data for the period 1981 to 2011 for modeling the future water budget.

DWR provides several sets of change factors representing potential climate conditions in 2030 and 2070. DWR recommends using the 2030 change factors to evaluate conditions over the GSP implementation period (DWR, 2018b). Consistent with DWR recommendations, datasets of monthly 2030 change factors for the Paso Robles area were applied to precipitation and ETo data from the historical base period to develop monthly time series of precipitation and ETo, which were then used to simulate future hydrology conditions.

6.5.2 Modifications to Modeling Platform to Simulate Future Conditions

The existing modeling platform was modified to simulate future conditions, and the results of these simulations are used to develop the future water budget.

6.5.2.1 Modification to Soil Water Balance Model

The soil water balance model operates on a daily time scale and tracks daily variations in soil water storage for different agricultural areas in the Paso Robles Subbasin. For consistency with the monthly climate change factors provided by DWR, the daily model was used to develop monthly soil water balance calculations. These calculations compute irrigation demand as the residual crop evapotranspiration demand unsatisfied by effective precipitation.

These calculations use monthly precipitation and ETo, rescaled by the monthly climate change factors provided by DWR, and the same monthly crop coefficients used in the historical water budget analysis. Empirical relationships were developed to account for soil moisture carryover from the winter into the spring based on results from the daily soil water balance model.

Monthly applied irrigation water was determined over the future base period from computed monthly crop demand and the crop-specific irrigation efficiencies. Agricultural irrigation return flow is then computed as the difference between the applied irrigation water and the crop demand. Results were then averaged to provide average monthly rates of applied irrigation water and irrigation return flow that would be expected under future climate conditions.

6.5.2.2 Modifications to the Watershed Model

The watershed model operates on a daily time scale and simulates streamflow and infiltration of direct precipitation. The watershed model was modified to account for climate change by rescaling daily precipitation and ETo with the monthly climate change factors provided by DWR. The watershed model was then re-run using the modified precipitation and ETo values.

Results from the modified historical base period simulation were then averaged to provide average monthly rates of infiltration of direct precipitation and streamflow under future climate conditions.

6.5.2.3 Modifications to the Groundwater Model

The groundwater model operates at a semi-annual time scale, with stress periods representing six-month periods. The groundwater model was extended and modified to simulate the period 2020 to 2040. Starting groundwater levels for the future simulation were set to groundwater levels at the end of Water Year (WY) 2016, extracted from the updated groundwater model.

Future groundwater recharge components were computed using the modified soil water balance model and watershed model, as described above. Future streamflow generated both inside and outside the Subbasin was computed using the modified watershed model.

Future agricultural groundwater pumping was computed based on the modified soil water balance model. Future non-agricultural groundwater pumping was determined based on water demand assumptions described in Section 6.4.1.1.

Future groundwater recharge, streamflow, and agricultural pumping are specified in the groundwater model as repeating average time-series, based on average monthly calculation of applied irrigation water, excess irrigation water, recharge of direct precipitation, and streamflow.

This approach was adopted to simplify the future water budget and allow reporting of average future conditions accounting for climate change. Future non-agricultural pumping and wastewater return flows are the only inputs to the groundwater model that exhibit a long-term trend over the implementation period.

6.5.3 Projected Future Water Budget

Future surface water and groundwater budgets were projected.

6.5.3.1 Future Surface Water Budget

The future surface water budget includes average inflows from local imported supplies, average inflows from local supplies, average stream outflows, and average stream percolation to groundwater. Average future local imported supplies are estimated to be approximately 1,400 AFY. Table 6-11 summarizes the average local supply components of projected surface water budget.

Table 6-11. Projected Future Annual Average Surface Water Budget

Surface Water Budget Component	Flow Amount
Inflows	
Nacimiento River Inflow to Subbasin	214,300
Precipitation Runoff within Watershed	84,800
Salinas River Inflow to Subbasin	39,300
Groundwater Discharge to Rivers and Streams	4,600
Total	343,000
Outflows	
Nacimiento River Outflow from Subbasin	214,300
Salinas River Outflow from Subbasin	99,900
Percolation of Surface Water to Groundwater	28,800
Total	343,000

Note: All values in AF

6.5.3.2 Future Groundwater Budget

Projected groundwater budget components are computed using the modified groundwater flow model to simulate average conditions over the implementation period.

Table 6-12 summarizes projected annual groundwater inflows. In contrast to the historical groundwater budget which accounted for month-to-month variability, the projected groundwater budget is based on average monthly inflows. Therefore, variability in simulated groundwater budget components is minor, and minimum and maximum values are not included in Table 6-12.

Table 6-12. Projected Future Annual Groundwater Inflow to Subbasin

Groundwater Inflow Component	Average
Streamflow Percolation	28,800
Agricultural Irrigation Return Flow	14,500
Deep Percolation of Direct Precipitation	12,600
Subsurface Inflow into Subbasin	8,300
Wastewater Pond Leakage	3,500
Urban Irrigation Return Flow	1,800
Total	69,500

Note: All values in AF

The total average annual groundwater inflow is 1,900 AF less during the future period than during the historical base period. Annual agricultural irrigation return flow is the inflow component with the most significant reduction – about 3,300 AF – between the historical base period and future water budget period. Reduction in agricultural irrigation return flow is due partly to changes in historical cropping patterns and partly to improvements in vineyard irrigation efficiency.

Table 6-13 summarizes projected annual groundwater outflows.

Table 6-13. Projected Future Annual Groundwater Outflow from Subbasin

Groundwater Outflow Component	Average
Total Groundwater Pumping	74,800
Discharge to Streams and Rivers from Alluvial Aquifer	4,600
Groundwater Flow Out of Subbasin	2,100
Riparian Evapotranspiration	1,700
Total	83,200

Note: All values in AF

The total average annual groundwater outflow is estimated to be 800 AF less during the future period than during the historical base period. Future total annual groundwater pumping is projected to increase by about 2,400 AF compared to the historical base period. Concurrently, total annual discharge to streams and rivers and total annual groundwater outflow from the Subbasin are projected to decrease by about 2,700 AF and 500 AF, respectively.

6.5.3.3 Future Sustainable Yield

The projected future groundwater budget shows a long-term imbalance between inflows and outflows, with projected groundwater inflows of about 69,500 AFY and projected groundwater outflows of about 83,200 AFY. The projected future imbalance indicates an average annual decrease in groundwater in storage of 13,700 AFY. A calculated annual volume for the projected future sustainable yield of the Subbasin was estimated by subtracting the average groundwater storage deficit of 13,700 AFY from the total projected future average amount of groundwater pumping of 74,800 AFY. In this case, the future sustainable yield for the Subbasin period is estimated to be approximately 61,100 AFY. The estimated future sustainable yield is similar to the estimated sustainable yield for the historic base period. This similarity indicates that potential future changes in climate are not projected to have a substantial impact on the amount of groundwater that can be sustainably used compared to historical conditions. The calculated sustainable yield of the Subbasin is a reasonable estimate of the long-term pumping that can be maintained without producing undesirable results. Sustainable yield looks to the presence or absence of undesirable results, not strictly inflows and outflows. The definitive sustainable yield can only be determined once undesirable results have been described and data show undesirable results have not occurred. The sustainable yield estimate will be revised in the future as new data become available from monitoring data that evaluate the presence or absence of undesirable results.

7 MONITORING NETWORKS

This chapter describes the monitoring networks that exist and improvements to the monitoring networks that will be developed in the Subbasin as part of GSP implementation. This chapter is prepared in accordance with the SGMA regulations §354.32 and §354.34 and includes monitoring objectives, monitoring protocols, and data reporting requirements.

The monitoring networks presented in this chapter are based on existing monitoring sites. It will be necessary to expand the existing monitoring networks and identify or install more monitoring sites to fully demonstrate sustainability, refine the hydrogeologic conceptual model, and improve the GSP model. Monitoring networks are described for each of the five applicable sustainability indicators, and data gaps are identified for every monitoring network. These data gaps will be addressed during GSP implementation. Addressing these data gaps and developing more extensive and complete monitoring networks will improve the GSAs' ability to track progress and demonstrate sustainability.

7.1 Monitoring Objectives

The SGMA regulations require monitoring networks be developed to promote the collection of data of sufficient quality, frequency, and spatial distribution to characterize groundwater and related surface water conditions in the Subbasin and to evaluate changing conditions that occur through implementation of the GSP. The monitoring network should accomplish the following:

- Demonstrate progress toward achieving measurable objectives described in the GSP.
- Monitor impacts to the beneficial uses and users of groundwater.
- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.
- Quantify annual changes in water budget components.
- The minimum thresholds and measurable objectives monitored by the networks are described in Chapter 8 - Sustainable Management Criteria.

7.1.1 Monitoring Networks

Monitoring networks are developed for each of the five sustainability indicators that are relevant to the Subbasin:

- Chronic lowering of groundwater levels
- Reduction in groundwater storage

- Degraded water quality
- Land subsidence
- Depletion of interconnected surface water

The Subbasin is isolated from the Pacific Ocean and is not threatened by seawater intrusion; therefore, this GSP does not provide monitoring for the seawater intrusion sustainability indicator.

The SGMA regulations allow the GSP to use existing monitoring sites for the monitoring network. Wells used for monitoring, however, are limited by restrictions in §352.4(c) of the SGMA regulations which requires the GSAs to provide various data for any wells used as monitoring wells, including but not limited to: CASGEM well identification number, well location, ground surface elevation, well depth, and perforated intervals. Wells for which these data were not available, or could not be easily inferred, could not be used in the current groundwater monitoring network.

The approach for establishing the monitoring network for this Subbasin is to leverage existing monitoring programs and incorporate additional monitoring locations that have been made available by cooperating entities. The monitoring networks are limited to locations with data that are publicly available and not collected under confidentiality agreements; the availability of well data and restrictions of existing confidentiality agreements results in a monitoring network with relatively few wells. This chapter identifies data gaps in each monitoring network and proposes locations for filling those data gaps.

7.1.2 Management Areas

The SGMA regulations require that if management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the Subbasin setting and sustainable management criteria specific to that area. At this time, management areas have not been defined for the Subbasin. If management areas are developed in the future, the monitoring networks will be reevaluated to ensure that there is sufficient monitoring to evaluate conditions in each management area.

7.2 Groundwater Level Monitoring Network

The minimum thresholds and measurable objectives for the chronic lowering of groundwater levels sustainability indicator are evaluated by monitoring groundwater levels. The SGMA regulations require a network of monitoring wells sufficient to demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features.

Existing well records and existing groundwater monitoring programs in the Subbasin are described in Chapters 3 and 5, respectively. Groundwater well construction data and water level data were obtained from the following public sources:

- San Luis Obispo County Flood Control and Water Conservation District (SLOFCWCD)
- USGS National Water Information System (NWIS)
- DWR Online System for Well Completion Reports (OSWCR)
- DWR SGMA Data Viewer
- DWR California Statewide Groundwater Elevation Monitoring (CASGEM)
- City of Paso Robles and San Miguel CSD for public drinking water supply wells

These data sources resulted in a dataset of thousands of wells. The dataset was analyzed using the following steps to assess whether individual wells could be included in the initial GSP groundwater level monitoring network:

1. **Include Only Currently Measured Wells**. To reduce the possibility of selecting a well that has not been monitored in many years or that may no longer be accessible, wells were excluded that did not have at least one groundwater level measurement from 2012 or later. All the groundwater level monitoring data available for the Subbasin that met this criterion were provided by SLOFCWCD or the USGS NWIS, which have monitored groundwater levels in approximately 130 wells since 2012.

2. **Remove Confidential Wells**. Most of the data from wells in the SLOFCWCD groundwater level monitoring network are subject to confidentiality agreements. Because monitoring data collected as part of this GSP will be publicly available, data from the wells subject to confidentiality agreements cannot be published and therefore these wells are currently excluded from the GSP monitoring network.

3. **Include Additional Wells Provided by GSAs**. The GSAs provided an additional set of wells after securing permission from well owners to be included in the monitoring network. Only wells that had measurements at least as recent at 2012, were included.

Within the group of wells that met the criteria listed above, there are two well clusters: each consisting of three wells in the same location. The wells in these two clusters are all screened in the Paso Robles Formation Aquifer at various depths. A comparison of hydrographs for each cluster indicates that water levels have been generally similar in the three wells in each cluster, as shown on will be addressed in the future by either identifying an existing well in the area that meets the criteria for a valid monitoring well, or drilling a new well in the area. There are approximately 90 confidential wells in the Subbasin that have been monitored since

2012 that could be used to fill some of these data gaps if the well owners agree to sign amended confidentiality agreements. SLOFCWCD will attempt to secure such amended agreements in areas where data gaps have been identified. The GSI data gap report identifies and targets specific confidential wells for consideration as new monitoring wells in a publicly accessible monitoring system. If an existing well cannot be identified to fill a data gap, it will be necessary to drill a new monitoring well for that data gap area.

Table 7-3. Summary of Best Management Practices, Groundwater Level Monitoring Well Network, and Data Gaps

Best Management Practice (DWR, 2016b)	Current Monitoring Network	Data Gap
Groundwater level data will be collected from each principal aquifer in the basin.	23 wells total. 22 wells are completed in the Paso Robles Formation Aquifer; one well is completed in the Alluvial Aquifer.	Additional wells are needed; well depth, screen interval, well log, and aquifer designation are unknown for candidate monitoring wells; renegotiate to release confidentiality from confidential wells with water level measurement more recent than 2000 in database
Groundwater level data must be sufficient to produce seasonal maps of groundwater elevations throughout the basin that clearly identify changes in groundwater flow direction and gradient (Spatial Density).	Confidential data from 43 wells and non-confidential data from 9 wells were used to create seasonal groundwater elevation maps for the Paso Robles Formation Aquifer (Chapter 5); Confidential data from 7 wells and data from 1 non-confidential well were used to create an annual groundwater elevation map for the Alluvial Aquifer (Chapter 5).	Some data used to prepare groundwater elevation maps in the GSP are confidential; in the future, only publicly available data will be used to develop contour maps. Additional wells are needed to develop representative contour maps.
Groundwater levels will be collected during the middle of October and March for comparative reporting purposes, although more frequent monitoring may be required (Frequency).	The 22 wells in the existing monitoring network that are screened in the Paso Robles Formation have been monitored twice a year, in spring (April) and fall (October), since at least 2012.	Seasonal monitoring is the protocol for SLOFCWCD (Appendix F); more frequent monitoring may be needed to identify actual seasonal high and low groundwater elevations and further characterize groundwater level fluctuations; instrumentation like transducers or other technology may be used in future to monitor groundwater elevations.
Data must be sufficient for mapping groundwater depressions, recharge areas, and along margins of basins where groundwater flow is known to enter or leave a basin.	Current network of 23 wells is insufficient for mapping all of these areas.	Additional monitoring wells are required in groundwater depressions, near recharge features such as rivers and streams, and along Subbasin margins; possibly install instrumentation like transducers or other technology in future monitoring wells.
Well density must be adequate to determine changes in storage.	Current network of 23 wells is insufficient for determining changes in groundwater storage.	Additional monitoring wells are required to adequately cover the Subbasin and determine changes in groundwater storage.
Data must be able to demonstrate the interconnectivity between shallow groundwater and surface water bodies, where appropriate.	One well in the existing monitoring network is confirmed to be completed in the Alluvial Aquifer. There is at least one additional well that may be completed in the Alluvial Aquifer if construction data were known.	Additional wells will be needed in the Alluvial Aquifer near reaches of interconnected surface water to characterize interconnectivity.
Data must be able to map the effects of management actions, i.e., managed aquifer recharge.	Current network of 23 wells is inadequate for mapping the effects of management actions.	Additional monitoring wells are required to map the effectiveness of management actions. This monitoring will be addressed as projects are implemented
Data must be able to demonstrate conditions near basin boundaries; agencies may consider coordinating monitoring efforts with adjacent basins to provide consistent data across basin boundaries. Agencies may consider characterization and continued impacts of internal hydraulic boundary conditions, such as faults, disconformities, or other internal boundary types.	Several wells in the existing monitoring network are used to monitor conditions on the southwestern boundary of the Subbasin.	Additional wells are likely necessary along the northern boundary with the Upper Valley Subbasin of the Salinas Valley. Additional wells may be necessary to map the structure and effect of internal faults.
Data must be able to characterize conditions and monitor adverse impacts to beneficial uses and users identified within the basin.	The current monitoring network characterizes only a portion of the Subbasin and the potential impacts.	Network will be expanded in accordance with the data gaps identified above.

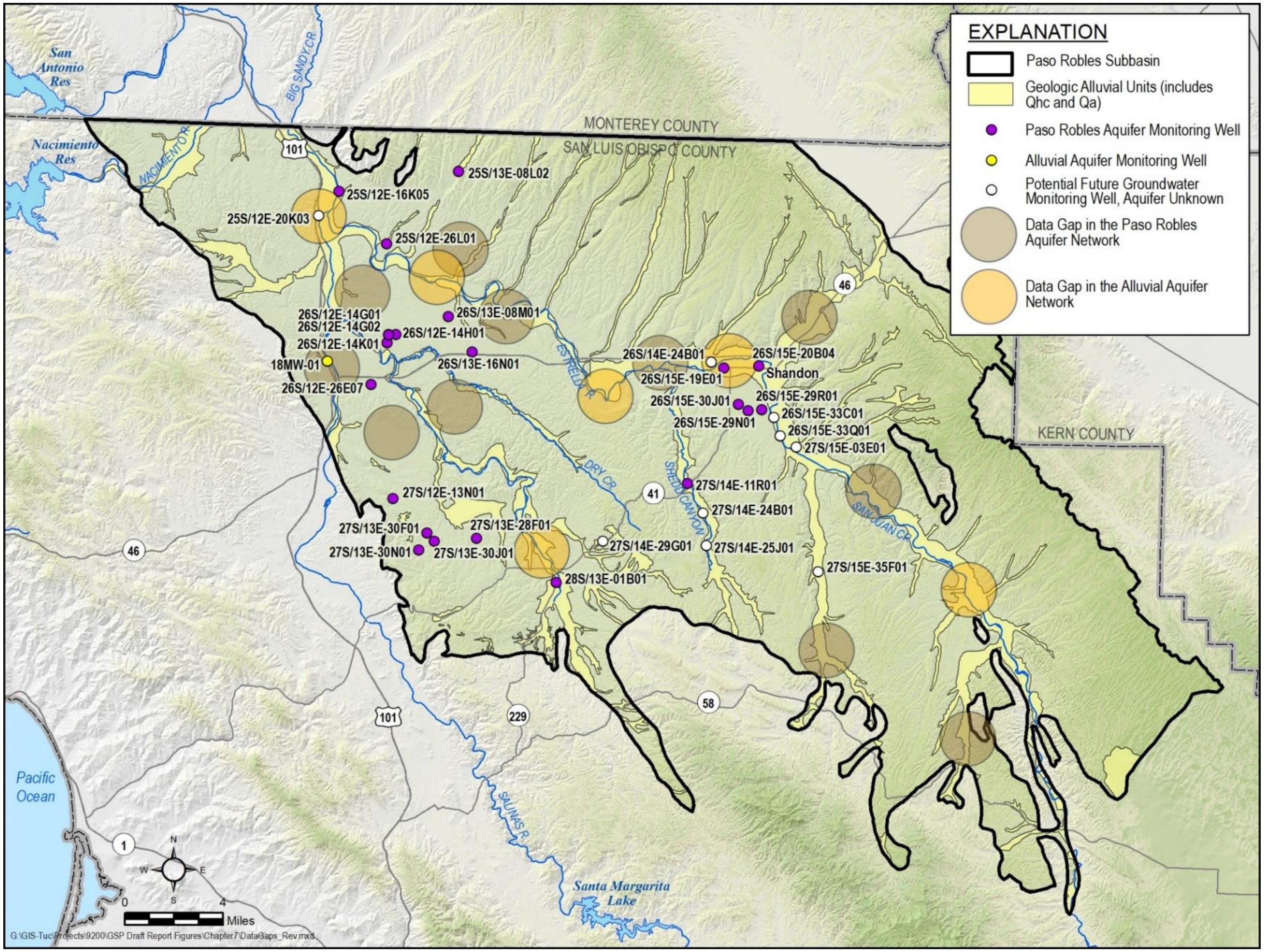


Figure 7-3. Data Gaps in the Groundwater Level Monitoring Well Network

7.2.1 Groundwater Level Monitoring Protocols

The groundwater level monitoring protocols established by SLOFCWCD are adopted by this GSP for manual groundwater level monitoring. The monitoring protocols are included in Appendix F.

There are various automated groundwater level monitoring devices in operation across the Subbasin and the GSP implementation phase will incorporate automated logging of groundwater elevations. Automated water level monitoring is already used in a number of private wells in the basin; these data may be used to supplement the current water level monitoring network in the future. As automated groundwater level monitoring systems are added to the monitoring network, appropriate protocols for each automated system will be incorporated into this GSP.

Automated groundwater level monitoring systems have the advantage of supplying more frequent groundwater levels with no increase in monitoring costs. The groundwater level monitoring BMP recommends more frequent monitoring in certain areas, including shallow, unconfined aquifers, in areas of rapid recharge, in areas of greater withdrawal rates, and in areas of more variable climatic conditions. More frequent monitoring may also be required in specific places where sustainability indicators are a concern or to track impacts of specific management actions and projects. The need for more frequent monitoring will be evaluated, and a program to increase monitoring frequency will be developed during the GSP implementation phase.

7.3 Groundwater Storage Monitoring Network

This GSP adopts groundwater levels as a proxy for assessing change in groundwater storage, as described in Chapter 8, Sustainable Management Criteria. To support the proxy, the relationship between change in groundwater levels and the change in the amount of groundwater in storage will be developed after GSP adoption and when additional data are available to develop the relationship. Groundwater level monitoring locations that are adequate for collecting the groundwater level data are identified in Section 7.2. Therefore, the network of wells providing groundwater level data for the reduction in groundwater storage sustainability indicator is the same wells shown on Table 7-1.

7.3.1 Groundwater Storage Monitoring Data Gaps

Data gaps in the groundwater storage monitoring network are similar to the data gaps identified for the groundwater level monitoring network discussed in Section 7.2.1. Because change in groundwater storage is predominantly influenced by changes in shallow water table elevations, more shallow wells than those discussed in Section 7.2.1 may be necessary. Additional water table wells may be needed throughout the Paso Robles Formation Aquifer.

The number of additional water table wells will not be known until there is an assessment of how many existing wells are screened at or near the existing water table in the Paso Robles Formation Aquifer. This is a data gap that will be addressed during GSP implementation.

7.3.2 Groundwater Storage Monitoring Protocols

The groundwater storage monitoring network is identical to the groundwater level monitoring network. Therefore, the protocols used for gathering water level data to assess changes in groundwater storage are identical to the protocols used for the chronic lowering of groundwater levels sustainability indicator. Protocols for the manual collection of groundwater levels are included in Appendix F. As automated groundwater level collection devices are added to the monitoring network, protocols will be developed for each of these automated systems and incorporated into the GSP.

7.4 Water Quality Monitoring Network

The sustainability indicator for degraded water quality is evaluated by monitoring groundwater quality at a network of existing supply wells. The SGMA regulations require sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators to address known water quality issues.

As described in Chapter 5, there are no known contaminant plumes in the Subbasin, therefore the monitoring network is monitoring only non-point source constituents of concern and naturally occurring water quality impacts.

Existing groundwater quality monitoring programs in the Subbasin are described in Chapter 3 and groundwater quality distribution and trends are described in Chapter 5. Constituents of concern were identified in Chapter 5 based on comparison to drinking water standards and levels that could impact crop production. As described in Chapter 8, separate minimum thresholds are set for agricultural constituents of concern and public supply well constituents of concern. Therefore, although there is a single groundwater quality monitoring network, different wells in the network will be assessed for different constituents. Constituents of concern for drinking water will be assessed at public water supply wells. Constituents of concern for crop health will be assessed at agricultural supply wells.

The public water supply wells included in the monitoring network were identified by reviewing data from the State Water Resources Control Board (SWRCB) Division of Drinking Water. Wells were selected that were sampled for at least one of the constituents of concern during 2015 or more recently. These wells are listed in Table 7-4 and shown on Figure 7-4. For the 41 public supply wells in the groundwater quality monitoring network, an assumed aquifer designation was assigned based on surficial geologic maps (Figure 4-4) and well depths when available. There are 31 wells that are in the Paso Robles Formation Aquifer, seven wells in the Alluvial Aquifer, and three wells where the aquifer could not be estimated. Verifying the aquifer for these three wells is a data gap that will be addressed during plan implementation.

The agricultural supply wells included in the monitoring network were identified by reviewing data from the Irrigated Lands Regulatory Program (ILRP) that are stored in the SWRCB's Geotracker/GAMA database. Wells were selected that had detections of at least one of the agricultural constituents of concern reported from 2015 or more recently (GAMA, 2015). There are 28 ILRP properties with agricultural supply wells in the groundwater quality monitoring network. Since multiple wells of unknown depth are associated with a given IRLP ID, the aquifer monitored by these wells is unknown. These wells are listed in Table 7-4 and shown on Figure 7-4. If an IRLP property has multiple wells, the location of the well is shown at the average of these coordinates.

Table 7-4. Groundwater Quality Monitoring Well Network

Well ID	Type of Well	Well Depth[1] (feet)	Screen Interval (feet bls)	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count	Assumed Aquifer
W0604000207-001	PWS	440	340-440	2002	2018	16	63	PR
W0604000210-001	PWS	117	87-117	2002	2015	13	9	---
W0604000512-001	PWS	60	30-60	2002	2015	13	13	AA
W0604000554-001	PWS	355	155-355	2002	2016	14	16	PR
W0604000554-003	PWS	237	174-237	2002	2016	14	16	PR
W0604000620-001	PWS	354	120-354	2001	2018	17	36	PR
W0604000620-002	PWS	510	310-510	2002	2018	16	41	PR
W0604000693-002	PWS	40	---	2005	2017	12	9	AA
W0604000708-001	PWS	80	80-80	2002	2018	16	10	AA
W0604000781-001	PWS	792	412-792	2002	2018	16	21	PR
W0604000781-011	PWS	670	380-670	2002	2018	16	21	PR
W0604000788-001	PWS	450	235-450	2002	2018	16	15	PR
W0604000788-005	PWS	920	400-920	2003	2018	15	14	PR
W0604000789-001	PWS	245	125-245	2002	2018	16	17	PR
W0604000790-001	PWS	175	126-175	2002	2018	16	62	---
W0604000803-001	PWS	420	100-420	2004	2018	14	10	PR
W0604000803-002	PWS	420	200-420	2004	2018	14	10	PR
W0604010007-003	PWS	400	200-400	1984	2016	32	36	PR
W0604010007-004	PWS	500	---	1984	2018	34	82	PR
W0604010007-006	PWS	344	---	1987	2018	31	34	PR
W0604010007-007	PWS	80	20-80	1984	2017	33	23	AA
W0604010007-008	PWS	80	20-80	1984	2018	34	24	AA

Well ID	Type of Well	Well Depth[1] (feet)	Screen Interval (feet bls)	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count	Assumed Aquifer
W0604010007-009	PWS	---	---	1990	2018	28	8	---
W0604010007-010	PWS	600	260-600	1990	2017	27	17	PR
W0604010007-012	PWS	425	---	1984	2018	34	35	PR
W0604010007-013	PWS	317	---	1984	2018	34	34	PR
W0604010007-017	PWS	675	---	1993	2018	25	26	PR
W0604010007-018	PWS	535	---	1993	2016	23	23	PR
W0604010007-019	PWS	220	---	1995	2017	22	25	PR
W0604010007-020	PWS	610	---	1996	2017	21	22	PR
W0604010007-021	PWS	100	---	1998	2018	20	22	AA
W0604010007-038	PWS	1060	300-1060	2003	2018	15	18	PR
W0604010010-004	PWS	300	85-300	1984	2018	34	118	PR
W0604010010-005	PWS	360	162-360	1991	2018	27	105	PR
W0604010010-009	PWS	380	350-380	2007	2018	11	250	PR
W0604010028-002	PWS	342	297-342	1991	2018	27	46	PR
W0604010028-004	PWS	400	300-400	2002	2018	16	31	PR
W0604010831-001	PWS	840	640-840	1989	2016	27	24	PR
W0604010831-002	PWS	446	401-446	1989	2016	27	23	PR
W0604010831-003	PWS	475	410-475	1989	2016	27	24	PR
W0604010900-002	PWS	50	---	1999	2018	19	18	AA
AGL020000646	ILRP	660	---	2012	2017	5	---	---
AGL020000801	ILRP	---	---	2013	2017	4	---	---
AGL020001525	ILRP	---	---	2014	2017	3	---	---
AGL020001534	ILRP	---	---	2013	2017	4	---	---

Well ID	Type of Well	Well Depth[1] (feet)	Screen Interval (feet bls)	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count	Assumed Aquifer
AGL020001605	ILRP	---	---	2015	2017	2	---	---
AGL020001689	ILRP	---	---	2014	2017	3	---	---
AGL020001800	ILRP	---	---	2015	2015	<1	---	---
AGL020003900	ILRP	---	---	2015	2015	<1	---	---
AGL020004014	ILRP	---	---	2014	2017	3	---	---
AGL020005173	ILRP	---	---	2015	2017	2	---	---
AGL020005268	ILRP	---	---	2015	2015	<1	---	---
AGL020007128	ILRP	---	---	2014	2017	3	---	---
AGL020007471	ILRP	---	---	2015	2015	<1	---	---
AGL020007593	ILRP	---	---	2015	2018	3	---	---
AGL020007721	ILRP	---	---	2017	2017	<1	---	---
AGL020007807	ILRP	---	---	2012	2017	5	---	---
AGL020007815	ILRP	---	---	2012	2017	5	---	---
AGL020007848	ILRP	---	---	2015	2015	<1	---	---
AGL020007872	ILRP	---	---	2015	2018	3	---	---
AGL020009803	ILRP	---	---	2014	2018	4	---	---
AGL020010282	ILRP	---	---	2012	2015	3	---	---
AGL020013814	ILRP	---	---	2015	2018	3	---	---
AGL020015242	ILRP	---	---	2015	2018	3	---	---
AGL020015302	ILRP	---	---	2013	2017	4	---	---
AGL020016382	ILRP	---	---	2015	2018	3	---	---
AGL020024742	ILRP	---	---	2016	2017	1	---	---
AGL020025402	ILRP	---	---	2015	2017	2	---	---

Well ID	Type of Well	Well Depth[1] (feet)	Screen Interval (feet bls)	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count	Assumed Aquifer
AGL020028348	ILRP	---	---	2017	2017	<1	---	---

Notes

--- = Unknown

(1) = total well depth is assumed to be equivalent to bottom of perforated interval

AA = Alluvial Aquifer; PR = Paso Robles Formation Aquifer

PWS = Public water supply

ILRP = Irrigated Lands Regulatory Program

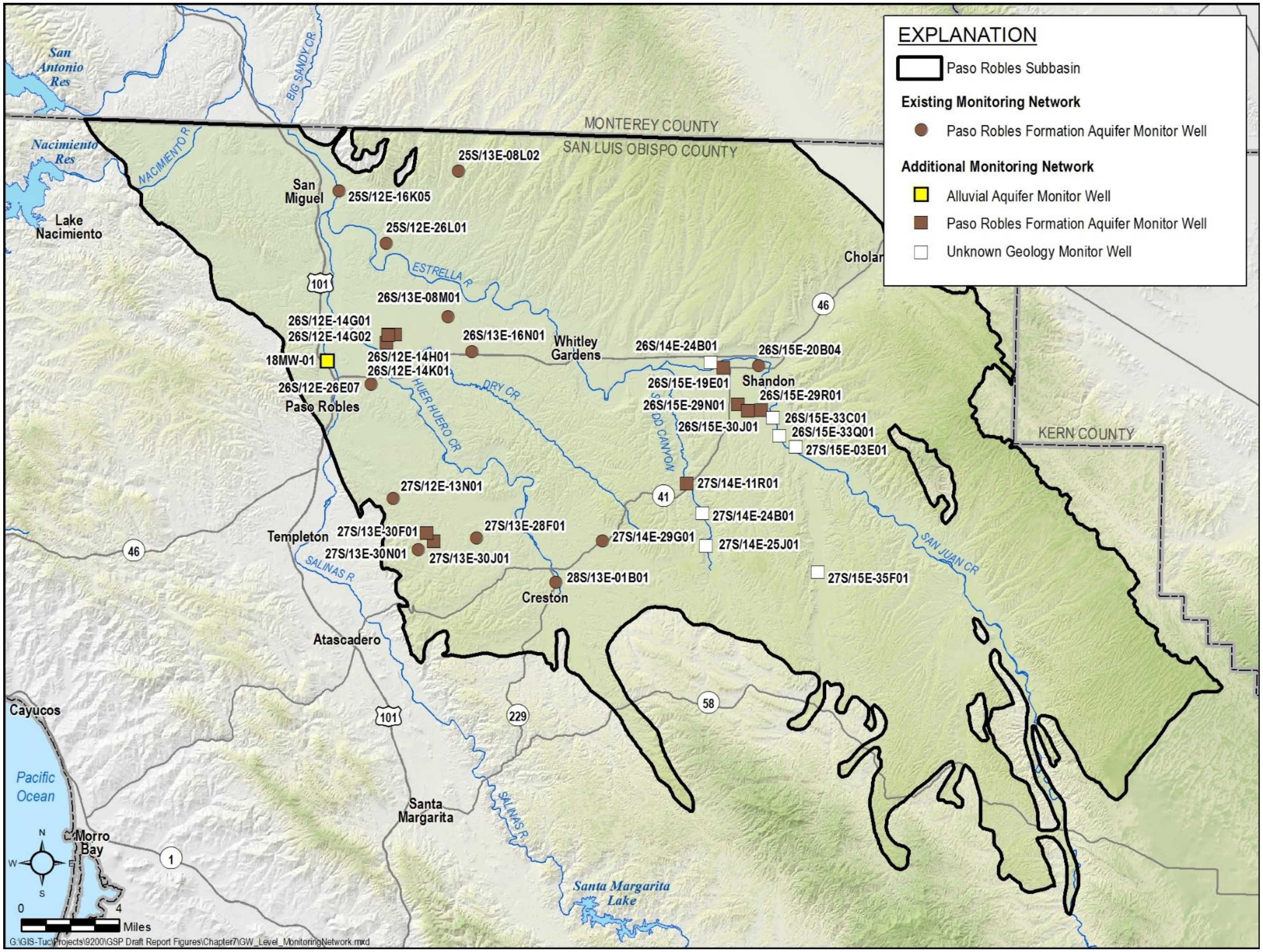


Figure 7-4. Groundwater Quality Monitoring Well Network

7.4.1 Groundwater Quality Monitoring Data Gaps

Because the groundwater quality monitoring network is based on existing supply wells, there are no spatial data gaps in the network.

Table 7-5Table 7-5 summarizes the recommendations for groundwater quality monitoring from the BMPs, the current network, and data gaps. There is adequate spatial coverage in the network to assess impacts to beneficial uses and users. The primary data gap is that well construction info for many wells in the monitoring network is unknown. This is a data gap that will be addressed during GSP implementation.

7.4.2 Groundwater Quality Monitoring Protocols

Water quality samples are currently being collected according to SWRCB and ILRP requirements. ILRP data are currently collected under Central Coast RWQCB Ag Order 3.0. ILRP samples are collected under the Tier 1, Tier 2, or Tier 3 monitoring and reporting programs. Copies of these monitoring and reporting programs are included in Appendix F, and incorporated herein as monitoring protocols. These protocols will continue to be followed during GSP implementation for the groundwater quality monitoring.

Table 7-5. Summary of Groundwater Quality Monitoring, Best Management Practices, and Data Gaps

Best Management Practice (DWR, 2016b)	Current Network	Data Gap
Monitor groundwater quality data from each principal aquifer in the basin that is currently, or may be in the future, impacted by degraded water quality. • The spatial distribution must be adequate to map or supplement mapping of known contaminants. • Monitoring should occur based upon professional opinion, but generally correlate to the seasonal high and low groundwater level, or more frequent as appropriate.	There are 41 municipal wells and 28 IRLP wells within the plan area that have been regularly sampled since at least 2015 for groundwater quality.	None; the current monitoring network contains adequate spatial distribution to map water quality in the basin.
Collect groundwater quality data from each principal aquifer in the basin that is currently, or may be in the future, impacted by degraded water quality. • Agencies should use existing water quality monitoring data to the greatest degree possible. For example, these could include ILRP, GAMA, existing RWQCB monitoring and remediation programs, and drinking water source assessment programs.	Public databases provide adequate water quality information for degraded water quality.	Well depth and construction info for some wells in the monitoring network is unknown; however, there seems to be adequate coverage in both principal aquifers
Define the three-dimensional extent of any existing degraded water quality impact.	There are a large number of wells that are actively sampled.	Depth or construction information will need to be obtained to determine the vertical extent of contaminants
Data should be sufficient for mapping movement of degraded water quality.	There are a large number of wells that are actively sampled.	None
Data should be sufficient to assess groundwater quality impacts to beneficial uses and users.	Water quality monitoring program assesses impacts to both agricultural and municipal users.	None
Data should be adequate to evaluate whether management activities are contributing to water quality degradation.	There are a large number of wells that are actively sampled.	Projects and actions are being developed. Water quality network will be evaluated and augmented if necessary.

7.5 Land Subsidence Monitoring Network

The sustainability indicator for land subsidence is evaluated by monitoring land subsidence using InSAR data. As described in Chapter 5, land subsidence is monitored in the Subbasin by measuring ground elevation using microwave satellite imagery. This data is currently provided by DWR, covers the most recent three years of subsidence data (2015 - 2018), and is adequate to identify areas of recent subsidence. One or more GSA may opt to contract with USGS or others with expertise in subsidence to gather any additional datasets and evaluate the cause(s) of any identified subsidence. The GSAs will continue to annually assess subsidence using the DWR provided InSAR data.

7.5.1 Land Subsidence Monitoring Data Gaps

Available data indicate that there is currently no long-term subsidence occurring in the Subbasin that affects infrastructure. There are no data gaps identified with the subsidence network at this time.

7.5.2 Land Subsidence Monitoring Protocols

The BMP notes that no standard procedures exist for collecting subsidence data. The GSAs will continue to monitor data annually as part of GSP implementation. If additional relevant datasets become available, they will be evaluated and incorporated into the monitoring program. If the annual monitoring indicates subsidence is occurring at a rate greater than the minimum thresholds, then additional investigation and monitoring may be warranted. In particular, the GSAs will implement a study to assess if the observed subsidence can be correlated to groundwater elevations, and whether a reasonable causality can be established. The GSAs will also consider subsidence surveys published by the USGS in assessing land subsidence across the Subbasin if they become available.

7.6 Interconnected Surface Water Monitoring Network

Data presented in Section 5.5 indicate potential groundwater connection to surface water or to the riparian vegetation root zone at least some of the time along certain sections of the Salinas River, along the middle reach of the Estrella River (from Shedd Canyon to Martingale Circle) and along San Juan Creek upstream of Spring Creek. The potential connection along the Salinas River is between the surface water system and the adjacent Alluvial Aquifer. There is no evidence that the Salinas River surface water flows are connected to the underlying Paso Robles Formation Aquifer. The potential connection between the surface water system along the middle reach of the Estrella River (from Shedd Canyon to Martingale Circle) and along San Juan Creek upstream of Spring Creek, and the underlying Paso Robles Formation Aquifer is unknown but sufficient evidence exists that there could potentially be a connection, and therefore further investigation in these areas is recommended.

Seven existing wells already are monitored for water levels within 2,000 feet of those stream reaches and these have water-level patterns consistent with expected shallow water table conditions. Two of these are shown as blue squares in Figure 7-5. The locations of the others are not shown due to confidentiality restrictions, but they include three wells along the Salinas River between Wellsona and the Estrella River, one well next to the Estrella River near Jardine Road and one well next to San Juan Creek about 7 miles above Shandon. The City of Paso Robles' Supplemental Environmental Project (SEP) identified ten sites where multi-depth monitoring wells and stream gages would be useful for better characterizing interconnection of surface water and groundwater (Cleath-Harris Geologists, 2021). Those sites are shown as orange circles numbered 1 through 10 on the figure. Sites 1 and 9 have existing stream gages, and shallow and intermediate depth monitoring wells were installed nearby in spring 2021.

7.6.1 Interconnected Surface Water Monitoring Data Gaps

The existing shallow monitoring wells do not adequately cover the three stream reaches where interconnection of groundwater with surface water and/or the riparian vegetation root zone appears to occur some or most of the time. The presence of shallow clay layers and degree of separation between Alluvial Aquifer groundwater levels and Paso Robles Formation Aquifer pumping and water levels is poorly known in the eastern part of the Subbasin. Recommended locations for additional wells to verify and monitor interconnection are listed in Table 7-6 and shown in Figure 7-5 as green squares labeled A through H. Shallow and deep monitoring wells are needed at some of the locations to confirm any differences between Alluvial Aquifer and Paso Robles Formation Aquifer water levels. These locations are suggestions that would need to be refined based on practical considerations such as land ownership and adequate road access.

New stream gages have already been installed since the beginning of the GSP development process. This includes SEP sites 2, 4 and 10 on the Salinas River, Huer Huero Creek and Estrella River (see Figure 7-5) and a new gage installed by DWR on Cholame Creek at SEP site 8. Of the remaining SEP sites, a gage at site 7 would be the most useful.

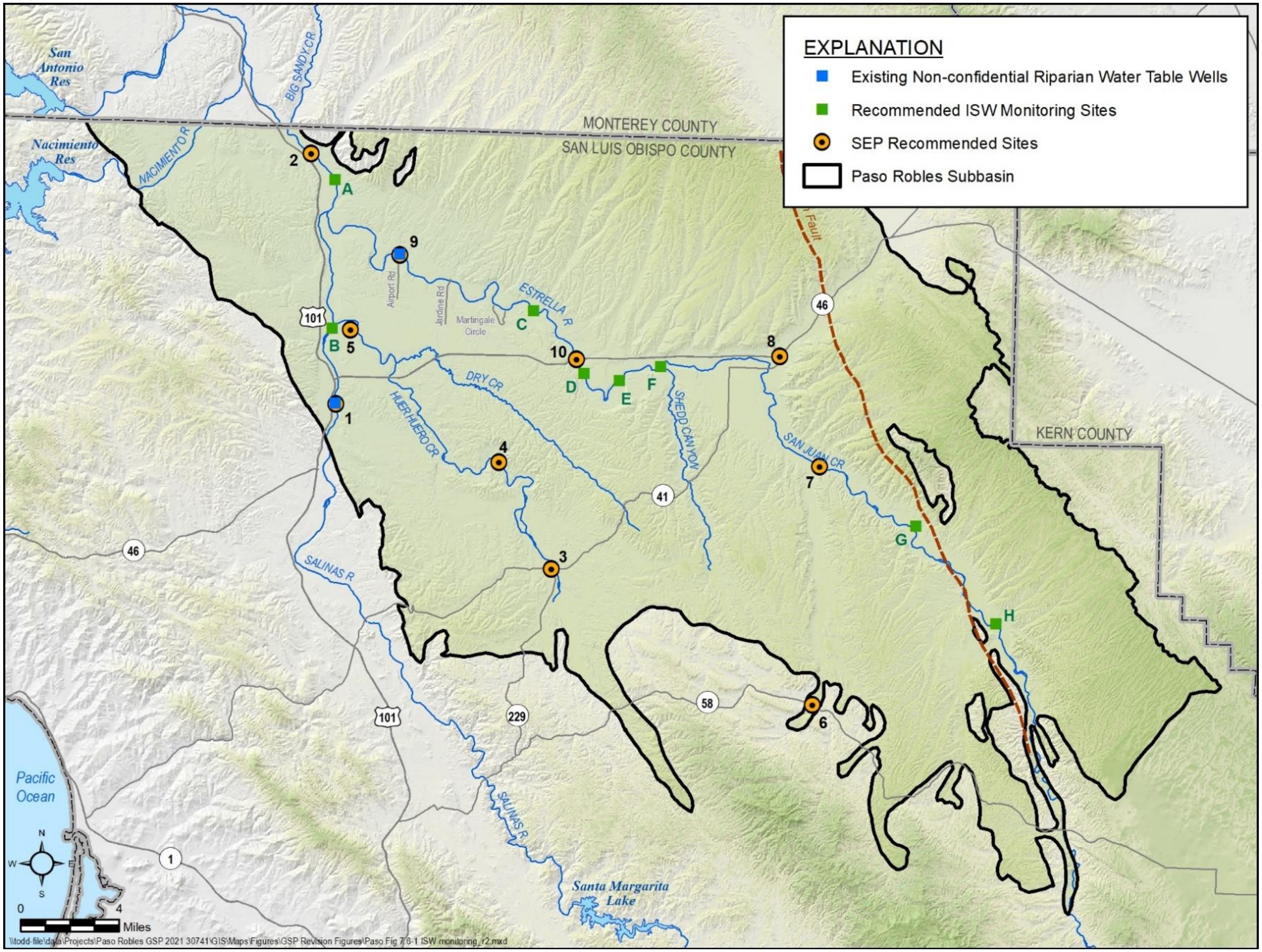
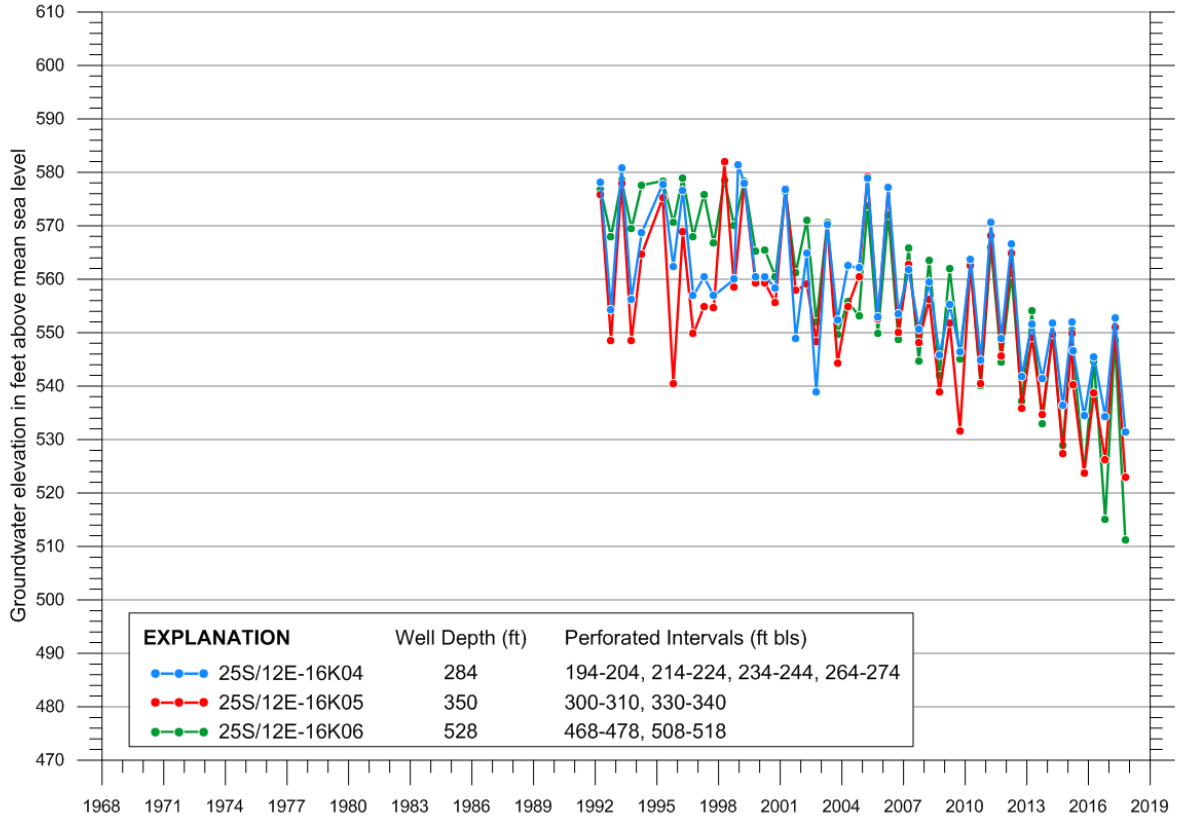


Figure 7-5. Interconnected Surface Water Monitoring Well Network

Table 7-6. Recommended Well Locations for Monitoring Interconnected Surface Water and GDEs

Map Label	Description
A	Salinas River in San Miguel, near existing Paso Robles Formation Aquifer monitoring well clusters. This site could replace or be shifted to SEP site 2. Only a shallow well is needed.
B	Salinas River near Wellsona. This fills a long reach with no data and is a location where surface flow is likely to become discontinuous before other reaches. Only a shallow well is needed.
C	Estrella River above Martingale Circle. This site is near an existing monitoring well near the river that shows a Paso Robles Formation Aquifer water-level pattern. Only a shallow well is needed.
D	Estrella River at Whitley Gardens. The suggested site is at the River Grove Drive bridge at the upstream edge of town. This site could replace or be shifted to SEP site 10. This site needs shallow and deep wells to confirm whether the alluvial water table is somewhat independent of underlying Paso Robles Formation Aquifer water levels.
E	Estrella River 3.3 channel miles upstream of Highway 46 (Whitley Gardens). There are no nearby existing wells to confirm the apparent presence of shallow water table conditions. This site needs shallow and deep wells to confirm whether the alluvial water table is somewhat independent of underlying Paso Robles Formation Aquifer water levels.
F	Estrella River near Shedd Canyon confluence. There are no nearby existing wells to confirm the apparent presence of shallow water table conditions. This site needs shallow and deep wells to confirm whether the alluvial water table is somewhat independent of underlying Paso Robles Formation Aquifer water levels.
G	San Juan Creek between existing monitoring well and San Juan Fault preferably near riparian vegetation. A shallow well is needed at this location to supplement the single existing well along this reach of San Juan Creek, which is reportedly 225 feet deep but has relatively stable water levels close to the creek bed elevation, like an Alluvial Aquifer well.
H	At this location, the San Juan Fault forces groundwater into the channel of San Juan Creek, creating a spring and a short reach of flowing water bordered by wetland vegetation. In lieu of a well, the length of the flowing reach and wetland area could be monitored to detect decreases in the flow of groundwater across the fault.

~~Figure 7-1~~. Only one well was selected from each cluster for inclusion in the monitoring network because it is representative of all the wells in that cluster. The two wells selected for monitoring are wells 26S/15E-20B04 and 25S/12E-16K05.



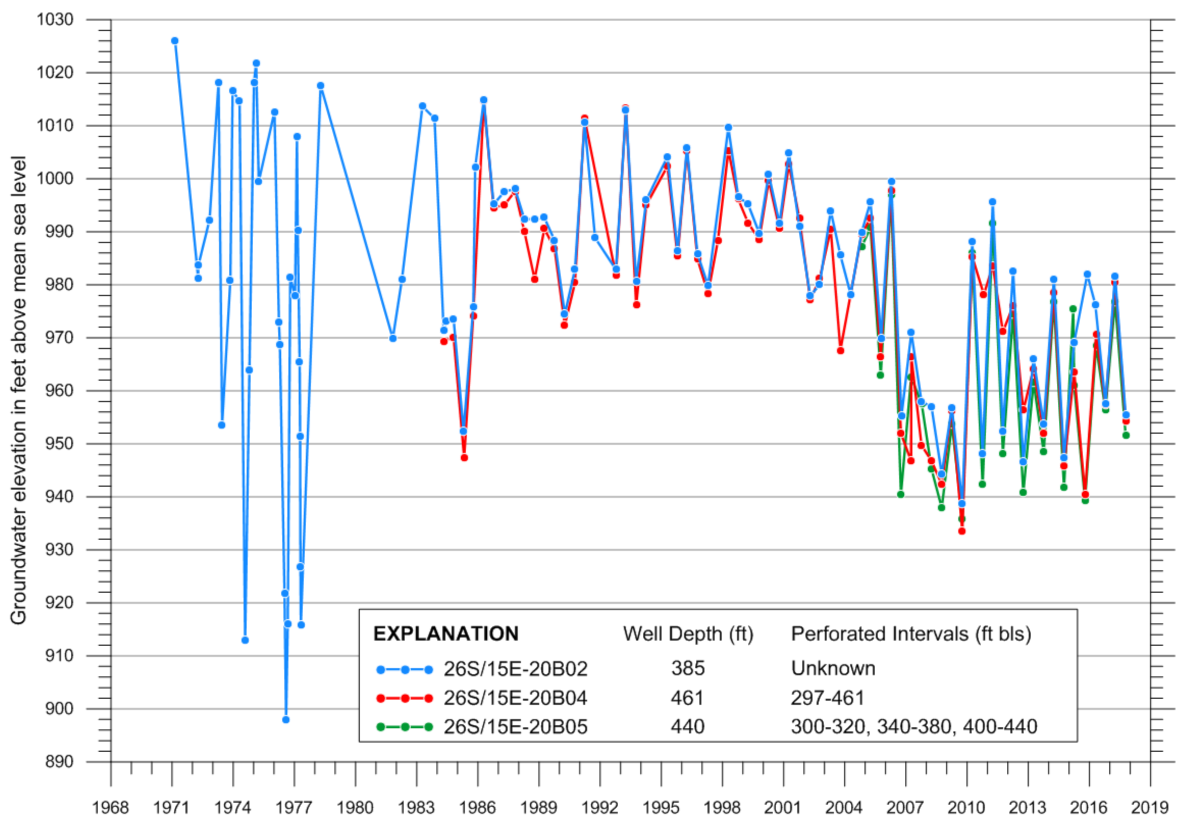


Figure 7-1. Hydrographs of Wells in Well Clusters

There are two principal aquifers in the Subbasin, as described in Chapter 4 – Hydrogeologic Conceptual Model. The Alluvial Aquifer occurs along stream channels and is generally up to about 100 feet thick. The Paso Robles Formation Aquifer occurs in thin discontinuous sand and gravel zones throughout the Subbasin. The wells in the proposed monitoring network are assigned to an aquifer according to these guidelines:

- The well location is compared to the surface geology map, Figure 4-4.
- If the well is located where the Paso Robles Formation is mapped at land surface on the surface geology map, then it is assumed to be monitoring the Paso Robles Formation Aquifer.
- If the well is located in the mapped extent of alluvium, and the screened interval or total well depth is less than 100 feet, then it was assumed to be monitoring the Alluvial Aquifer. If the top of the perforated interval is greater than 100 feet below land surface, then the well was assumed to be monitoring the Paso Robles Formation Aquifer.

The depths of several wells are unknown. Although well completion reports are available online via the State's OSWCR system, the well completion report numbers are unknown for these wells and therefore it is impossible to identify the associated well completion reports. Wells in which depth to water is greater than 100 feet below land surface on average are assumed to be monitoring the Paso Robles Formation Aquifer. Wells with depth to water less than 100 feet below land surface may be monitoring the alluvial aquifer, but their aquifer designations are unknown pending confirmation of screened interval and/or total depth. Wells for which an aquifer could not be assigned are considered potential future monitoring wells, and they will be included in the monitoring system when and if the well completion information and aquifer can be verified during GSP implementation. Likewise, there are also wells within the Alluvial Aquifer that could be included in the monitoring network when and if the data on depth and screened interval are obtained and confidentiality restrictions are lifted.

The wells in the water level monitoring network are listed in Table 7-1~~Table 7-1~~ and shown on Figure 7-2~~Figure 7-2~~. ~~There~~As of 2019 there are~~ currently~~ 23 wells in the network, 22 wells monitor the Paso Robles Formation Aquifer and one well owned by the City of Paso Robles monitors the Alluvial Aquifer. Any of these wells that are missing well completion information will be assessed during GSP implementation to obtain well depth and/or screened interval. There are nine potential future monitoring wells listed on Table 7-2~~Table 7-2~~.

All 22 wells monitoring the Paso Robles Formation Aquifer are part of the SLOFCWCD monitoring network. These wells either are not subject to confidentiality agreements or the well data are located in a public database hosted by DWR and therefore are publicly available. The monitoring frequency indicates that water levels are presumably measured twice a year, in accordance with the SLOFCWCD protocol of measuring depths to water in April and October of each year. The most recent available measurement was 2016 or 2017 in all wells.

Table 7-1. Groundwater Level Monitoring Well Network

Well ID (alt ID)	Well Depth (feet)	Screen Interval(s) (feet bls)	Reference Point Elevation (feet AMSL)	First Year of Data	Last Year of Data	Years Measured (years)	Number of Measurements	Aquifer
18MW-0191[1]	50	10-50	672 (LSE)	2018	2018	<1	1	Qa
25S/12E-16K05 (PASO-0345)	350	300-310, 330-340	669.8	1992	2017	25	52	PR
25S/12E-26L01 (PASO-0205)	400	200-400	719.72	1970	2017	47	103	PR
25S/13E-08L02 (PASO-0195)	270	110-270	1,033.81	2012	2017	5	11	PR
26S/12E-14G01 (PASO-0048)	740	---	789.3	1969	2017	48	117	PR
26S/12E-14G02 (PASO-0017)	840	640-840	787	1993	2012	19	27	PR
26S/12E-14H01 (PASO-0184)	1230	180-?	790	1969	2016	47	45	PR
26S/12E-14K01 (PASO-0238)	1100	---	786	1979	2017	38	80	PR
26S/12E-26E07 (PASO-0124)	400	---	835	1958	2017	59	128	PR
26S/13E-08M01 (PASO-0164)	400	260-400	827.92	2013	2017	4	11	PR
26S/13E-16N01 (PASO-0282)	400	200-400	890.17	2012	2017	5	11	PR
26S/15E-19E01 (PASO-0073)	512	223-512	1,020	1987	2017	30	52	PR
26S/15E-20B04 (PASO-0401)	461	297-461	1,036.36	1984	2017	33	66	PR
26S/15E-29N01 (PASO-0226)	350	---	1,135	1958	2017	59	122	PR
26S/15E-29R01 (PASO-0406)	600	180-600	1,109.5	2012	2017	5	9	PR
26S/15E-30J01 (PASO-0393)	605	195-605	1,123.3	1970	2017	47	80	PR
27S/12E-13N01 (PASO-0223)	295	195-295	972.42	2012	2017	5	11	PR
27S/13E-28F01 (PASO-0243)	212	118-212	1,072	1969	2017	48	104	PR
27S/13E-30F01 (PASO-0355)	310	200-310	1,043.2	2012	2017	5	8	PR
27S/13E-30J01 (PASO-0423)	685	225-685	1,095	2012	2015	3	6	PR
27S/13E-30N01 (PASO-0086)	355	215-235, 275-355	1,086.73	2012	2016	4	6	PR
27S/14E-11R01 (PASO-0392)	630	180-630	1,160.5	1974	2017	43	69	PR
28S/13E-01B01 (PASO-0066)	254	154-254	1,099.93	2012	2016	4	9	PR

NOTES: New alluvial monitoring well information provided by City of Paso Robles; well not included in County database.

"—" = unknown; AMSL – above mean sea level; PR Paso Robles Formation Aquifer; Qa Alluvial Aquifer

Table 7-2. Potential Future Groundwater Monitoring Well, Aquifer Unknown

Well ID (alt ID)	Well Depth (feet)	Screen Interval(s) (feet bls)	Reference Point Elevation (feet AMSL)	First Year of Data	Last Year of Data	Years Measured (years)	Number of Measurements	Aquifer
25S/12E-20K03 (PASO-0304)	---	---	625	1974	2017	43	82	---
26S/14E-24B01 (PASO-0302)	---	---	1001	1962	2017	55	93	---
26S/15E-33C01 (PASO-0314)	---	---	1095	1973	2017	44	75	---
26S/15E-33Q01 (PASO-0381)	---	---	1102	1973	2017	44	78	---
27S/15E-03E01 (PASO-0277)	---	---	1120.8	1968	2017	49	104	---
27S/14E-24B01 (PASO-0391)	---	---	1180.5	1973	2017	44	69	---
27S/14E-25J01 (PASO-0074)	---	---	1,225.5	1972	2017	45	67	--
27S/14E-29G01 (PASO-0041)	---	---	1201.5	1974	2017	43	73	---
27S/15E-35F01 (PASO-0053)	---	---	1230	1965	2017	52	78	---

NOTES: “—“ = unknown

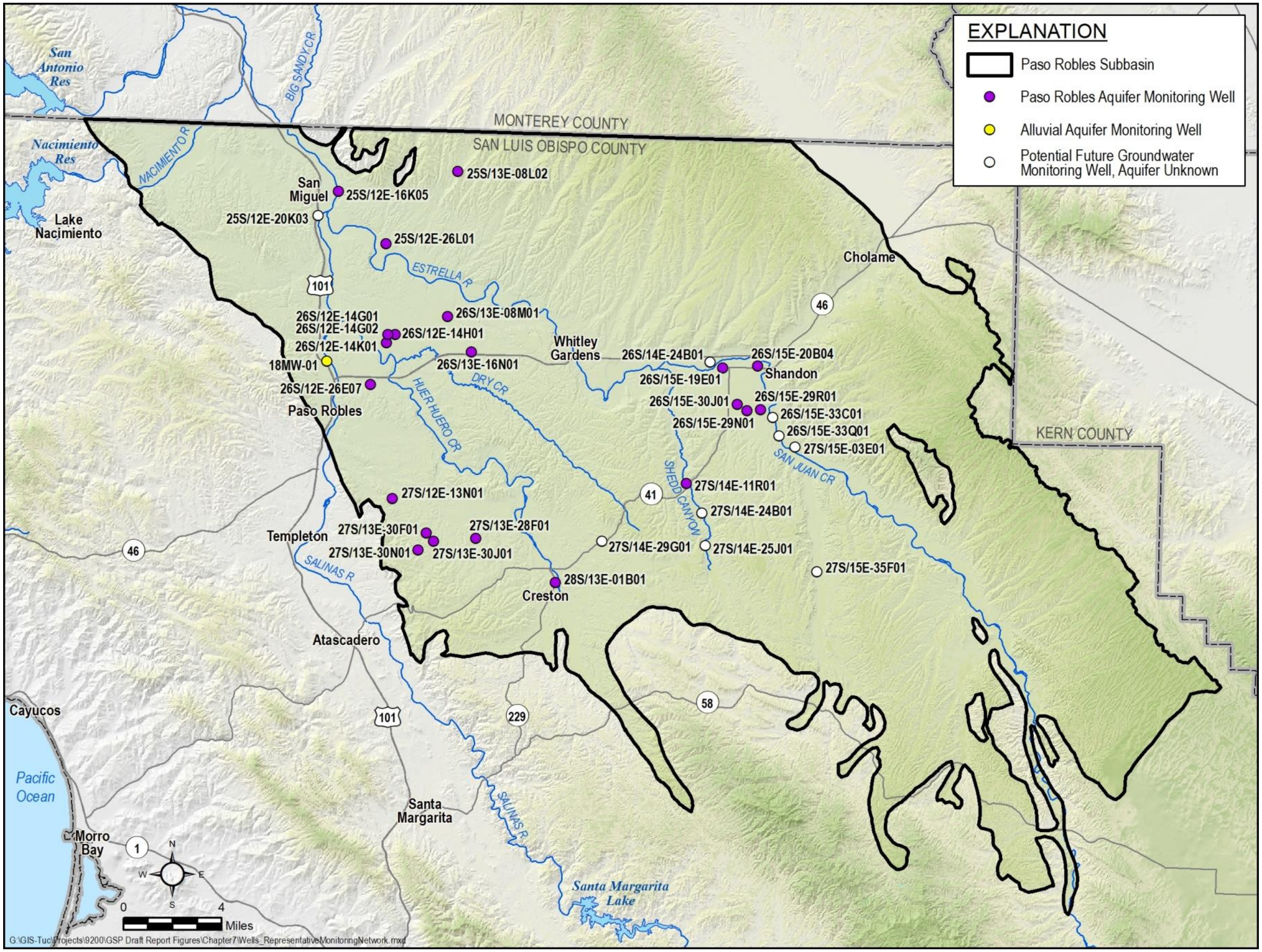


Figure 7-2. Groundwater Level Monitoring Well Network in Paso Robles Formation Aquifer

~~7.2.1~~7.6.2 Groundwater Level Monitoring Network Data Gaps

The GSAs identified data gaps using guidelines in the SGMA regulations and BMPs published by DWR on monitoring networks (DWR, 2016b). Table 7-3~~Table 7-3~~ summarizes the suggested attributes of a groundwater level monitoring network from the BMPs in comparison to the current network, and identifies data gaps.

The SGMA regulations require a sufficient density of monitoring wells to characterize the groundwater table or potentiometric surface for each principal aquifer. Professional judgement is also used to determine an adequate level of monitoring density in areas of active groundwater pumping.

While there is no definitive rule on well density, the BMP cites a range of 0.2 to 10 wells per 100 square miles, with a median of 5 wells per 100 square miles from various cited studies. The CASGEM monitoring plan includes 10 to 20 wells per 100 square miles (SLOFCWCD, 2014). The Subbasin is 684 square miles, which equates to 34 wells at a median density of 5 wells per 100 square miles. The monitoring network of 22 wells in the Paso Robles Formation Aquifer is within the recommended range cited in the BMP (1 to 68 wells), but the number of monitoring wells may be considered low given the size and complexity of the Subbasin. The single monitoring well in the Alluvial Aquifer is insufficient. This is a data gap that will be addressed during plan implementation.

A program to increase monitoring frequency will be developed to determine seasonal high and low groundwater elevations and also monitor groundwater response to recharge and other activities. One method to increase monitoring frequency is to install continuous dataloggers in existing and new monitoring wells.

Groundwater level data must be sufficient to identify changes in groundwater flow directions and gradients. Groundwater contour maps are presented in Chapter 5 for both aquifers. These maps were prepared using available monitoring data, including data collected from wells subject to confidentiality agreements. To comply with the confidentiality agreements, the data and well locations are not included on the maps. The 23 wells in the proposed Paso Robles Formation Aquifer monitoring network are insufficient to develop representative and sufficiently detailed groundwater contour maps. The lack of publicly available data for both aquifers is identified as a data gap that will be addressed early in GSP implementation.

A recent study by GSI Water Solutions, Inc. (GSI) came to similar conclusions about data gaps in the Paso Robles Formation (GSI, 2018). The data gap areas developed by GSI are shown on Figure 7-3~~Figure 7-3~~. These are areas where existing wells that can serve as monitoring wells should be identified, or new monitoring wells should be installed in the Paso Robles Formation Aquifer. Figure 7-3~~Figure 7-3~~ also shows locations of data gaps and potential new well locations for the Alluvial Aquifer.

The data gap areas on Figure 7-3Figure 7-3 will be addressed in the future by either identifying an existing well in the area that meets the criteria for a valid monitoring well, or drilling a new well in the area. There are approximately 90 confidential wells in the Subbasin that have been monitored since 2012 that could be used to fill some of these data gaps if the well owners agree to sign amended confidentiality agreements. SLOFCWCD will attempt to secure such amended agreements in areas where data gaps have been identified. The GSI data gap report identifies and targets specific confidential wells for consideration as new monitoring wells in a publicly accessible monitoring system. If an existing well cannot be identified to fill a data gap, it will be necessary to drill a new monitoring well for that data gap area.

Table 7-3. Summary of Best Management Practices, Groundwater Level Monitoring Well Network, and Data Gaps

Best Management Practice (DWR, 2016b)	Current Monitoring Network	Data Gap
Groundwater level data will be collected from each principal aquifer in the basin.	23 wells total. 22 wells are completed in the Paso Robles Formation Aquifer; one well is completed in the Alluvial Aquifer.	Additional wells are needed; well depth, screen interval, well log, and aquifer designation are unknown for candidate monitoring wells; renegotiate to release confidentiality from confidential wells with water level measurement more recent than 2000 in database
Groundwater level data must be sufficient to produce seasonal maps of groundwater elevations throughout the basin that clearly identify changes in groundwater flow direction and gradient (Spatial Density).	Confidential data from 43 wells and non-confidential data from 9 wells were used to create seasonal groundwater elevation maps for the Paso Robles Formation Aquifer (Chapter 5); Confidential data from 7 wells and data from 1 non-confidential well were used to create an annual groundwater elevation map for the Alluvial Aquifer (Chapter 5).	Some data used to prepare groundwater elevation maps in the GSP are confidential; in the future, only publicly available data will be used to develop contour maps. Additional wells are needed to develop representative contour maps.
Groundwater levels will be collected during the middle of October and March for comparative reporting purposes, although more frequent monitoring may be required (Frequency).	The 22 wells in the existing monitoring network that are screened in the Paso Robles Formation have been monitored twice a year, in spring (April) and fall (October), since at least 2012.	Seasonal monitoring is the protocol for SLOFCWCD (Appendix F); more frequent monitoring may be needed to identify actual seasonal high and low groundwater elevations and further characterize groundwater level fluctuations; instrumentation like transducers or other technology may be used in future to monitor groundwater elevations.
Data must be sufficient for mapping groundwater depressions, recharge areas, and along margins of basins where groundwater flow is known to enter or leave a basin.	Current network of 23 wells is insufficient for mapping all of these areas.	Additional monitoring wells are required in groundwater depressions, near recharge features such as rivers and streams, and along Subbasin margins; possibly install instrumentation like transducers or other technology in future monitoring wells.
Well density must be adequate to determine changes in storage.	Current network of 23 wells is insufficient for determining changes in groundwater storage.	Additional monitoring wells are required to adequately cover the Subbasin and determine changes in groundwater storage.
Data must be able to demonstrate the interconnectivity between shallow groundwater and surface water bodies, where appropriate.	One well in the existing monitoring network is confirmed to be completed in the Alluvial Aquifer. There is at least one additional well that may be completed in the Alluvial Aquifer if construction data were known.	Additional wells will be needed in the Alluvial Aquifer near reaches of interconnected surface water to characterize interconnectivity.
Data must be able to map the effects of management actions, i.e., managed aquifer recharge.	Current network of 23 wells is inadequate for mapping the effects of management actions.	Additional monitoring wells are required to map the effectiveness of management actions. This monitoring will be addressed as projects are implemented
Data must be able to demonstrate conditions near basin boundaries; agencies may consider coordinating monitoring efforts with adjacent basins to provide consistent data across basin boundaries. Agencies may consider characterization and continued impacts of internal hydraulic boundary conditions, such as faults, disconformities, or other internal boundary types.	Several wells in the existing monitoring network are used to monitor conditions on the southwestern boundary of the Subbasin.	Additional wells are likely necessary along the northern boundary with the Upper Valley Subbasin of the Salinas Valley. Additional wells may be necessary to map the structure and effect of internal faults.
Data must be able to characterize conditions and monitor adverse impacts to beneficial uses and users identified within the basin.	The current monitoring network characterizes only a portion of the Subbasin and the potential impacts.	Network will be expanded in accordance with the data gaps identified above.

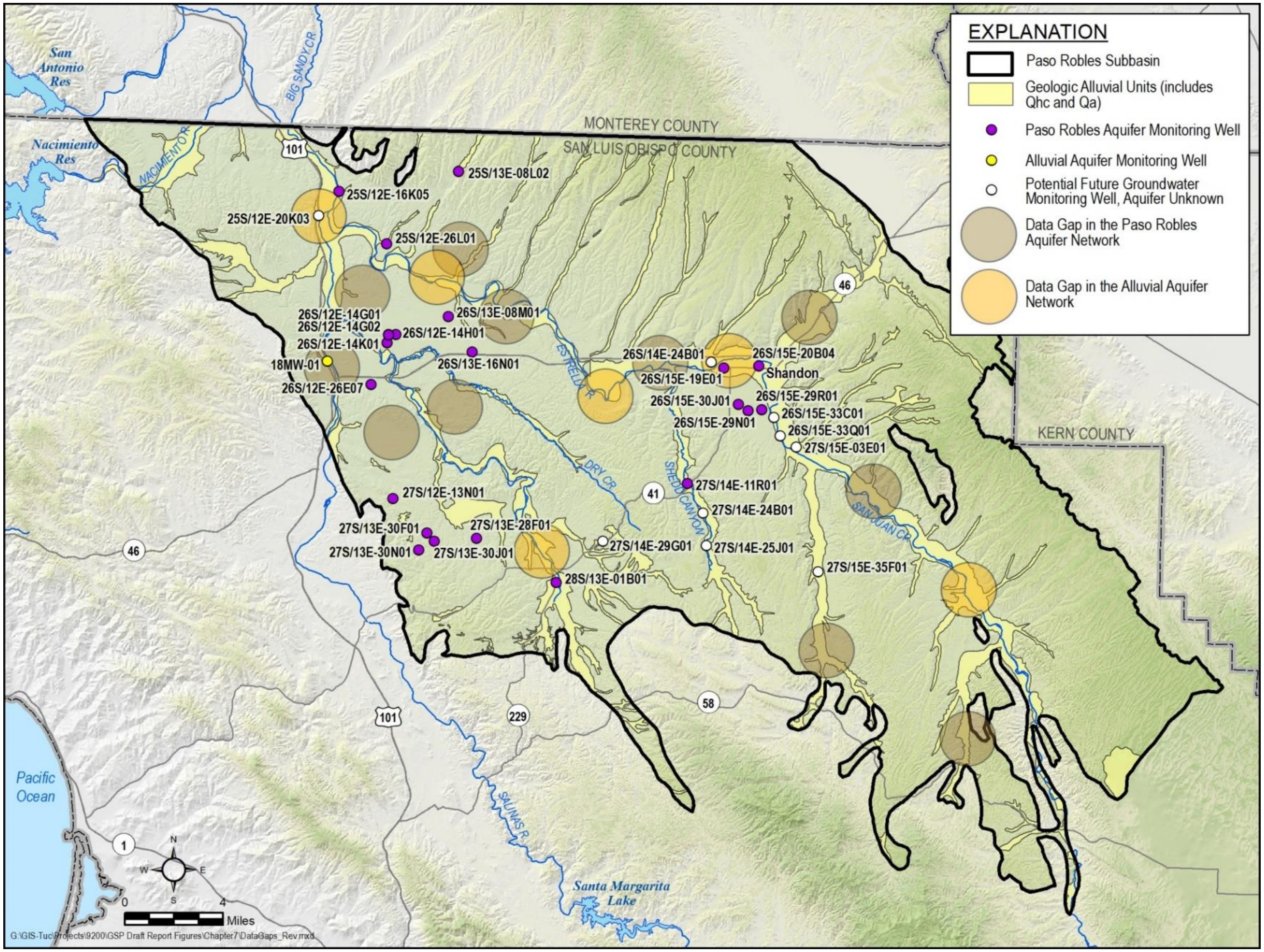


Figure 7-3. Data Gaps in the Groundwater Level Monitoring Well Network

~~7.2.2~~7.6.3 Groundwater Level Monitoring Protocols

The groundwater level monitoring protocols established by SLOFCWCD are adopted by this GSP for manual groundwater level monitoring. The monitoring protocols are included in Appendix F.

There are various automated groundwater level monitoring devices in operation across the Subbasin and the GSP implementation phase will incorporate automated logging of groundwater elevations. Automated water level monitoring is already used in a number of private wells in the basin; these data may be used to supplement the current water level monitoring network in the future. As automated groundwater level monitoring systems are added to the monitoring network, appropriate protocols for each automated system will be incorporated into this GSP.

Automated groundwater level monitoring systems have the advantage of supplying more frequent groundwater levels with no increase in monitoring costs. The groundwater level monitoring BMP recommends more frequent monitoring in certain areas, including shallow, unconfined aquifers, in areas of rapid recharge, in areas of greater withdrawal rates, and in areas of more variable climatic conditions. More frequent monitoring may also be required in specific places where sustainability indicators are a concern or to track impacts of specific management actions and projects. The need for more frequent monitoring will be evaluated, and a program to increase monitoring frequency will be developed during the GSP implementation phase.

~~7.3~~7.7 Groundwater Storage Monitoring Network

This GSP adopts groundwater levels as a proxy for assessing change in groundwater storage, as described in Chapter 8, Sustainable Management Criteria. To support the proxy, the relationship between change in groundwater levels and the change in the amount of groundwater in storage will be developed after GSP adoption and when additional data are available to develop the relationship. Groundwater level monitoring locations that are adequate for collecting the groundwater level data are identified in Section 7.2. Therefore, the network of wells providing groundwater level data for the reduction in groundwater storage sustainability indicator is the same wells shown on Table 7-1~~Table 7-1~~.

~~7.3.1~~7.7.1 Groundwater Storage Monitoring Data Gaps

Data gaps in the groundwater storage monitoring network are similar to the data gaps identified for the groundwater level monitoring network discussed in Section 7.2.1. Because change in groundwater storage is predominantly influenced by changes in shallow water table elevations, more shallow wells than those discussed in Section 7.2.1 may be necessary. Additional water table wells may be needed throughout the Paso Robles Formation Aquifer.

The number of additional water table wells will not be known until there is an assessment of how many existing wells are screened at or near the existing water table in the Paso Robles Formation Aquifer. This is a data gap that will be addressed during GSP implementation.

7.3.27.7.2 Groundwater Storage Monitoring Protocols

The groundwater storage monitoring network is identical to the groundwater level monitoring network. Therefore, the protocols used for gathering water level data to assess changes in groundwater storage are identical to the protocols used for the chronic lowering of groundwater levels sustainability indicator. Protocols for the manual collection of groundwater levels are included in Appendix F. As automated groundwater level collection devices are added to the monitoring network, protocols will be developed for each of these automated systems and incorporated into the GSP.

7.47.8 Water Quality Monitoring Network

The sustainability indicator for degraded water quality is evaluated by monitoring groundwater quality at a network of existing supply wells. The SGMA regulations require sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators to address known water quality issues.

As described in Chapter 5, there are no known contaminant plumes in the Subbasin, therefore the monitoring network is monitoring only non-point source constituents of concern and naturally occurring water quality impacts.

Existing groundwater quality monitoring programs in the Subbasin are described in Chapter 3 and groundwater quality distribution and trends are described in Chapter 5. Constituents of concern were identified in Chapter 5 based on comparison to drinking water standards and levels that could impact crop production. As described in Chapter 8, separate minimum thresholds are set for agricultural constituents of concern and public supply well constituents of concern. Therefore, although there is a single groundwater quality monitoring network, different wells in the network will be assessed for different constituents. Constituents of concern for drinking water will be assessed at public water supply wells. Constituents of concern for crop health will be assessed at agricultural supply wells.

The public water supply wells included in the monitoring network were identified by reviewing data from the State Water Resources Control Board (SWRCB) Division of Drinking Water. Wells were selected that were sampled for at least one of the constituents of concern during 2015 or more recently. These wells are listed in Table 7-4Table 7-4 and shown on Figure 7-4Figure 7-4. For the 41 public supply wells in the groundwater quality monitoring network, an assumed aquifer designation was assigned based on surficial geologic maps (Figure 4-4) and well depths when available. There are 31 wells that are in the Paso

Robles Formation Aquifer, seven wells in the Alluvial Aquifer, and three wells where the aquifer could not be estimated. Verifying the aquifer for these three wells is a data gap that will be addressed during plan implementation.

The agricultural supply wells included in the monitoring network were identified by reviewing data from the Irrigated Lands Regulatory Program (ILRP) that are stored in the SWRCB's Geotracker/GAMA database. Wells were selected that had detections of at least one of the agricultural constituents of concern reported from 2015 or more recently (GAMA, 2015). There are 28 ILRP properties with agricultural supply wells in the groundwater quality monitoring network. Since multiple wells of unknown depth are associated with a given IRLP ID, the aquifer monitored by these wells is unknown. These wells are listed in Table 7-4Table 7-4 and shown on Figure 7-4Figure 7-4. If an IRLP property has multiple wells, the location of the well is shown at the average of these coordinates.

Table 7-4. Groundwater Quality Monitoring Well Network

Well ID	Type of Well	Well Depth[1] (feet)	Screen Interval (feet bls)	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count	Assumed Aquifer
W0604000207-001	PWS	440	340-440	2002	2018	16	63	PR
W0604000210-001	PWS	117	87-117	2002	2015	13	9	---
W0604000512-001	PWS	60	30-60	2002	2015	13	13	AA
W0604000554-001	PWS	355	155-355	2002	2016	14	16	PR
W0604000554-003	PWS	237	174-237	2002	2016	14	16	PR
W0604000620-001	PWS	354	120-354	2001	2018	17	36	PR
W0604000620-002	PWS	510	310-510	2002	2018	16	41	PR
W0604000693-002	PWS	40	---	2005	2017	12	9	AA
W0604000708-001	PWS	80	80-80	2002	2018	16	10	AA
W0604000781-001	PWS	792	412-792	2002	2018	16	21	PR
W0604000781-011	PWS	670	380-670	2002	2018	16	21	PR
W0604000788-001	PWS	450	235-450	2002	2018	16	15	PR
W0604000788-005	PWS	920	400-920	2003	2018	15	14	PR
W0604000789-001	PWS	245	125-245	2002	2018	16	17	PR
W0604000790-001	PWS	175	126-175	2002	2018	16	62	---
W0604000803-001	PWS	420	100-420	2004	2018	14	10	PR
W0604000803-002	PWS	420	200-420	2004	2018	14	10	PR
W0604010007-003	PWS	400	200-400	1984	2016	32	36	PR
W0604010007-004	PWS	500	---	1984	2018	34	82	PR
W0604010007-006	PWS	344	---	1987	2018	31	34	PR
W0604010007-007	PWS	80	20-80	1984	2017	33	23	AA
W0604010007-008	PWS	80	20-80	1984	2018	34	24	AA

Well ID	Type of Well	Well Depth[1] (feet)	Screen Interval (feet bls)	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count	Assumed Aquifer
W0604010007-009	PWS	---	---	1990	2018	28	8	---
W0604010007-010	PWS	600	260-600	1990	2017	27	17	PR
W0604010007-012	PWS	425	---	1984	2018	34	35	PR
W0604010007-013	PWS	317	---	1984	2018	34	34	PR
W0604010007-017	PWS	675	---	1993	2018	25	26	PR
W0604010007-018	PWS	535	---	1993	2016	23	23	PR
W0604010007-019	PWS	220	---	1995	2017	22	25	PR
W0604010007-020	PWS	610	---	1996	2017	21	22	PR
W0604010007-021	PWS	100	---	1998	2018	20	22	AA
W0604010007-038	PWS	1060	300-1060	2003	2018	15	18	PR
W0604010010-004	PWS	300	85-300	1984	2018	34	118	PR
W0604010010-005	PWS	360	162-360	1991	2018	27	105	PR
W0604010010-009	PWS	380	350-380	2007	2018	11	250	PR
W0604010028-002	PWS	342	297-342	1991	2018	27	46	PR
W0604010028-004	PWS	400	300-400	2002	2018	16	31	PR
W0604010831-001	PWS	840	640-840	1989	2016	27	24	PR
W0604010831-002	PWS	446	401-446	1989	2016	27	23	PR
W0604010831-003	PWS	475	410-475	1989	2016	27	24	PR
W0604010900-002	PWS	50	---	1999	2018	19	18	AA
AGL020000646	ILRP	660	---	2012	2017	5	---	---
AGL020000801	ILRP	---	---	2013	2017	4	---	---
AGL020001525	ILRP	---	---	2014	2017	3	---	---
AGL020001534	ILRP	---	---	2013	2017	4	---	---

Well ID	Type of Well	Well Depth[1] (feet)	Screen Interval (feet bls)	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count	Assumed Aquifer
AGL020001605	ILRP	---	---	2015	2017	2	---	---
AGL020001689	ILRP	---	---	2014	2017	3	---	---
AGL020001800	ILRP	---	---	2015	2015	<1	---	---
AGL020003900	ILRP	---	---	2015	2015	<1	---	---
AGL020004014	ILRP	---	---	2014	2017	3	---	---
AGL020005173	ILRP	---	---	2015	2017	2	---	---
AGL020005268	ILRP	---	---	2015	2015	<1	---	---
AGL020007128	ILRP	---	---	2014	2017	3	---	---
AGL020007471	ILRP	---	---	2015	2015	<1	---	---
AGL020007593	ILRP	---	---	2015	2018	3	---	---
AGL020007721	ILRP	---	---	2017	2017	<1	---	---
AGL020007807	ILRP	---	---	2012	2017	5	---	---
AGL020007815	ILRP	---	---	2012	2017	5	---	---
AGL020007848	ILRP	---	---	2015	2015	<1	---	---
AGL020007872	ILRP	---	---	2015	2018	3	---	---
AGL020009803	ILRP	---	---	2014	2018	4	---	---
AGL020010282	ILRP	---	---	2012	2015	3	---	---
AGL020013814	ILRP	---	---	2015	2018	3	---	---
AGL020015242	ILRP	---	---	2015	2018	3	---	---
AGL020015302	ILRP	---	---	2013	2017	4	---	---
AGL020016382	ILRP	---	---	2015	2018	3	---	---
AGL020024742	ILRP	---	---	2016	2017	1	---	---
AGL020025402	ILRP	---	---	2015	2017	2	---	---

Well ID	Type of Well	Well Depth[1] (feet)	Screen Interval (feet bls)	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count	Assumed Aquifer
AGL020028348	ILRP	---	---	2017	2017	<1	---	---

Notes

--- = Unknown

(1) = total well depth is assumed to be equivalent to bottom of perforated interval

AA = Alluvial Aquifer; PR = Paso Robles Formation Aquifer

PWS = Public water supply

ILRP = Irrigated Lands Regulatory Program

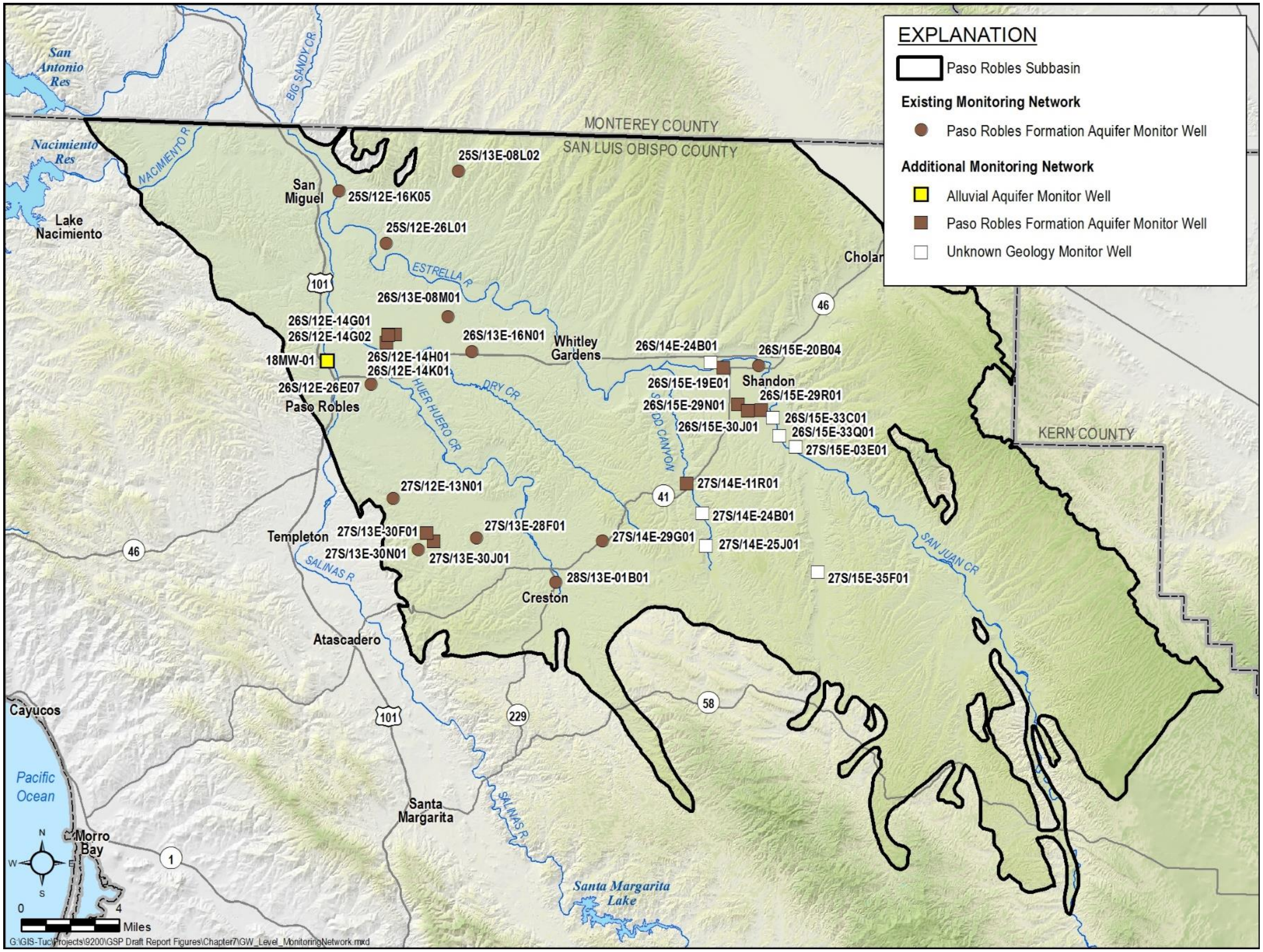


Figure 7-4. Groundwater Quality Monitoring Well Network

~~7.4.1~~7.8.1 Groundwater Quality Monitoring Data Gaps

Because the groundwater quality monitoring network is based on existing supply wells, there are no spatial data gaps in the network.

Table 7-5Table 7-5Table 7-5 summarizes the recommendations for groundwater quality monitoring from the BMPs, the current network, and data gaps. There is adequate spatial coverage in the network to assess impacts to beneficial uses and users. The primary data gap is that well construction info for many wells in the monitoring network is unknown. This is a data gap that will be addressed during GSP implementation.

7.4.27.8.2 Groundwater Quality Monitoring Protocols

Water quality samples are currently being collected according to SWRCB and ILRP requirements. ILRP data are currently collected under Central Coast RWQCB Ag Order 3.0. ILRP samples are collected under the Tier 1, Tier 2, or Tier 3 monitoring and reporting programs. Copies of these monitoring and reporting programs are included in Appendix F, and incorporated herein as monitoring protocols. These protocols will continue to be followed during GSP implementation for the groundwater quality monitoring.

Table 7-5. Summary of Groundwater Quality Monitoring, Best Management Practices, and Data Gaps

Best Management Practice (DWR, 2016b)	Current Network	Data Gap
Monitor groundwater quality data from each principal aquifer in the basin that is currently, or may be in the future, impacted by degraded water quality. • The spatial distribution must be adequate to map or supplement mapping of known contaminants. • Monitoring should occur based upon professional opinion, but generally correlate to the seasonal high and low groundwater level, or more frequent as appropriate.	There are 41 municipal wells and 28 IRLP wells within the plan area that have been regularly sampled since at least 2015 for groundwater quality.	None; the current monitoring network contains adequate spatial distribution to map water quality in the basin.
Collect groundwater quality data from each principal aquifer in the basin that is currently, or may be in the future, impacted by degraded water quality. • Agencies should use existing water quality monitoring data to the greatest degree possible. For example, these could include ILRP, GAMA, existing RWQCB monitoring and remediation programs, and drinking water source assessment programs.	Public databases provide adequate water quality information for degraded water quality.	Well depth and construction info for some wells in the monitoring network is unknown; however, there seems to be adequate coverage in both principal aquifers
Define the three-dimensional extent of any existing degraded water quality impact.	There are a large number of wells that are actively sampled.	Depth or construction information will need to be obtained to determine the vertical extent of contaminants
Data should be sufficient for mapping movement of degraded water quality.	There are a large number of wells that are actively sampled.	None
Data should be sufficient to assess groundwater quality impacts to beneficial uses and users.	Water quality monitoring program assesses impacts to both agricultural and municipal users.	None
Data should be adequate to evaluate whether management activities are contributing to water quality degradation.	There are a large number of wells that are actively sampled.	Projects and actions are being developed. Water quality network will be evaluated and augmented if necessary.

~~7.5~~7.9 Land Subsidence Monitoring Network

The sustainability indicator for land subsidence is evaluated by monitoring land subsidence using InSAR data. As described in Chapter 5, land subsidence is monitored in the Subbasin by measuring ground elevation using microwave satellite imagery. This data is currently provided by DWR, covers the most recent three years of subsidence data (2015 - 2018), and is adequate to identify areas of recent subsidence. One or more GSA may opt to contract with USGS or others with expertise in subsidence to gather any additional datasets and evaluate the cause(s) of any identified subsidence. The GSAs will continue to annually assess subsidence using the DWR provided InSAR data.

~~7.5.1~~7.9.1 Land Subsidence Monitoring Data Gaps

Available data indicate that there is currently no long-term subsidence occurring in the Subbasin that affects infrastructure. There are no data gaps identified with the subsidence network at this time.

~~7.5.2~~7.9.2 Land Subsidence Monitoring Protocols

The BMP notes that no standard procedures exist for collecting subsidence data. The GSAs will continue to monitor data annually as part of GSP implementation. If additional relevant datasets become available, they will be evaluated and incorporated into the monitoring program. If the annual monitoring indicates subsidence is occurring at a rate greater than the minimum thresholds, then additional investigation and monitoring may be warranted. In particular, the GSAs will implement a study to assess if the observed subsidence can be correlated to groundwater elevations, and whether a reasonable causality can be established. The GSAs will also consider subsidence surveys published by the USGS in assessing land subsidence across the Subbasin if they become available.

~~7.6~~7.10 Interconnected Surface Water Monitoring Network

~~As discussed in Chapter 5, there are no available data to establish that groundwater and surface water are connected through a continuous saturated zone in any aquifer in the Subbasin. Therefore, a monitoring network that quantifies surface water depletion from interconnected surface waters cannot be developed at this time. However, studies will be conducted after GSP adoption to verify whether or not there are interconnected surface waters in the Subbasin. The assessment of whether or not there are interconnected surface waters will be evaluated by monitoring surface water and groundwater in areas where interconnected surface water conditions may exist. Shallow monitoring well data will be collected and compared to the surveyed streambed of adjacent streams, rivers, or wetlands. In accordance with the assessment of wells discussed in Section 7.2, only one Alluvial Aquifer well was~~

identified that meets the criteria for inclusion in the monitoring network for monitoring shallow groundwater levels adjacent to streams, rivers, or wetlands.

Data presented in Section 5.5 indicate potential groundwater connection to surface water or to the riparian vegetation root zone at least some of the time along certain sections of the Salinas River, along the middle reach of the Estrella River (from Shedd Canyon to Martingale Circle) and along San Juan Creek upstream of Spring Creek. The potential connection along the Salinas River is between the surface water system and the adjacent Alluvial Aquifer. There is no evidence that the Salinas River surface water flows are connected to the underlying Paso Robles Formation Aquifer. The potential connection between the surface water system along the middle reach of the Estrella River (from Shedd Canyon to Martingale Circle) and along San Juan Creek upstream of Spring Creek, and the underlying Paso Robles Formation Aquifer is unknown but sufficient evidence exists that there could potentially be a connection, and therefore further investigation in these areas is recommended.

Seven existing wells already are monitored for water levels within 2,000 feet of those stream reaches and these have water-level patterns consistent with expected shallow water table conditions. Two of these are shown as blue squares in Figure 7-5Figure 7-5. The locations of the others are not shown due to confidentiality restrictions, but they include three wells along the Salinas River between Wellsona and the Estrella River, one well next to the Estrella River near Jardine Road and one well next to San Juan Creek about 7 miles above Shandon. The City of Paso Robles' Supplemental Environmental Project (SEP) identified ten sites where multi-depth monitoring wells and stream gages would be useful for better characterizing interconnection of surface water and groundwater (Cleath-Harris Geologists, 2021). Those sites are shown as orange circles numbered 1 through 10 on the figure. Sites 1 and 9 have existing stream gages, and shallow and intermediate depth monitoring wells were installed nearby in spring 2021.

7.6.17.10.1 Interconnected Surface Water Monitoring Data Gaps

There are data gaps in assessing the existence of interconnected surface water bodies in the Subbasin. The initial data gap is the lack of wells that monitor the shallow groundwater table adjacent to streams and rivers. Areas of potential shallow groundwater in the Alluvial Aquifer will be targeted as areas where shallow groundwater wells are needed. In these areas of potential shallow groundwater, either existing shallow monitoring wells must be identified, or new monitoring wells must be installed.

If the shallow monitoring wells indicate interconnected surface water bodies in the Subbasin, additional analysis will be undertaken to quantify the surface water depletion and potentially relate the quantified surface water depletion rates to shallow groundwater elevations. The surface water depletion rates will be quantified with the GSP model or other appropriate means, including incorporating the existing stream gauging programs described in Chapter 3.

~~If the shallow monitoring wells indicate interconnected surface water bodies in the Subbasin, additional data gaps may be identified to address all of the SGMA regulations including the following:~~

- ~~Establishing flow conditions including surface water discharge, surface water head, and baseflow contribution.~~
- ~~Establishing the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.~~

~~Establishing temporal change in conditions due to variations in stream discharge and regional groundwater extraction.~~ The existing shallow monitoring wells do not adequately cover the three stream reaches where interconnection of groundwater with surface water and/or the riparian vegetation root zone appears to occur some or most of the time. The presence of shallow clay layers and degree of separation between Alluvial Aquifer groundwater levels and Paso Robles Formation Aquifer pumping and water levels is poorly known in the eastern part of the Subbasin. Recommended locations for additional wells to verify and monitor interconnection are listed in Table 7-6~~Table 7-6~~ and shown in Figure 7-5~~Figure 7-5~~ as green squares labeled A through H. Shallow and deep monitoring wells are needed at some of the locations to confirm any differences between Alluvial Aquifer and Paso Robles Formation Aquifer water levels. These locations are suggestions that would need to be refined based on practical considerations such as land ownership and adequate road access.

New stream gages have already been installed since the beginning of the GSP development process. This includes SEP sites 2, 4 and 10 on the Salinas River, Huer Huero Creek and Estrella River (see Figure 7-5~~Figure 7-5~~) and a new gage installed by DWR on Cholame Creek at SEP site 8. Of the remaining SEP sites, a gage at site 7 would be the most useful.

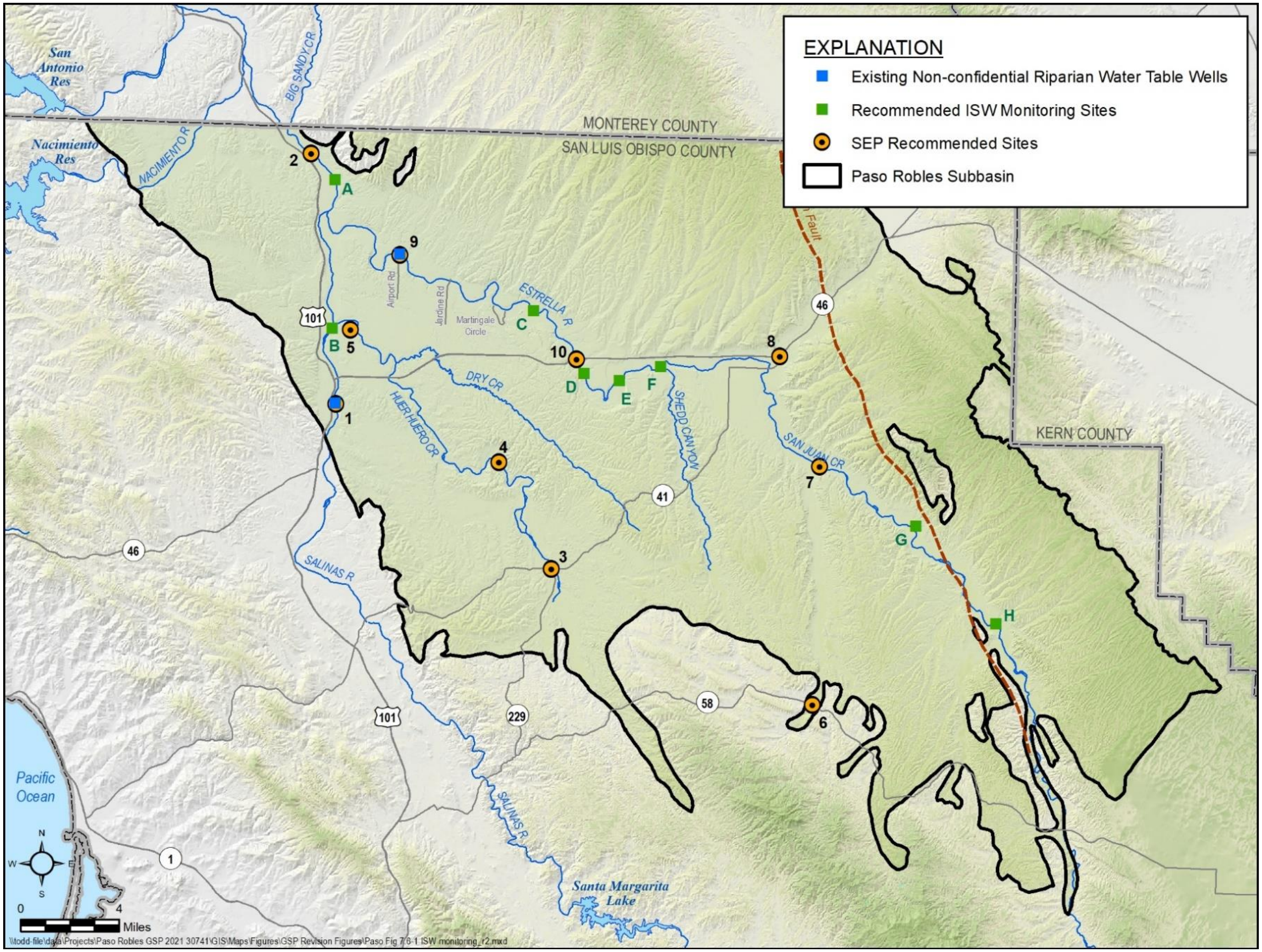


Figure 7-5. Interconnected Surface Water Monitoring Well Network

Table 7-6. Recommended Well Locations for Monitoring Interconnected Surface Water and GDEs

Map Label	Description
A	Salinas River in San Miguel, near existing Paso Robles Formation Aquifer monitoring well clusters. This site could replace or be shifted to SEP site 2. Only a shallow well is needed.
B	Salinas River near Wellsona. This fills a long reach with no data and is a location where surface flow is likely to become discontinuous before other reaches. Only a shallow well is needed.
C	Estrella River above Martingale Circle. This site is near an existing monitoring well near the river that shows a Paso Robles Formation Aquifer water-level pattern. Only a shallow well is needed.
D	Estrella River at Whitley Gardens. The suggested site is at the River Grove Drive bridge at the upstream edge of town. This site could replace or be shifted to SEP site 10. This site needs shallow and deep wells to confirm whether the alluvial water table is somewhat independent of underlying Paso Robles Formation Aquifer water levels.
E	Estrella River 3.3 channel miles upstream of Highway 46 (Whitley Gardens). There are no nearby existing wells to confirm the apparent presence of shallow water table conditions. This site needs shallow and deep wells to confirm whether the alluvial water table is somewhat independent of underlying Paso Robles Formation Aquifer water levels.
F	Estrella River near Shedd Canyon confluence. There are no nearby existing wells to confirm the apparent presence of shallow water table conditions. This site needs shallow and deep wells to confirm whether the alluvial water table is somewhat independent of underlying Paso Robles Formation Aquifer water levels.
G	San Juan Creek between existing monitoring well and San Juan Fault preferably near riparian vegetation. A shallow well is needed at this location to supplement the single existing well along this reach of San Juan Creek, which is reportedly 225 feet deep but has relatively stable water levels close to the creek bed elevation, like an Alluvial Aquifer well.
H	At this location, the San Juan Fault forces groundwater into the channel of San Juan Creek, creating a spring and a short reach of flowing water bordered by wetland vegetation. In lieu of a well, the length of the flowing reach and wetland area could be monitored to detect decreases in the flow of groundwater across the fault.

~~7.6.2~~7.10.2 Interconnected Surface Water Monitoring Protocols

Stream gauging is currently being conducted by the USGS according to the protocol outlined in the BMP. Water level monitoring will be conducted in accordance the protocols described in the water level monitoring network section of this chapter.

~~7.7~~7.11 Representative Monitoring Sites

Representative monitoring sites (RMS) are defined in the SGMA regulations as a subset of monitoring sites that are representative of conditions in the Subbasin. All of the monitoring sites in this chapter are considered RMS.

~~7.8~~7.12 Data Management System and Data Reporting

The SGMA regulations provide broad requirements on data management, stating that a GSP must adhere to the following guidelines for a DMS:

- Article 3, Section 352.6: Each Agency shall develop and maintain a data management system that is capable of storing and reporting information relevant to the development or implementation of the GSP and monitoring of the Subbasin.
- Article 5, Section 354.40: Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department.

The Paso Robles Subbasin Data Management System (DMS) will be used for the organization, review, and uploading of data to implement the GSP. All data stored in the DMS have a unique identifier and a quality control check was performed on the data.

The Paso Robles Subbasin DMS was developed in Microsoft Access and contains the following main tables:

- **Well_Info** - General information about a well, including identifiers used by various agencies.
- **Site_Info** - Site information about a well, recharge site, or diversion; including location, elevation, and address information
- **Well_Constr** - Well construction information including depth, diameter, etc.
- **Well_Constr_Screen**- Supplements **Well_Constr** with well screen information. One well can have multiple screens.

- **Well_Geologic_Aquifer** - Information about the aquifer parameters of the well such as pumping test information, confinement, and transmissivity.
- **Well_Geologic_Lithology** - Lithologic information at a well site. Each well may have multiple lithologies at different depths.
- **Water_Level** - Water level measurements for wells
- **Well_Pumping** - Pumping measurements for wells, annual or monthly
- **SW_Recharge** - Recharge measurements for a recharge site, annual or monthly
- **SW_Diversion** - Diversion volume measurements for a diversion site, annual or monthly
- **Water_Quality** - Water quality data for wells or other type of site

Data sources used to populate the Paso Robles DMS are listed on Table 7-7~~Table 7-7~~. Categories marked with an X indicate datasets that are publicly accessible.

Table 7-7. Data Sources Used to Populate DMS

Data Sets	Data Category							
	Well and site info	Well construction	Aquifer properties and lithology (data to be added)	Water level	Pumping (data to be added)	Recharge (data to be added)	Diversion (data to be added)	Water quality
DWR (CASGEM)	X	X		X				
San Luis Obispo County	X	X		X				
Geotracker GAMA	X							X

Data were compiled and reviewed to comply with data quality objectives. The review included the following checks:

- Identifying outliers that may have been introduced during the original data entry process by others.
- Removing or flagging questionable data being uploaded in the DMS. This applies to historic water level data, water quality data, and water level over time.

The data were loaded into the database and checked for errors and missing data. Error tables were developed to identify water level and/or well construction data that were missing. For water level data, another data quality check was completed by plotting well hydrographs to identify and remove anomalous data points.

In the future, well log information will be entered for selected wells and other information will be added as needed to satisfy the requirements of the SGMA regulations. It is anticipated that the DMS will be migrated to a web-based DMS currently being planned and developed by the County of San Luis Obispo.

8 SUSTAINABLE MANAGEMENT CRITERIA

This chapter defines the conditions that constitute sustainable groundwater management, discusses the process by which the four GSAs in the Subbasin will characterize undesirable results, and establishes minimum thresholds and measurable objectives for each sustainability indicator.

This is the fundamental chapter that defines sustainability in the Subbasin, and it addresses significant regulatory requirements. The measurable objectives, minimum thresholds, and undesirable results presented in this chapter define the future sustainable conditions in the Subbasin and commit the GSAs to actions that will achieve these future conditions.

Defining Sustainable Management Criteria requires significant analysis and scrutiny. This chapter presents the data and methods used to develop Sustainable Management Criteria and demonstrate how they influence beneficial uses and users. The Sustainable Management Criteria presented in this chapter are based on currently available data and application of the best available science. As noted in this GSP, data gaps exist in the hydrogeologic conceptual model. Uncertainty caused by these data gaps was considered when developing the Sustainability Management Criteria. Due to uncertainty in the hydrogeologic conceptual model, these Sustainable Management Criteria are considered initial criteria and will be reevaluated and potentially modified in the future as new data become available.

The Sustainable Management Criteria are grouped by sustainability indicator. The following sustainability indicators are applicable in the Subbasin:

- Chronic lowering of groundwater elevations levels
- Reduction in groundwater storage
- Degraded water quality
- Land subsidence
- Depletion of interconnected surface water

The sixth Sustainable Management Criteria, sea water intrusion, is not applicable in the Subbasin.

To retain an organized approach, this chapter follows the same structure for each sustainability indicator. The description of each Sustainable Management Criterion contains all the information required by Section 354.22 *et. seq* of the SGMA regulations and outlined in the Sustainable Management Criteria BMP (DWR, 2017), including:

- How locally defined significant and unreasonable conditions were developed

- How minimum thresholds were developed, including:
  - The information and methodology used to develop minimum thresholds (§354.28 (b)(1))
  - The relationship between minimum thresholds and the relationship of these minimum thresholds to other sustainability indicators (§354.28 (b)(2))
  - The effect of minimum thresholds on neighboring basins (§354.28 (b)(3))
  - The effect of minimum thresholds on beneficial uses and users (§354.28 (b)(4))
  - How minimum thresholds relate to relevant Federal, State, or local standards (§354.28 (b)(5))
  - The method for quantitatively measuring minimum thresholds (§354.28 (b)(6))
- How measurable objectives were developed, including:
  - The methodology for setting measurable objectives (§354.30)
  - Interim milestones (§354.30 (a), §354.30 (e), §354.34 (g)(3))
- How undesirable results were developed, including:
  - The criteria defining when and where the effects of the groundwater conditions cause undesirable results based on a quantitative description of the combination of minimum threshold exceedances (§354.26 (b)(2))
  - The potential causes of undesirable results (§354.26 (b)(1))
  - The effects of these undesirable results on the beneficial users and uses (§354.26 (b)(3))
- As noted above, the SGMA regulations address minimum thresholds before measurable objectives. This order was used for all applicable sustainability indicators except Chronic Lowering of Groundwater Levels. For this sustainability indicator, measurable objectives are presented first, followed by the minimum thresholds – the order in which they were developed.

8.1 Definitions

The SGMA legislation and SGMA regulations contain a number of new terms relevant to the Sustainable Management Criteria. These terms are defined below using the definitions included in the SGMA regulations (§ 351, Article 2). Where appropriate additional explanatory text is added in italics. This explanatory text is not part of the official definitions of these terms. To the extent possible, plain language, including limited use of overly technical terms and acronyms, was used so that a broad audience will understand the development process and implications of the Sustainable Management Criteria.

- **Interconnected surface water** refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water.
- Interconnected surface waters are parts of streams, lakes, or wetlands where the groundwater table is at or near the ground surface and there is water in the lakes, streams, or wetlands.
- **Interim milestone** refers to a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan.
- Interim milestones are targets such as groundwater elevations that will be achieved every five years to demonstrate progress towards sustainability.
- **Management area** refers to an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors.
- **Measurable objectives** refer to specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin.
- Measurable objectives are goals that the GSP is designed to achieve.
- **Minimum thresholds** refer to numeric values for each sustainability indicator used to define undesirable results.
- Minimum thresholds are established at representative monitoring sites. Minimum thresholds are indicators of where an unreasonable condition might occur. For example, a particular groundwater elevation might be a minimum threshold if lower groundwater elevations would result in a significant and unreasonable reduction in groundwater storage.
- **Representative monitoring** refers to a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin.
- **Sustainability indicator** refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results, as described in Water Code Section 10721(x).
- The five sustainability indicators relevant to the Subbasin are listed in the introductory section of Chapter 8.

- **Uncertainty** refers to a lack of understanding of the basin setting that significantly affects an Agency's ability to develop sustainable management criteria and appropriate projects and management actions in a Plan, or to evaluate the efficacy of Plan implementation, and therefore may limit the ability to assess whether a basin is being sustainably managed.
- **Undesirable Result** Section 10721 of the Sustainable Groundwater Management Act states that
- Undesirable result means one or more of the following effects caused by groundwater conditions occurring throughout the basin:

    (1) *Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.*

    (2) *Significant and unreasonable reduction of groundwater storage.*

    (3) *Significant and unreasonable seawater intrusion.*

    (4) *Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.*

    (5) *Significant and unreasonable land subsidence that substantially interferes with surface land uses.*

    (6) *Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.*

- Section § 354.26 of the SGMA regulations states that "The criteria used to define when and where the effects of the groundwater conditions cause undesirable results …shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin."

8.2 Sustainability Goal

Per Section §354.24 of the SGMA regulations, the sustainability goal for the Subbasin has three parts:

- A description of the sustainability goal;

- A discussion of the measures that will be implemented to ensure the Subbasin will be operated within sustainable yield, and;
- An explanation of how the sustainability goal is likely to be achieved.

The goal of this GSP is to sustainably manage the groundwater resources of the Paso Robles Subbasin for long-term community, financial, and environmental benefit of Subbasin users. This GSP outlines the approach to achieve a sustainable groundwater resource free of undesirable results within 20 years, while maintaining the unique cultural, community, and business aspects of the Subbasin. In adopting this GSP, it is the express goal of the GSAs to balance the needs of all groundwater users in the Subbasin, within the sustainable limits of the Subbasin's resources.

A number of management actions and conceptual projects are included in this GSP. Some combination of these management actions and conceptual projects will be implemented to ensure the Subbasin is operated within its sustainable yield and achieves sustainability. These management actions and conceptual projects include:

Management Actions

- Monitoring, reporting and outreach
- Promoting Best Water Use Practices
- Promoting stormwater capture
- Promoting voluntary fallowing of agricultural land
- Mandatory pumping limitations in specific areas
- Conceptual Projects
- City Recycled Water Delivery
- San Miguel CSD Recycled Water Delivery
- Nacimiento Water Project (NWP) Delivery at Salinas and Estrella River Confluence
- NWP Delivery North of City of Paso Robles
- NWP Delivery East of City of Paso Robles
- Expansion of Salinas Dam

The management actions and conceptual projects are designed to achieve sustainability within 20 years by one or more of the following means:

- Educating stakeholders and prompting changes in behavior to improve chances of achieving sustainability.

- Increasing awareness of groundwater pumping impacts to promote voluntary reductions in groundwater use through improved water use practices or fallowing crop land.
- Increasing basin recharge by capturing excess stormwater under approved permits.
- Developing new renewable water supplies for use in the Subbasin to offset groundwater pumping

8.3 General Process for Establishing Sustainable Management Criteria

The Sustainable Management Criteria presented in this chapter were developed using information from public input, received in public surveys, public meetings, comment forms; hydrogeologic analysis; and meetings with GSA staff and Cooperative Committee members. The process built on the Paso Robles Basin's long history of interested parties - including rural residents, farmers, local cities, and the County - holding public meetings to work on protecting the groundwater resource.

The general process for establishing Sustainable Management Criteria included:

- Holding a series of public outreach meetings that outlined the GSP development process and introduced stakeholders to Sustainable Management Criteria.
- Surveying the public and gathering input on minimum thresholds and measurable objectives. The survey questions were designed to get public input on all five sustainability indicators applicable to the Subbasin. A summary of the survey results is included in Appendix G.
- Analyzing survey results to assess preferences and trends relevant to Sustainable Management Criteria. Survey results and public comments from outreach meetings were analyzed to assess if different areas in the Subbasin had different preferences for minimum thresholds and measurable objectives.
- Combining survey results, outreach efforts, and hydrogeologic data to set initial conceptual minimum thresholds and measurable objectives.
- Conducting public meetings to present initial conceptual minimum thresholds and measurable objectives and receive additional public input. Three meetings on Sustainable Management Criteria were held in the Subbasin.
- Reviewing public input on preliminary Sustainable Management Criteria with GSAs.
- Addressing corrective actions provided by DWR with additional analyses relative to lowering of groundwater levels, identification of interconnected surface water, and establishment of sustainability criteria.

8.4 Chronic Lowering of Groundwater Levels Sustainable Management Criteria

This section is organized to first present the general concepts of the sustainable management criteria as developed in 2019. Responsive to the DWR Corrective Actions, this is supplemented by additional description of the undesirable results and additional explanation of the sustainability criteria with evaluation of the effects of the criteria on beneficial uses and users of groundwater.

8.4.1 Information and Methodology Used to Establish Measurable Objectives and Minimum Thresholds

The information used for establishing the chronic lowering of groundwater levels measurable objectives and minimum thresholds includes:

- Information about the public definition of significant and unreasonable conditions and preferred current and future groundwater elevations, gathered from the Sustainable Management Criteria survey and public outreach meetings.
- Historical groundwater elevation data from wells monitored by the County of San Luis Obispo
- Depths and locations ~~of~~from existing ~~wells~~well records
- Maps of current and historical groundwater elevation data
- Results of modeling of various scenarios of future groundwater level conditions

Information and methods used to initially establish sustainable management criteria were supplemented using:

- The identified deficiencies and Corrective Actions defined by DWR in its June 3, 2021 letter reviewing the Paso Robles Area Subbasin – 2020 Groundwater Sustainability Plan (DWR, June 2021) and the January 21, 2022 "Incomplete" Determination of the 2020 Paso Robles Area Subbasin Groundwater Sustainability Plan (DWR, January 2022)
- Evaluation of existing well records with information on construction and locations (as of 2021) relative to the Representative Monitoring Site (RMS) wells
- Evaluation of the effects of the sustainability criteria on beneficial uses and users of groundwater, especially existing domestic well records

8.4.2 Locally Defined Significant and Unreasonable Conditions

This section provides the descriptions, definitions, and evaluation that are the basis for establishing sustainability criteria in the next section.

- Description of significant and unreasonable conditions
- Potential causes of significant and unreasonable conditions
- Definition of significant and unreasonable conditions

8.4.2.1 Description of Significant and ~~unreasonable~~Unreasonable Conditions

As groundwater levels ~~in the~~ decline in a well, a sequence of increasingly severe conditions will occur. These include an increase in pumping costs and a decrease in pump output (in gallons per minute). With further declines, the pump may break suction, which means that the water level in the well has dropped to the level of the pump intake. This can be remedied by lowering the pump inside the well, which can cost thousands of dollars. Chronically declining water levels will eventually drop below the top of the well screen. This exposes the screen to air, which can produce two adverse effects. In the first, water entering the well at the top of the screen will cascade down the inside of the well, entraining air; this air entrainment can result in cavitation damage to pump. The other potential adverse effect is accelerated corrosion of the well screen. Corrosion can reduce the efficiency and capacity of a well and eventually creates a risk of well screen collapse, which would likely render the well unusable. If water level declines significantly reduce the length of saturated well screen, water might not be able to flow into the well at the desired rate regardless of the capacity or depth setting of the pump. This might occur more frequently where the thickness of basin fill materials is relatively thin. While describing a progression of potential adverse effects, at some point the well no longer fulfills its water supply purpose and is deemed to have "gone dry." For the purposes of this discussion, a well going dry means that the entire well (to the reported total depth of the well) is unsaturated.

For purposes of setting the Measurable Objective and Minimum Threshold, significant and unreasonable conditions are defined in terms of an increased percentage of wells going dry. The rationale is based on four general assumptions summarized below, with more explanation in the following sections:

1. Accurate information on the location, elevation, use, status, and construction of most local supply wells is not readily available for detailed evaluation of the range of adverse effects. Analysis was initiated with the simple concept of the entire well depth as "going dry" and then applied to the set of existing wells that have available information on location and construction.

2. Responsibility for wells in a SGMA managed groundwater basin is shared between GSAs that manage groundwater levels to protect against significant and unreasonable conditions and well owners who have responsibility for their respective wells.

3. During the recent drought, many wells within the Subbasin are were reported to have gone dry. The California Department of Water Resources (DWR) *Household Water Supply Shortage Reporting System* (DWR, April 2022) lists a total of 141 private household wells (i.e., domestic wells) that went dry as of the end of 2017, as shown on Figure 8-1Figure 8-1.

4. Wells that went dry prior to 2017 are assumed to have either been replaced by deeper wells or an alternative water supply source. 2017 is used as the end of this analysis period to be consistent with the water level measurable objectives defined below.

8.4.2.2 Potential Causes of Significant and Unreasonable Conditions

With respect to chronic groundwater level declines, the primary cause of significant and unreasonable conditions is a water budget imbalance with pumping in excess of recharge. At any given time and place, this could involve multiple factors including local hydrogeologic conditions, cumulative pumping, reduced natural recharge due to drought, or reduction of surface water supplies used in lieu of groundwater and associated reduction in groundwater recharge from return flows.

The groundwater level declines in turn cause adverse conditions (i.e., loss of yield) that not only vary across the Subbasin and through time, but also differ in magnitude from well to well depending on its location, construction, operation, and conditions. Accurate information on the location, elevation, status, and construction of most local supply wells is not readily available and therefore, detailed evaluation of the range of adverse effects is not possible.

Moreover, the significant and unreasonable conditions of a well losing yield, experiencing damage, or "going dry" represent a complex interplay of causes and shared responsibility. Some of the potential causes are within the responsibility of the GSAs. Most notably, a GSA is responsible for groundwater basin management without causing significant and unreasonable conditions such as chronic groundwater level declines. SGMA also requires that a GSA address significant and unreasonable effects caused by groundwater conditions *throughout the basin.* This indicates that a GSA is not solely responsible for local or well-specific problems and furthermore that responsibility is shared with a well owner. A reasonable expectation exists that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts, and with some anticipation that neighbors also might construct wells (consistent with land use and well permitting policies).

8.4.2.3 Definition of Significant and Unreasonable Conditions

As context, the Sustainability Goal for the Paso Robles Subbasin is to sustainably manage groundwater resources for the long-term community, financial, and environmental benefit of users while maintaining the unique cultural, community, and business aspects of the Subbasin. Significant and unreasonable groundwater levels were initially defined in 2019 as those that:

- Impact the ability of existing domestic wells of average depth to produce adequate water for domestic purposes.
- Cause significant financial burden to those who rely on the groundwater basin
- Interfere with other SGMA sustainability indicators.

These have been modified. First, the limitation of existing domestic wells to those of average depth has been modified to conceptually include all existing well records, with a focus on domestic well records. This focus recognizes the importance of domestic wells as a source of potable supply (often the sole source to one or more households) and assumes that these are more likely to be shallow and thus susceptible to undesirable results from groundwater level declines. Data limitations in identifying domestic wells and evaluating impacts are acknowledged throughout this section. Second, financial burdens are not evaluated as a groundwater sustainability issue but are more appropriately addressed as part of the analysis of projects and management actions and implementation plan. Third, the effects on other SGMA sustainability indicators are addressed in Section 8.4.5.5.

For purposes of this supplementary analysis in response to DWR Corrective Actions and to support the sustainability criteria in this GSP, significant and unreasonable groundwater levels are defined as follows.

1. A significant number of wells throughout the Subbasin going dry with the following considerations:
    - As noted above, “going dry” means that the entire well length (to the bottom of the well) is unsaturated.
    - It is acknowledged that groundwater level declines involve a continuum of potential impacts that are specific to a well.
    - These include effects not noticed by the well owner and those that are noticed and reasonably handled by the well owner.
    - This significance criteria relates to dry wells that did not already go dry prior to 2017.

- The GSAs define a significant number of wells throughout the Subbasin as ten percent of all wells, as represented by wells with known location and construction information.

2. Chronic groundwater level declines that interfere with other SGMA sustainability indicators.

In that light, the definition of significant and unreasonable conditions would be the chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply equivalent to more than ten percent of wells going dry. This is defined by groundwater conditions occurring throughout the Subbasin. Additional temporal and spatial components defining undesirable results are presented in Section 8.4.6.

8.4.3 Measurable Objectives

The measurable objectives for chronic lowering of groundwater levels represent target groundwater elevations that are established to achieve the sustainability goal by at least 2040. Measurable objectives are groundwater levels established at each ~~Representative Monitoring Site (RMS).~~RMS. Measurable objective groundwater levels are higher than minimum threshold groundwater levels. Measurable objectives provide operational flexibility above minimum threshold levels to ensure that the Subbasin can be managed sustainably over a reasonable range of climate and hydrologic variability. Measurable objectives may change after GSP adoption as new information and hydrologic data become available.

8.4.3.1 Methodology for Setting Measurable Objectives

Initial measurable objectives were established based on historical groundwater level data~~;~~ along with input and preferences on future groundwater levels from domestic groundwater users, agricultural interests, environmental interests, and other Subbasin stakeholders. The input and preferences were used to formulate a range of conceptual measurable objective scenarios. These scenarios were evaluated using the GSP model to project the effect on future Subbasin operation and to select measurable objectives for the GSP.

8.4.3.2 Paso Robles Formation Aquifer Measurable Objectives

Initial measurable objectives for each groundwater level RMS in the Paso Robles Formation Aquifer ~~are summarized in Table 8-1. Initial measurable objectives~~ were set at the approximate 2017 average groundwater levels~~ unless noted differently in the table~~. The measurable objectives are depicted on hydrographs in Appendix H.

Table 8-1. Chronic Lowering of Groundwater Levels Measurable Objectives for Paso Robles Formation Aquifer

Well ID (alt ID)	Measurable Objective (feet NAVD88)
25S/12E-16K05 (PASO-0345)	521
25S/12E-26L01 (PASO-0205)	490
25S/13E-08L02 (PASO-0195)	916
26S/12E-14G01 (PASO-0048)	495
26S/12E-14G02 (PASO-0017)	498
26S/12E-14H01 (PASO-0184)	505
26S/12E-14K01 (PASO-0238)	483
26S/12E-26E07 (PASO-0124)	648
26S/13E-08M01 (PASO-0164)	613
26S/13E-16N01 (PASO-0282)	588
26S/15E-19E01 (PASO-0073)	929
26S/15E-20B04 (PASO-0401)	967
26S/15E-29N01 (PASO-0226)	993
26S/15E-29R01 (PASO-0406)	986
26S/15E-30J01 (PASO-0393)	959
27S/12E-13N01 (PASO-0223)	716
27S/13E-28F01 (PASO-0243)	894
27S/13E-30F01 (PASO-0355)	766
27S/13E-30J01 (PASO-0423)	806
27S/13E-30N01 (PASO-0086)	810
27S/14E-11R01 (PASO-0392)	1,028
28S/13E-01B01 (PASO-0066)	1,040

8.4.3.3 Alluvial Aquifer Measurable Objectives

Only one RMS could be established for the Alluvial Aquifer. This RMS is associated with a new monitoring well (well name 18MW-0191) installed by the City of Paso Robles in June 2018. A measurable objective was not established for this RMS because it does not have sufficient historical groundwater level data. Additional measurable objectives will be established for the Alluvial Aquifer early after GSP adoption when the RMS network is expanded by either locationlocating new candidate monitoring wells, modifying confidentiality agreements at known wells so that groundwater level data can be used, or by installing new monitoring wells.

8.4.4 Minimum Thresholds

Section §354.28(c)(1) of the SGMA regulations states that *"The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results."*

The Sustainable Management Criteria survey (Appendix G) provided general information on stakeholders' preferences for future groundwater levels. Initial minimum thresholds were developed based on the survey and public outreach results, hydrogeologic information including contours of 2017 groundwater levels and evaluation of historical groundwater level variability at the RMS, and information about well construction.

Average 2017 non-pumping groundwater levels have been selected as measurable objectives ~~and minimum thresholds are set below those levels.~~, and minimum thresholds are set below those levels. As stated in the Executive Summary section ES-7, a groundwater elevation minimum threshold for each monitoring well was set to an elevation 30 feet below the measurable objective. Analysis of historical groundwater elevation data suggested that 30 feet allows for reasonable operational flexibility that accounts for seasonal and anticipated climatic variations on groundwater elevation. Specific conditions such as well depths at each RMS were considered when establishing the groundwater level for the initial minimum threshold. Protecting a sustainable groundwater supply for existing wells was a guiding consideration. ~~Initial minimum~~Minimum thresholds were selected to allow sufficient time for the GSAs to develop a broader and publicly accessible dataset that will give clear guidance to establish a reasonable justification for any potential management actions that would be triggered by exceedances of minimum thresholds.

~~8.4.4.1 Paso Robles Formation Aquifer Minimum Thresholds~~

~~Minimum thresholds for each groundwater level RMS in the Paso Robles Formation Aquifer are summarized on Table 8-2. Hydrographs for each RMS with well completion information, and minimum thresholds are included in Appendix H.~~As noted above, only~~These minimum thresholds were selected to avoid the locally defined significant and unreasonable conditions.~~

~~Table 8-2: Chronic Lowering of Groundwater Levels Minimum Thresholds for Paso Robles Formation Aquifer~~

~~Well ID (alt ID)~~	~~Minimum Threshold (feet NAVD88)~~
~~25S/12E-16K05 (PASO-0345)~~	~~491~~
~~25S/12E-26L01 (PASO-0205)~~	~~460~~
~~25S/13E-08L02 (PASO-0195)~~	~~886~~
~~26S/12E-14G01 (PASO-0048)~~	~~465~~
~~26S/12E-14G02 (PASO-0017)~~	~~468~~

Well ID (alt ID)	Minimum Threshold (feet NAVD88)
26S/12E-14H01 (PASO-0184)	475
26S/12E-14K01 (PASO-0238)	453
26S/12E-26E07 (PASO-0124)	618
26S/13E-08M01 (PASO-0164)	583
26S/13E-16N01 (PASO-0282)	558
26S/15E-19E01 (PASO-0073)	899
26S/15E-20B04 (PASO-0401)	937
26S/15E-29N01 (PASO-0226)	963
26S/15E-29R01 (PASO-0406)	956
26S/15E-30J01 (PASO-0393)	929
27S/12E-13N01 (PASO-0223)	686
27S/13E-28F01 (PASO-0243)	864
27S/13E-30F01 (PASO-0355)	736
27S/13E-30J01 (PASO-0423)	776
27S/13E-30N01 (PASO-0086)	780
27S/14E-11R01 (PASO-0392)	998
28S/13E-01B01 (PASO-0066)	1,010

8.4.51.1.1 Alluvial Aquifer Minimum Thresholds

Only one RMS could be established for the Alluvial Aquifer. This RMS is associated with a new monitoring well (well name 18MW-0191) installed by the City of Paso Robles in June 2018. A measurable objective was not established for this well; therefore, a minimum threshold is not established. A minimum threshold will be established after additional groundwater level data are available for the well. Additional minimum thresholds will be established for the Alluvial Aquifer early after GSP adoption when an expanded RMS network is developed.

8.4.4.1 Evaluation of Effect on Existing Wells of Sustainability Criteria

This section focuses on the sustainability criteria for the Paso Robles Formation Aquifer. As noted in Sections 8.4.3.3 and 8.4.4, only one well was identified in 2019 to represent the Alluvial Aquifer and no sustainability criteria were defined. This 2021 evaluation includes:

- identification of existing well records with construction information relative to RMS wells
- presentation of measurable objectives at RMS and analysis of effects on existing well records

- presentation of minimum thresholds at RMS and analysis of effects on existing well records

8.4.4.1.1 Evaluation of Existing Wells with Construction Information

Figure 8-2~~Figure 8-2~~ shows the locations of the Representative Monitoring Site (RMS) wells along with locations of existing supply well records in their vicinity. Each of the existing well records (shown on the map as a colored dot) has an assigned location and documented construction details from available sources.

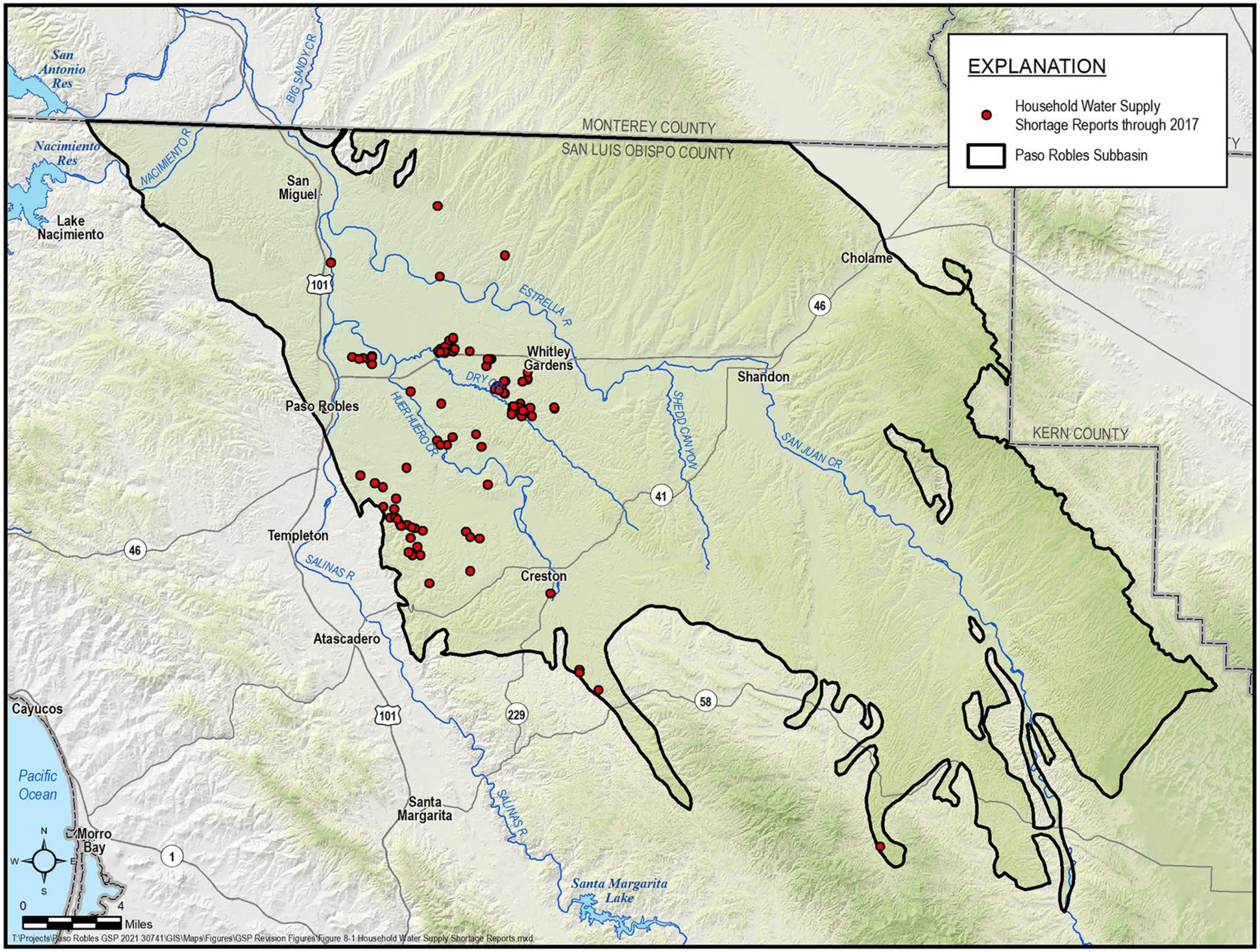


Figure 8-1. Household Water Supply Shortage Reports through 2017

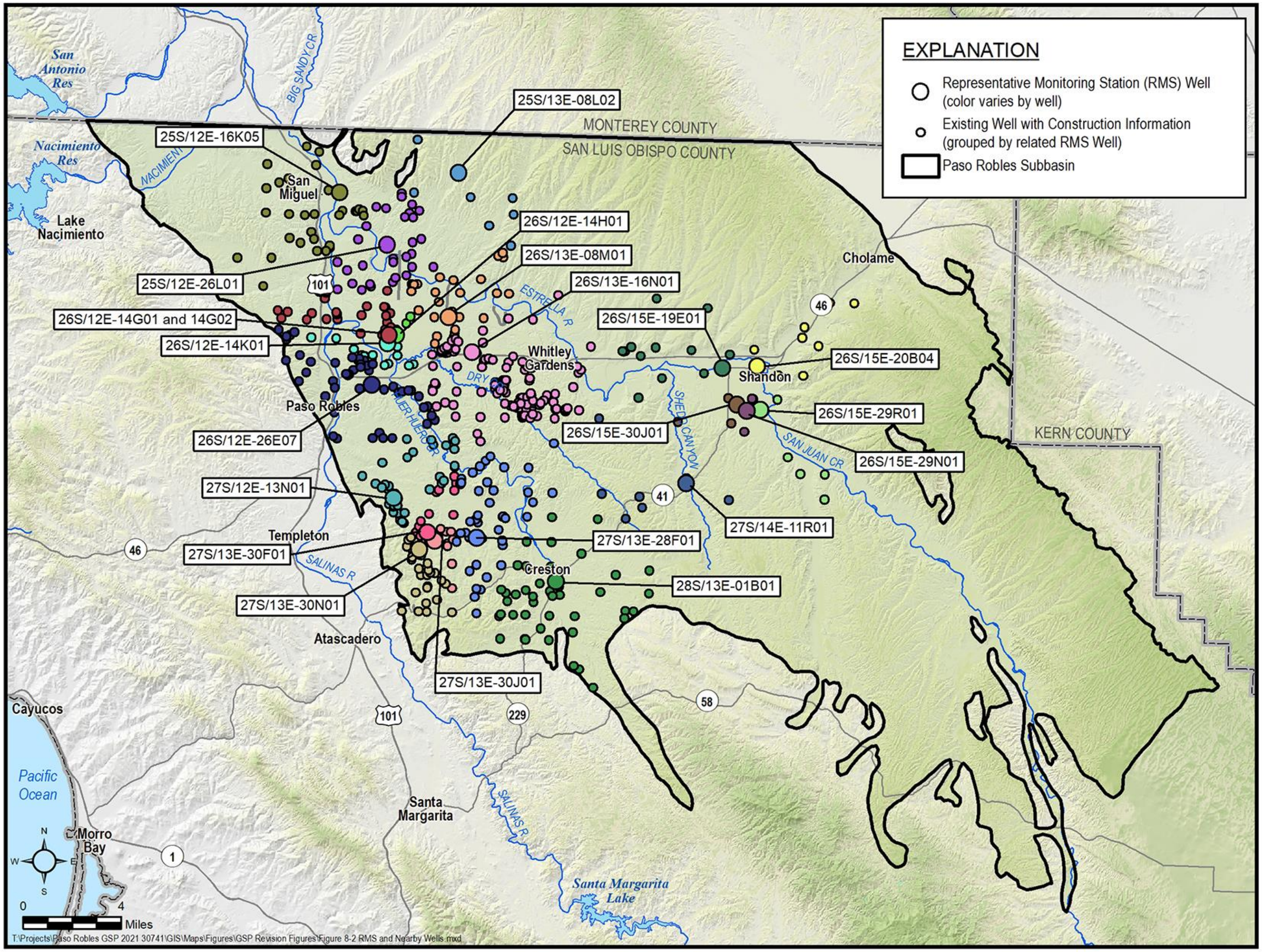


Figure 8-2. Representative Monitoring System (RMS) Wells and Existing Wells with Construction Information

Well locations and total depth information for existing wells in the Subbasin have been collected from three sources:

1. Records digitized as part of the Paso Robles Subbasin Data Management System (DMS)
2. Information from model development (GSSI 2016)
3. Records from DWR's Online System of Well Completion Reports (OSWCR, DWR October 2021)

A total of 1,593 wells with total depth information was identified within these three datasets: 71 from the DMS, 193 from model development, and 1,329 from OSWCR. While these datasets include significant well location and construction information, they also have limitations. Specifically:

- These datasets are solely records of well construction. None of the three indicate which wells have been replaced or destroyed, which still exist, or which are actively used for water supply.
- None of these records include information on pumping equipment, so assessment of the effects of water level changes on pumping costs is not possible.
- Very few of these records include complete screen interval information, and total well depth is the most commonly available information relating to well construction. Accordingly, assessment of water levels in comparison to saturated screen length is not possible, but comparison to total well depth is.
- The wells in these datasets represent a long history of well construction and groundwater conditions in the Subbasin. Older wells were typically shallower, corresponding to higher water levels and the drilling technology and practices at the time. Older wells have not been removed from these datasets, even though old shallow wells are likely no longer viable.
- While OSWCR includes the most wells by far, accurate locations for most of the wells in the OSWCR dataset are unknown. Only 4.5 percent of the OSWCR sourced wells with total depth information in the Subbasin are located by address. The remaining wells from this data source have been given Public Land Survey System (PLSS) section centers as their location. This location inaccuracy limits how these data can be used:

- Groundwater surface elevation from subbasin-wide contours or numerical model simulations interpolated at the mapped locations will be incorrect because the elevations would be different at the actual well location(s).
- The hydrogeologic conditions and aquifer in which these wells are completed cannot be accurately assessed because the conditions may be different at the actual well location(s).
- Assessment of the impacts of historical or future groundwater conditions on these wells is limited by the inaccurate locations and should be assumed to be representative in the aggregate and not on an individual-well basis.

The data from these three sources were combined into a single geographically-enabled dataset for evaluation in comparison to water levels in the RMS wells. These existing well recorded locations were mapped and the RMS well closest to each existing well record was identified. The existing well records were then grouped according to the nearest RMS well.

For each of the 22 groupings of wells around the RMS wells, the total depth of the wells was then compiled for comparison to depth to groundwater measurement in the respective RMS well. This allows the enumeration of how many wells theoretically would have been gone dry in historical and future periods.

Table 8-1~~Table 8-1~~ presents summary information for the 1,593 existing well records grouped by the nearest RMS well. As shown in Table 8-1~~Table 8-1~~, there is variability in the number and depths of existing wells nearest each RMS well. The number of nearby wells ranges from zero for RMS Well 26S/12E-14G02 (PASO-0017) to 310 for RMS Well 26S/13E-16N01 (PASO-0282). The shallowest well in this dataset is only 6 feet deep (nearest to RMS Well 26S/12E-26E07 (PASO-0124), while the deepest is 1,250 feet deep (nearest RMS Well 26S/13E-08M01 (PASO-0164). While there is a great deal of variability in the total depth of existing well records, the important observations from Table 8-1~~Table 8-1~~ are that:

1. The average depth of existing well records is over 400 feet, as shown by the weighted average at the bottom of the last column in the table.
2. The depth of the shallowest wells in the Subbasin varies widely with geography, as shown by the wide range of shallowest well total depths. However, the average depth of the shallowest wells in the Subbasin is only 76 feet, as indicated by the weighted average for the column showing the total depth of the shallowest wells.

These two statistics show that while most well records are for relatively deep wells, there have historically been shallow wells located in the Subbasin.

Table 8-1. RMS Wells and Nearby Existing Wells

RMS Well ID (alt ID)	Number of Nearby Wells	Total Depth of Shallowest Nearby Existing Well (feet)	Total Depth of Deepest Nearby Existing Well (feet)	Average Nearby Well Total Depth (feet)
25S/12E-16K05 (PASO-0345)	40	39	800	431
25S/12E-26L01 (PASO-0205)	92	70	890	377
25S/13E-08L02 (PASO-0195)	8	270	1,180	644
26S/12E-14G01 (PASO-0048)	99	30	870	362
26S/12E-14G02 (PASO-0017)	0	---	---	---
26S/12E-14H01 (PASO-0184)	11	100	1,090	585
26S/12E-14K01 (PASO-0238)	53	32	1,075	379
26S/12E-26E07 (PASO-0124)	174	6	1,004	347
26S/13E-08M01 (PASO-0164)	49	97	1,250	623
26S/13E-16N01 (PASO-0282)	310	120	1,220	610
26S/15E-19E01 (PASO-0073)	16	55	1,060	591
26S/15E-20B04 (PASO-0401)	36	39	475	304
26S/15E-29N01 (PASO-0226)	2	400	640	520
26S/15E-29R01 (PASO-0406)	23	210	867	419
26S/15E-30J01 (PASO-0393)	7	290	800	565
27S/12E-13N01 (PASO-0223)	62	92	980	442
27S/13E-28F01 (PASO-0243)	188	55	800	379
27S/13E-30F01 (PASO-0355)	55	104	810	398
27S/13E-30J01 (PASO-0423)	51	65	740	413
27S/13E-30N01 (PASO-0086)	111	100	660	348
27S/14E-11R01 (PASO-0392)	8	500	940	689
28S/13E-01B01 (PASO-0066)	198	62	750	381
Minimum:	**0**	**6**	**475**	**304**
Maximum:	**310**	**500**	**1,250**	**689**
Range:	**310**	**494**	**775**	**385**
Total / Weighted Average:	**1,593**	**76**	**927**	**437**

8.4.4.2 Effect of Paso Robles Formation Aquifer Measurable Objectives

Measurable objectives for groundwater level RMS wells in the Paso Robles Formation Aquifer are summarized in Table 8-2~~Table 8-2~~. Initial measurable objectives were set at the approximate 2017 average groundwater levels.

Assessment of the measurable objectives for the Paso Robles Formation Aquifer involved evaluation of the number of existing recorded wells that would have gone dry in 2017 when the measurable objective last occurred. The total depths of existing wells (with construction information) near the RMS wells were reviewed to identify which wells would have gone dry in average 2017 conditions, as represented by the nearest RMS well. The number and percentage of wells near each RMS well that would have gone dry are indicated on Table 8-2~~Table 8-2~~. As shown, a total of 225 wells within the available well information dataset would have gone dry in average 2017 groundwater level conditions, equivalent to 14.1 percent of the wells with construction information. This is more than the 141 wells that were reported to have gone dry in the *Household Water Supply Shortage Reporting System* (DWR, April 2022). This likely reflects three characteristics or limitations of the available information. First, the dataset includes well construction records for very old wells that have either been destroyed or are no longer in use and thus would not be reported to DWR. Second, not all of the existing wells for which construction information is available are household water supply sources, and thus this analysis likely includes wells for other purposes (e.g., irrigation). Finally, not all wells that went dry may have been reported to DWR; some well owners may not be aware of the reporting systems and some may have reported the conditions later.

Table 8-2. Chronic Lowering of Groundwater Levels Measurable Objectives for Paso Robles Formation Aquifer

RMS Well ID (alt ID)	Measurable Objective (feet NAVD88)	Number of Nearby Wells Dry at Measurable Objective	Percent of Nearby Wells Dry at Measurable Objective
25S/12E-16K05 (PASO-0345)	521	3	7.5%
25S/12E-26L01 (PASO-0205)	490	35	38.0%
25S/13E-08L02 (PASO-0195)	916	0	0.0%
26S/12E-14G01 (PASO-0048)	495	32	32.3%
26S/12E-14G02 (PASO-0017)	498	0	---
26S/12E-14H01 (PASO-0184)	505	2	18.2%
26S/12E-14K01 (PASO-0238)	483	17	32.1%
26S/12E-26E07 (PASO-0124)	648	38	21.8%
26S/13E-08M01 (PASO-0164)	613	4	8.2%
26S/13E-16N01 (PASO-0282)	588	4	1.3%
26S/15E-19E01 (PASO-0073)	929	1	6.3%
26S/15E-20B04 (PASO-0401)	967	1	2.8%
26S/15E-29N01 (PASO-0226)	993	0	0.0%
26S/15E-29R01 (PASO-0406)	986	0	0.0%
26S/15E-30J01 (PASO-0393)	959	0	0.0%
27S/12E-13N01 (PASO-0223)	716	10	16.1%
27S/13E-28F01 (PASO-0243)	894	19	10.1%
27S/13E-30F01 (PASO-0355)	766	16	29.1%
27S/13E-30J01 (PASO-0423)	806	12	23.5%
27S/13E-30N01 (PASO-0086)	810	31	27.9%
27S/14E-11R01 (PASO-0392)	1,028	0	0.0%
28S/13E-01B01 (PASO-0066)	1,040	0	0.0%
	Total:	225	14.1%

8.4.4.3 Effect of Paso Robles Formation Aquifer Minimum Thresholds

Minimum thresholds for groundwater level RMS wells in the Paso Robles Formation Aquifer are summarized on Table 8-3~~Table 8-3~~. Hydrographs for RMS wells with minimum thresholds are included in Appendix H. These minimum thresholds were selected to avoid the locally defined significant and unreasonable conditions.

As with the measurable objectives, the number of existing wells that would go dry at the minimum threshold was assessed. In this case, the assessment only included well records that would not have gone dry at the measurable objective. It is assumed that wells that would have gone dry in average 2017 groundwater conditions were either no longer active or were replaced with a deeper well or alternative water supply source. The number and percentage of additional wells near each RMS well that would go dry at the minimum threshold are indicated on Table 8-3~~Table 8-3~~. A total of 62 additional wells, or 3.9 percent within the available well information dataset, would go dry at the minimum threshold.

As a qualitative comparison, the number of wells that were reported to have gone dry in the Household Water Supply Shortage Reporting System indicates that 95 wells have been reported to have gone dry between the end of 2017 and the start of 2022. Some of these well issues have been resolved by lowering the pump or deepening the well. Some of these wells may also have gone dry prior to the end of 217, but the conditions may not have been reported until later. The total number of wells reported to have gone dry through the start of 2022 (236) is very similar to the number of existing wells with construction information predicted to go dry in average 2017 conditions (225). Therefore, the available data indicate that the minimum thresholds are protective of undesirable results as they relate to shallow domestic wells, defined as 10 percent of wells going dry after 2017.

Table 8-3: Chronic Lowering of Groundwater Levels Minimum Thresholds for Paso Robles Formation Aquifer

RMS Well ID (alt ID)	Minimum Threshold (feet NAVD88)	Number of Nearby Wells Dry at Minimum Threshold Not Dry at Measurable Objective	Percent of Nearby Wells Dry at Minimum Threshold Not Dry at Measurable Objective
25S/12E-16K05 (PASO-0345)	491	2	5.0%
25S/12E-26L01 (PASO-0205)	460	7	7.6%
25S/13E-08L02 (PASO-0195)	886	0	0.0%
26S/12E-14G01 (PASO-0048)	465	11	11.1%
26S/12E-14G02 (PASO-0017)	468	0	---
26S/12E-14H01 (PASO-0184)	475	0	0.0%
26S/12E-14K01 (PASO-0238)	453	3	5.7%
26S/12E-26E07 (PASO-0124)	618	4	2.3%
26S/13E-08M01 (PASO-0164)	583	0	0.0%
26S/13E-16N01 (PASO-0282)	558	1	0.3%
26S/15E-19E01 (PASO-0073)	899	0	0.0%
26S/15E-20B04 (PASO-0401)	937	0	0.0%
26S/15E-29N01 (PASO-0226)	963	0	0.0%
26S/15E-29R01 (PASO-0406)	956	0	0.0%
26S/15E-30J01 (PASO-0393)	929	0	0.0%
27S/12E-13N01 (PASO-0223)	686	3	4.8%
27S/13E-28F01 (PASO-0243)	864	4	2.1%
27S/13E-30F01 (PASO-0355)	736	4	7.3%
27S/13E-30J01 (PASO-0423)	776	4	7.8%
27S/13E-30N01 (PASO-0086)	780	15	13.5%
27S/14E-11R01 (PASO-0392)	998	0	0.0%
28S/13E-01B01 (PASO-0066)	1,010	4	2.0%
	Total:	62	3.9%

~~8.4.5.1~~8.4.4.4 Minimum Thresholds Impact on Domestic Wells

~~Early after GSP adoption and during efforts to expand the monitoring networks, additional analysis of the minimum thresholds for groundwater elevations will be conducted to ensure that they are protective of average domestic well operations in the Subbasin. Minimum thresholds in some areas of the Subbasin may be modified based on the results of this evaluation.~~

The potential impacts of the minimum thresholds on domestic wells are included in the assessment presented above, while acknowledging that the available well information datasets do not necessarily differentiate which wells are domestic. The analysis indicates that no more than 3.9 percent of all wells in the Subbasin are susceptible to going dry in the event that the minimum threshold is reached in all RMS wells simultaneously. The methodologies used for the analysis, and methodologies used for forecasting occurrences of wells going dry, will be further refined during GSP implementation. As not all wells used in the analysis are for domestic supply, this indicates that a smaller number of domestic wells are susceptible to going dry at the minimum threshold.

~~8.4.5.2~~8.4.4.5 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

Section 354.28 of the SGMA regulations requires that the description of all minimum thresholds include a discussion about the relationship between the minimum thresholds for each sustainability indicator. In the SMC BMP (DWR, 2017), DWR has clarified this requirement. First, the GSP must describe the relationship between each sustainability indicator's minimum threshold; in other words, describe why or how a water level minimum threshold set at a particular RMS is similar to or different to water level thresholds in nearby RMS. Second, the GSP must describe the relationship between the selected minimum threshold and minimum thresholds for other sustainability indicators; in other words, describe how a water level minimum threshold would not trigger an undesirable result for land subsidence, for example.

Groundwater elevation minimum thresholds are derived from the measurable objectives, which are average 2017 groundwater elevations. Because the measurable objectives represent a historical and realistic groundwater elevation map, the minimum thresholds derived from these objectives (i.e., 30 feet lower) likely do not conflict with each other.

Groundwater elevation minimum thresholds can influence other sustainability indicators.

- **Change in groundwater storage**. Changes in groundwater elevations reflect changes in the amount of groundwater in storage. Pumping at or less than the sustainable yield will maintain or raise average groundwater elevations in the Subbasin. The groundwater elevation minimum thresholds are set to maintain a constant elevation over an extended period of time, consistent with the practice of pumping at or less than the sustainable yield. Therefore, the groundwater elevation minimum thresholds will not result in long term significant or unreasonable change in groundwater storage.

- **Seawater intrusion**. This sustainability indicator is not applicable to this Subbasin.
- **Degraded water quality**. Protecting groundwater quality is critically important to all who depend upon the groundwater resource, particularly for drinking water and agricultural uses. Maintaining groundwater levels protects against degradation of water quality or exceeding regulatory limits for constituents of concern in supply wells due to actions proposed in the GSP. Water quality could be affected through two processes:

    1. Low groundwater elevations in an area could cause deeper, poor-quality groundwater to flow upward into existing supply wells. Groundwater elevation minimum thresholds are set below current levels, meaning upward flow of deep, poor-quality groundwater could occur in the future. Should groundwater quality degrade due to lower groundwater elevations, the groundwater elevation minimum thresholds will be raised to avoid this degradation.
    2. Changes in groundwater elevation due to actions implemented to achieve sustainability could change groundwater gradients, which could cause poor quality groundwater to flow towards supply wells that would not have otherwise been impacted. These groundwater gradients, however, are only dependent on differences between groundwater elevations, not on the groundwater elevations themselves. Therefore, the minimum threshold groundwater elevations do not directly lead to a significant and unreasonable degradation of groundwater quality in production wells.

- **Subsidence**. A significant and unreasonable condition for subsidence is permanent pumping induced subsidence that substantially interferes with surface land use. Subsidence is caused by dewatering and compaction of clay-rich sediments in response to lowering groundwater levels. Very small amounts of land surface elevation fluctuations have been reported across the Basin. The groundwater elevation minimum thresholds are set below existing groundwater elevations, which could induce additional subsidence that has not already started. Should new subsidence be observed due to lower groundwater elevations, the groundwater elevation minimum thresholds will be raised to avoid this subsidence.
- **Depletion of interconnected surface water**. ~~There are no minimum thresholds or undesirable results established in this GSP for depletion of interconnected surface water that could be affected by the groundwater elevation minimum thresholds. Increases in groundwater elevations, however, could connect surface water and~~

~~groundwater. If this occurs, minimum thresholds will be established for depletion of interconnected surface waters and the relationship between those new minimum thresholds and all other sustainability indicators will be reassessed.~~ The set of monitoring wells used to evaluate interconnected surface water includes some overlap with the set of RMS wells used for the groundwater level minimum threshold. Depending on the local relationship between Alluvial Aquifer water levels and Paso Robles Formation Aquifer water levels, the minimum threshold for interconnected surface water could be more constraining than the minimum threshold for groundwater elevations. The interconnected surface water minimum threshold (no more than 10 feet below the spring 2017 water level) is higher than the groundwater elevation minimum threshold (30 feet below the average 2017 water level), but the former applies only to Alluvial Aquifer wells. At locations along stream segments with riparian vegetation where the difference between Alluvial Aquifer and Paso Robles Formation Aquifer water levels is less than 20 feet, the interconnected surface water minimum threshold would likely constrain water levels. The only locations where existing data indicates a potential connection between the surface water system and the underlying Paso Robles Formation Aquifer include the middle reach of the Estrella River (from Shedd Canyon to Martingale Circle) and along San Juan Creek upstream of Spring Creek. At these locations the connection between surface waters and the underlying Paso Robles Formation Aquifer is unknown but sufficient evidence exists that there could potentially be a connection, and therefore further investigation in these areas is recommended.

~~8.4.5.3~~8.4.4.6 Effect of Minimum Thresholds on Neighboring Basins

One neighboring groundwater basin is required to develop a GSP: the Upper Valley Subbasin of the Salinas Valley Basin. Additionally, the adjoining Atascadero Subbasin is currently developing a GSP under SGMA. The anticipated effect of the groundwater elevation minimum thresholds on each of the two subbasins is addressed below.

Upper Valley Subbasin of the Salinas Valley Basin. The Upper Valley Subbasin is required to develop a GSP by 2022. The Upper Valley Subbasin is hydrogeologically downgradient of the Paso Robles Subbasin: groundwater generally flows from the Paso Robles Subbasin into the Upper Valley Subbasin. Lower groundwater levels in the Paso Robles Subbasin as a result of GSP actions could reduce the amount of groundwater flowing into the Upper Valley Subbasin, affecting that Subbasin’s ability to achieve sustainability. The groundwater elevation minimum thresholds are set at constant levels that are below current elevations; therefore, they could reduce groundwater flow into the adjacent Upper Valley Subbasin. If reduced groundwater flow is observed that impacts sustainability in the Upper Valley Subbasin of the Salinas Valley Basin, then minimum thresholds would be adjusted to avoid this impact.

The Paso Robles Subbasin GSAs have developed a cooperative working relationship with the Salinas Valley Basin GSA who will be developing the GSP for the Upper Valley Subbasin. The two GSAs will monitor and work together to ensure that minimum thresholds do not significantly affect each Subbasin's ability to achieve sustainability.

Atascadero Subbasin. The Paso Robles Subbasin is hydrogeologically separated from the Atascadero Subbasin by the Rinconada Fault. The fault acts as a barrier to groundwater flow in the Paso Robles Formation Aquifer as presented in Chapter 4. While minimum thresholds are set at levels below current groundwater levels, these lower levels are not expected to impact sustainability in the Atascadero Subbasin due to the limited groundwater flow between the two Subbasins. The Paso Robles Subbasin GSAs have a cooperative working relationship with the Agencies managing the Atascadero Subbasin and will continue to work together to ensure that minimum thresholds do not significantly affect each Subbasin's ability to achieve sustainability.

~~8.4.5.4~~8.4.4.7 Effects on Beneficial Users and Land Uses

The groundwater elevation minimum thresholds may have several effects on beneficial users and land uses in the Subbasin.

Agricultural land uses and users. The groundwater elevation minimum thresholds limit lowering of groundwater levels in the Subbasin. In the absence of other mitigating measures this has the effect of potentially limiting the amount of groundwater pumping in the Subbasin. Limiting the amount of groundwater pumping will limit the amount and type of crops that can be grown in the Subbasin, which could result in a proportional reduction in the economic viability of some properties. The groundwater elevation minimum thresholds could therefore limit expansion of the Subbasin's agricultural economy. This could have various effects on beneficial users and land uses:

- There will be an economic impact to employees and suppliers of production products and materials. Many parts of the local economy rely on a vibrant agricultural industry, and they too will be hurt proportional to the losses imparted to agricultural businesses.
- Growth of city, county and state tax rolls could be slowed or reduced due to the limitations imposed on agricultural growth.

Urban land uses and users. The groundwater elevation minimum thresholds effectively limit the amount of groundwater pumping in the Subbasin. This may limit urban growth or result in urban areas obtaining alternative sources of water. This may result in higher water costs for municipal water users.

Domestic land uses and users. The groundwater elevation minimum thresholds protect most domestic wells. Therefore, the minimum thresholds will likely have an overall beneficial effect on existing domestic land uses by protecting the ability to pump from domestic wells. However, limited water in some of the shallowest domestic wells may require owners to drill deeper wells. Additionally, the groundwater elevation minimum thresholds may limit the increase of non-*de minimis* groundwater use in order to limit future declines in groundwater levels caused by more non *de minimis* domestic pumping. Policies allowing offsets of existing use to allow new construction or bringing in new sources of water can mitigate against this effect.

Ecological land uses and users. Historical reductions in the extent and density of riparian vegetation in certain stretches of rivers and creeks may have been associated with declines in groundwater levels. The additional 30 feet of water-level decline allowed by the water-level minimum threshold could cause further reduction in riparian vegetation in areas where the Alluvial Aquifer is hydraulically connected with the Paso Robles Formation Aquifer. Groundwater elevation minimum thresholds effectively protect the groundwater resource including those existing ecological habitats that rely upon it because they are set to avoid long term declines in groundwater levels in a short amount of time. ~~As noted above, groundwater level~~The sustainability criteria for interconnected surface water (see Section 8.8) include minimum thresholds ~~may limit increases~~defined as groundwater levels that are in ~~non-*de minimis*~~some locations higher than the groundwater ~~use. Ecological land uses and users may benefit by this reduction in non-*de minimis* groundwater use~~elevation minimum thresholds.

~~8.4.5.5~~8.4.4.8 Relevant Federal, State, or Local Standards

No Federal, State, or local standards exist for chronic lowering of groundwater elevations.

~~8.4.5.6~~8.4.4.9 Method for Quantitative Measurement of Minimum Thresholds

Groundwater elevation minimum thresholds will be directly measured from existing or new monitoring wells. The groundwater level monitoring will be conducted in accordance with the monitoring plan outlined in Chapter 7. Furthermore, the groundwater level monitoring will meet the requirements of the technical and reporting standards included in the SGMA regulations.

As noted in Chapter 7, the current groundwater monitoring network in the Paso Robles Formation Aquifer currently only includes 24 wells. For the Alluvial Aquifer, only one RMS was established. The GSAs will expand the monitoring network in both aquifers during GSP implementation.

~~8.4.6~~8.4.5 Interim Milestones

Initial interim milestones were developed for the 24 RMS established for the Paso Robles Formation Aquifer based on the results of modeling conducted to evaluate management actions and select measurable objectives (Chapter 9). Because measurable objectives have not been established at RMS for the Alluvial Aquifer, interim milestones cannot be developed. Interim milestones will be developed in the future (after GSP adoption) when the RMS network is expanded in the Alluvial Aquifer.

Conceptually, the following actions and groundwater conditions are expected to occur during implementation.

- Monitoring of Subbasin conditions using an expanded monitoring network and continuous monitoring devices will provide additional information to refine interim milestones
- Pumping cutbacks in some areas of the Subbasin will begin about five years after adoption of the GSP. During this five-year period, current groundwater levels trends would continue to be tracked by the RMS.
- After about 5 years, groundwater levels will begin trending toward measurable objectives as a result of management actions and possibly pumping cutbacks in some area of the Subbasin.

Table 8-4~~Table 8-4~~ summarizes the interim milestones for the RMS in the Paso Robles Formation Aquifer.

Table 8-434: Chronic Lowering of Groundwater Levels Interim Milestones for Paso Robles Formation Aquifer

Well ID (alt ID)	Interim Milestones (feet NAVD88)		
	2025	2030	2035
25S/12E-16K05 (PASO-0345)	521	521	520
25S/12E-26L01 (PASO-0205)	499	496	492
25S/13E-08L02 (PASO-0195)	911	905	901
26S/12E-14G01 (PASO-0048)	526	532	534
26S/12E-14G02 (PASO-0017)	523	531	533
26S/12E-14H01 (PASO-0184)	513	521	524
26S/12E-14K01 (PASO-0238)	527	533	535
26S/12E-26E07 (PASO-0124)	644	644	645
26S/13E-08M01 (PASO-0164)	620	619	617
26S/13E-16N01 (PASO-0282)	595	594	593
26S/15E-19E01 (PASO-0073)	935	937	938
26S/15E-20B04 (PASO-0401)	972	976	978
26S/15E-29N01 (PASO-0226)	1,009	1,012	1,014
26S/15E-29R01 (PASO-0406)	997	1,001	1,003

Well ID (alt ID)	Interim Milestones (feet NAVD88)		
	2025	2030	2035
26S/15E-30J01 (PASO-0393)	972	976	978
27S/12E-13N01 (PASO-0223)	711	710	709
27S/13E-28F01 (PASO-0243)	896	899	900
27S/13E-30F01 (PASO-0355)	770	768	765
27S/13E-30J01 (PASO-0423)	817	815	812
27S/13E-30N01 (PASO-0086)	804	799	794
27S/14E-11R01 (PASO-0392)	1,029	1,030	1,030
28S/13E-01B01 (PASO-0066)	1,052	1,055	1,055

Interim milestones may be revised during implementation as new data and understanding of the hydrogeologic conditions in the Subbasin become available.

~~8.4.7~~8.4.6 Undesirable Results

~~8.4.7.1~~8.4.6.1 Criteria for Defining Undesirable Results

The chronic lowering of groundwater elevation undesirable result is a quantitative combination of groundwater elevation minimum threshold exceedances. For chronic lowering of groundwater elevations, an exceedance is defined by the annual average (e.g., spring and fall) water level below the well's defined minimum threshold. For the Paso Robles Subbasin, the groundwater elevation undesirable result is:

Over the course of two years, no more than two exceedances for the groundwater elevation minimum thresholds within a 5-mile radius or within a defined area of the Basin for any single aquifer. A single monitoring well in exceedance for two consecutive years also represents an undesirable result for the area of the Basin represented by the monitoring well. Geographically isolated exceedances will require investigation to determine if local or Basin wide actions are required in response.

~~Undesirable~~This compound definition of undesirable results ~~provide~~provides flexibility in defining sustainability. Increasing the number of allowed minimum threshold exceedances provides more flexibility~~,~~ but may lead to significant and unreasonable conditions for a number of beneficial users. Reducing the number of allowed minimum threshold exceedances ensures strict adherence to minimum thresholds~~,~~ but reduces flexibility due to unanticipated hydrogeologic conditions. The undesirable result was set ~~at~~ to balance the interests of beneficial users with the practical aspects of groundwater management under uncertainty.

Use of this definition of undesirable results in combination with the minimum threshold for groundwater elevation will avoid the significant and unreasonable conditions discussed above. Specifically, it will be impossible to cause a significant percentage of the wells in the Subbasin to go dry because the undesirable result includes geographic and temporal components that prevent the entire Subbasin from reaching the minimum thresholds in the RMS wells simultaneously.

As the monitoring system is expanded, the number of exceedances allowed may be adjusted. One additional exceedance will be allowed for approximately every seven new monitoring wells. This was considered a reasonable number of exceedances given the hydrogeologic uncertainty of the ~~basin~~Subbasin. Close monitoring of groundwater data over the following years will allow actual numbers to be refined based on observable data. Management of the Subbasin will adapt to specific conditions and to a growing understanding of basin conditions and processes to adopt appropriate responses. When additional data and a better understanding of hydrogeologic conditions are available in the future, the GSAs may adjust measurable objectives and minimum thresholds and adaptively manage sustainability actions to avoid undesirable results.

~~8.4.7.2~~8.4.6.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include the following:

- Localized pumping clusters. Even if regional pumping is maintained within the sustainable yield, clusters of high-capacity wells may cause excessive localized drawdowns that lead to undesirable results in specific areas.
- Expansion of *de-minimis* pumping. Individual *de-minimis* pumpers, individually, do not have a significant impact on Subbasin-wide groundwater elevations. However, many *de-minimis* pumpers are often clustered in specific residential areas. Pumping by these *de-minimis* users is not currently regulated under this GSP. Adding additional domestic *de-minimis* pumpers in specific areas may result in excessive localized drawdowns and undesirable results.
- Extensive drought and climate change. Minimum thresholds were established based on historical groundwater elevations and reasonable estimates of future groundwater elevations. Extensive droughts may lead to excessively low groundwater elevations and undesirable results.

~~8.4.7.3~~8.4.6.3 Effects on Beneficial Users and Land Uses

The primary detrimental effect on beneficial users from allowing multiple exceedances occurs if more than one exceedance occurs in a small geographic area. ~~Allowing 15% exceedances~~

~~is~~Exceedances of the minimum thresholds for groundwater elevation are reasonable as long as the exceedances are spread out across the Subbasin. If the exceedances are clustered in a small area, it will indicate that significant and unreasonable effects are being born by a localized group of landowners.

8.5 Reduction in Groundwater Storage Sustainable Management Criteria

8.5.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions were assessed based on the Sustainable Management Criteria survey, public meetings, available data, and discussions with GSA staff. Significant and unreasonable changes in groundwater storage in the Subbasin are those that:

- Lead to long-term reduction in groundwater storage
- Interfere with other sustainability indicators

Responses to the Sustainable Management Criteria survey and public input suggest that most areas of the basin would like to see more groundwater in storage to help with droughts, and some areas of the basin would like to see significantly more groundwater in storage. Public input on which concessions would be acceptable to increase the amount of groundwater in storage revealed two highly ranked concessions:

1. New pumping be offset with new recharge or reduced pumping
2. Pumping be reduced in dry years

However, the concession that agricultural pumping be reduced in all years ranked relatively low. This suggests that, while stakeholders would prefer more groundwater in storage, they also would not prefer to reduce existing agricultural pumping during average years. Stakeholders also prefer that groundwater storage be increased by retaining wet year flows for local recharge and/or importing water.

8.5.2 Minimum Thresholds

Section §354.28(c)(2) of the SGMA regulations states that "*The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.*"

The reduction of groundwater in storage minimum threshold is established for the Subbasin as a whole, not for individual aquifers. Therefore, one minimum threshold for groundwater in storage is established for the entire Subbasin, but any reduction in storage that would cause an undesirable result in only a limited portion of the Subbasin shall be addressed in that area or areas where declining well levels indicate management actions or projects will be effective.

In accordance with the SGMA regulation cited above, the minimum threshold metric is a volume of pumping per year, or an annual pumping rate. Conceptually, the sustainable yield is the total volume of groundwater that can be pumped annually from the Subbasin without leading to undesirable results. As discussed in Chapter 6, absent the addition of supplemental water, the future estimated long-term sustainable yield of the Subbasin under reasonable climate change assumptions is 61,100 AFY. This estimated sustainable yield will change in the future as additional data become available.

This GSP adopts changes in groundwater level as a proxy for the change in groundwater storage metric. As allowed in §354.36(b)(1) of the SGMA regulations, an average of the semiannual groundwater elevation data at the RMSs will be reported annually as a proxy to track changes in the amount of groundwater in storage. A quantitative relationship between water level changes and volumetric changes in storage will be developed after the RMS network is expanded, new hydrogeologic data are developed, and the model is updated and recalibrated.

Based on well-established hydrogeologic principles, stable groundwater elevations maintained above the minimum threshold will limit depletion of groundwater from storage. Therefore, using groundwater elevations as a proxy, the minimum threshold is that the groundwater surface elevation averaged across all the wells in the groundwater level monitoring network will remain stable above the minimum threshold for chronic lowering of groundwater levels.

Exceedances of this minimum threshold, if limited to specific areas of the Basin, shall be addressed by management actions or projects developed where they affect those areas of exceedance. Multiple exceedances appearing across the Basin will require proportional Subbasin-wide responses.

8.5.2.1 Information Used and Methodology for Establishing Reduction in Storage Minimum Thresholds

The monitoring network and protocols used to measure groundwater elevations at the RMS are presented in Chapter 7, Monitoring Networks. These data will be used to monitor groundwater elevations and assess changes in groundwater storage.

8.5.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The minimum threshold for reduction in groundwater storage is a single value of average groundwater elevation over the entire Subbasin. Therefore, the concept of potential conflict between minimum thresholds at different locations in the Subbasin is not applicable.

The reduction in groundwater storage minimum threshold could influence other sustainability indicators. The reduction in groundwater storage minimum threshold was selected to avoid undesirable results for other sustainability indicators, as outlined below.

- **Chronic lowering of groundwater levels**. Because groundwater elevations will be used as a proxy for estimating groundwater pumping and changes in groundwater storage, the reduction in groundwater storage would not cause undesirable results for this sustainability indicator.
- **Seawater intrusion**. This sustainability indicator is not applicable to this Subbasin.
- **Degraded water quality**. The minimum threshold proxy of stable groundwater levels will not directly lead to a degradation of groundwater quality.
- **Subsidence**. Because future average groundwater levels will be stable, they will not induce any additional subsidence.
- **Depletion of interconnected surface waters**. ~~Minimum thresholds and undesirable results for interconnected surface water were not developed because there are insufficient data to determine the existence of interconnected surface water at this time in the Subbasin. This is a data gap that will be filled early in GSP implementation. Therefore, the reduction in groundwater storage minimum thresholds is unrelated to interconnected surface water at this time. If surface water interconnection is identified in the future, minimum thresholds will be established for depletion of interconnected surface waters and the relationship between those new minimum thresholds and all other sustainability indicators will be reassessed.~~ The alluvial aquifer and the Paso Robles Formation both store groundwater. The minimum threshold for groundwater elevations involves water levels in the Paso Robles Formation, while the minimum threshold for interconnected surface water involves water levels in the alluvial aquifer. Both minimum thresholds limit minimum groundwater elevations to a finite depth below the 2017 elevations and thereby prevent long-term depletion in groundwater storage.

8.5.2.3 Effect of Minimum Thresholds on Neighboring Basins

The anticipated effect of the groundwater storage minimum thresholds on each of the two neighboring subbasins is addressed below.

Upper Valley Subbasin of the Salinas Valley Basin. Removing groundwater from storage in the Paso Robles Subbasin would reduce flow into the Upper Valley Subbasin, potentially affecting the ability of that Subbasin to achieve sustainability. The reduction in storage minimum threshold is set to prevent long-term reduction in storage and therefore maintain flow into the Upper Valley Subbasin. This minimum threshold will not prevent the Upper Valley Subbasin from achieving sustainability.

Atascadero Subbasin. The Paso Robles Subbasin is hydrogeologically separated from the Atascadero Subbasin by the Rinconada Fault. The fault acts as a partial barrier to groundwater flow as presented in Chapter 4. Removing groundwater from storage in the Paso Robles Subbasin could induce additional groundwater flow from the Atascadero Subbasin into the Paso Robles Subbasin, affecting the ability to achieve sustainability in the Atascadero Subbasin. The reduction in storage minimum threshold is set to prevent long term reduction in storage and will be monitored using groundwater elevation proxies, therefore will not induce lowering of groundwater elevations that could cause additional groundwater flows from the Atascadero Subbasin. The minimum threshold will therefore not prevent the Atascadero Subbasin from achieving sustainability.

8.5.2.4 Effect on Beneficial Uses and Users

The reduction in groundwater storage minimum threshold of maintaining stable average groundwater elevations will potentially require a reduction in the amount of groundwater pumping in the Subbasin. Reducing pumping may impact the beneficial uses and users of groundwater in the Subbasin.

Agricultural land uses and users. Reducing the amount of groundwater pumping may limit or reduce non-*de minimis* production in the Subbasin by reducing the amount of available water. Owners of agricultural lands that are currently not irrigated may be particularly impacted because the additional groundwater pumping needed to irrigate these lands could increase the Subbasin pumping beyond the sustainable yield, violating the minimum threshold.

Urban land uses and users. Reducing the amount of groundwater pumping may increase the cost of water for municipal users in the Subbasin because municipalities may need to find other, more expensive water sources.

Domestic land uses and users. Existing domestic groundwater users may generally benefit from this minimum threshold. Many domestic groundwater users are *de-minimis* users whose pumping may not be restricted by the projects and management actions adopted in this GSP. By restricting the amount of groundwater that is pumped from the Subbasin, the *de-minimis* users would be protected from overdraft that could impact their ability to pump groundwater.

Ecological land uses and users. Groundwater dependent ecosystems would generally benefit from this minimum threshold. Maintaining groundwater levels close to current levels maintains groundwater supplies similar to present levels which will continue to support groundwater dependent ecosystems.

8.5.2.5 Relation to State, Federal, or Local Standards

No federal, state, or local standards exist for reductions in groundwater storage.

8.5.2.6 Methods for Quantitative Measurement of Minimum Threshold

The quantitative metric for assessing compliance with the reduction in groundwater storage minimum threshold is monitoring groundwater elevations. The approach for quantitatively evaluating compliance with the minimum threshold for reduction in groundwater storage will be based on evaluating groundwater elevations annually. All groundwater elevations collected from the groundwater level monitoring network will be analyzed and averaged.

8.5.3 Measurable Objectives

The change in storage sustainability indicator uses groundwater levels as a proxy, using the same minimum thresholds and measurable objectives to protect against significant and unreasonable reduction in groundwater storage as it does protecting against chronic lowering of groundwater levels. The measurable objective, using the groundwater level proxy, is stable average groundwater levels.

8.5.3.1 Method for Setting Measurable Objectives

As discussed in Section 8.5.1, input from stakeholders suggested that they would prefer more groundwater in storage. However, stakeholders also suggested that they would prefer not to attain this increase in groundwater storage by reducing existing pumping during years with average climate conditions. Instead, they prefer to increase groundwater storage through increasing local recharge or importing water for recharge. Therefore, the conservative approach of simply maintaining stable groundwater levels was adopted for the measurable objective.

8.5.3.2 Interim Milestones

Interim milestones for groundwater storage are the same as those established for chronic lowering of groundwater elevations. Achieving the groundwater elevation interim milestones will also eliminate long term reductions in groundwater in storage.

8.5.4 Undesirable Results

8.5.4.1 Criteria for Defining Undesirable Results

The reduction in groundwater storage undesirable result is a quantitative combination of reduction in groundwater storage minimum threshold exceedances. There is only one reduction in groundwater storage minimum threshold. Therefore, no minimum threshold exceedances are allowed to occur and the reduction in groundwater storage undesirable result is:

During average hydrogeologic conditions, and as a long-term average over all hydrogeologic conditions, there shall be no persistent exceedances of the groundwater level proxy minimum threshold for change in groundwater storage.

8.5.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result for the reduction in groundwater storage sustainability indicator include the following:

- **Expansion of non-*de minimis* pumping.** Additional non-*de minimis* pumping may result in continued decline in groundwater elevations and exceedance of the proxy minimum threshold.
- **Expansion of *de minimis* pumping**. Pumping by *de minimis* users is not regulated under this GSP. Adding domestic *de minimis* pumpers in the Subbasin may result in lower groundwater elevations, and an exceedance of the proxy minimum threshold.
- **Extensive, unanticipated drought**. Minimum thresholds are established based on reasonable anticipated future climatic conditions. Extensive, unanticipated droughts may lead to excessively low groundwater recharge and unanticipated high pumping rates that could cause lower groundwater elevations and an exceedance of the proxy minimum threshold.

8.5.4.3 Effects on Beneficial Users and Land Use

The practical effect of this GSP for protecting against the reduction in groundwater storage undesirable result is that it encourages no net change in groundwater elevations and storage during average hydrologic conditions and over the long-term. Therefore, during average hydrologic conditions and over the long-term, beneficial uses and users will have access to the same amount of groundwater in storage that currently exists, and the beneficial users and uses of groundwater are protected from undesirable results. Pumping at the long-term sustainable yield during dry years would likely temporarily lower groundwater elevations and reduce the amount of groundwater in storage. Such short-term impacts, due to drought, are anticipated in

SGMA and management actions should contain sufficient flexibility to accommodate them by ensuring they are offset by increases in groundwater levels or storage during normal or wet periods. Prolonged reductions in the amount of groundwater in storage could lead to undesirable results affecting beneficial users and uses of groundwater. In particular, groundwater pumpers that rely on water from shallow wells may be temporarily impacted by temporary reductions in the amount of groundwater in storage drops and lower water levels in their wells.

8.6 Seawater Intrusion Sustainable Management Criteria

The seawater intrusion sustainability indicator is not applicable to this Subbasin.

8.7 Degraded Water Quality Sustainable Management Criteria

8.7.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions were assessed based on federal and state mandated drinking water and groundwater quality regulations, the Sustainable Management Criteria survey, public meetings, and discussions with GSA staff. Significant and unreasonable changes in groundwater quality in the Subbasin are increases in a chemical constituent that either:

- Result in groundwater concentrations in a public supply well above an established primary or secondary MCL, or
- Lead to reduced crop production.

8.7.2 Minimum Thresholds

Section §354.28(c)(2)of the SGMA regulations states that "*The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin*."

As stated above, the SGMA regulations allow three options for setting degraded water quality minimum thresholds. In the Subbasin, degraded water quality minimum thresholds are based on a number of supply wells that exceed concentrations of constituents determined to be of concern for the Subbasin. The purpose of the minimum thresholds for constituents of concern with a primary or secondary MCL is to avoid furthering the migration of these constituents towards municipal or other drinking water wells. Therefore, the definition of supply wells for constituents of concern that have a primary or secondary MCL are public supply wells.

The purpose of the minimum thresholds for constituents of concern that may reduce crop productivity is to avoid furthering the migration of these constituents towards agricultural supply wells. Therefore, the definition of supply wells for constituents of concern that may lead to reduced crop production are agricultural supply wells.

As noted in Section 354.28 (c)(4) of the SGMA regulations, minimum thresholds are based on a degradation of groundwater quality, not an improvement of groundwater quality. Therefore, this GSP was developed to avoid taking actions that may inadvertently move groundwater constituents that have already been identified in the Subbasin in such a way that they have a significant and unreasonable impact that would not otherwise occur. Constituents of concern must meet two criteria:

1. They must have an established level of concern such as a primary or secondary MCL or a concentration that reduces crop production
2. They must have previously been found in the Subbasin at levels above the level of concern

Based on the review of groundwater quality in Chapter 5, different constituents of concern exist for both agricultural wells and public supply wells. The constituents of concern for agricultural wells are:

- Chloride
- Boron

The constituents of concern for public supply wells are:

- Total Dissolved Solids
- Chloride
- Sulfate
- Nitrate
- Gross Alpha Radiation

As noted in Section 5.6.3, based on available information there are no mapped groundwater contamination plumes in the Subbasin. Therefore, only potential impacts of diffuse or naturally occurring constituents listed above are addressed in this GSP.

The bases for establishing minimum thresholds for each constituent of concern in the Paso Robles Formation Aquifer and Alluvial Aquifer are listed in Table 8-5~~Table 8-4~~5. This table does not identify the number of supply wells that will exceed the level of concern, but rather identifies how many additional wells will be allowed to exceed the level of concern. Wells that already exceed this limit are not counted against the minimum thresholds. In the table, minimum thresholds are generally set to the number of existing exceedances plus 10%. When the additional 10% reflects less than one exceedance, one additional exceedance is allowed. For example, if there are currently three exceedances of a constituent in an aquifer, the minimum threshold is set to

$$Exceedences = 3\ x\ 1.1 = 3.3\ where\ 1.1\ represents\ 110\%$$

$$Rounded\ Up\ To\ 4$$

The UC Cooperative Extension Guidelines state "Unlike most annual crops, tree and vine crops are generally susceptible to boron and chloride toxicity. Tolerances vary among species and rootstocks. Tolerant varieties and rootstocks restrict the uptake and accumulation of boron and chloride in leaf tissue. Boron concentrations in the irrigation water exceeding 0.5 to 0.75 mg/L can reduce plant growth and yield. Climatic effects are also important. In the cool moist coastal climates, irrigation waters with boron concentrations exceeding 1 mg/L are used successfully on tree and vine crops. Chloride moves readily with the soil water and is taken up by the roots. It is then transported to the stems and leaves. Sensitive berries and avocado rootstocks can tolerate only up to 120 ppm of chloride, while grapes can tolerate up to 700 ppm or more."

Current sample size is small (more wells will be added in the future), but known conditions in the Subbasin include these constituents. To reduce crop production to a significant and unreasonable extent would require levels of boron to exceed 0.75 mg/L in 10% more wells of total wells sampled and chloride to exceed 350 mg/L in 10% more wells of total wells sampled.

Table 8-545. Groundwater Quality Minimum Thresholds Bases

Constituent of Concern	Minimum Threshold Based on Number of Production Wells
Agricultural Wells in Monitoring Program	
Chloride	Fewer than 10% of additional agricultural production wells that are in the GSP monitoring program shall exceed 350 milligrams per liter (mg/L).
Boron	Fewer than 10% of additional agricultural production wells that are in the GSP monitoring program shall exceed 0.5 mg/L.
Municipal Wells in Monitoring Program	
Total Dissolved Solids	Fewer than 10% of additional municipal or domestic production wells that are in the GSP monitoring program shall exceed the TDS secondary MCL of 500 mg/L.
Chloride	Fewer than 10% of additional municipal or domestic production wells that are in the GSP monitoring program shall exceed the chloride secondary MCL of 250 mg/L.
Sulfate	Fewer than 10% of additional municipal or domestic production wells that are in the GSP monitoring program shall exceed the sulfate secondary MCL of 250 mg/L.
Nitrate	Fewer than 10% of additional municipal or domestic production wells that are in the GSP monitoring program shall exceed the nitrate MCL of 45 mg/L, measured as nitrate.
Gross Alpha Radiation	Fewer than 10% of additional municipal or domestic production wells that are in the GSP monitoring program shall exceed the gross alpha radiation MCL of 15 pCi/L.

8.7.2.1 Paso Robles Formation Aquifer

The minimum thresholds for degraded water quality in the Paso Robles Formation Aquifer are based on the goal of fewer than 10% of additional exceedances can occur in the future. However, some exceedances already exist in Paso Robles Formation Aquifer wells, and these exceedances will likely continue into the future. The minimum threshold for the number of allowed exceedances is therefore equal to the current number of exceedances plus 10%. In cases where incorporating the increase of 10% results in a fraction of a well less than one, one additional well exceedance was allowed. Based on the number of agricultural and municipal supply wells in the existing water quality monitoring network that is described in Chapter 7, the number of existing exceedances plus the 10% (or a minimum of one well) for each constituent is shown in Table 8-6Table 8-56. The exceedance numbers in this table are the minimum thresholds. This table additionally includes the percentage of existing wells that exceed the minimum thresholds for each constituent. The percentage defines the upper bound of wells that can exceed the minimum thresholds as additional wells are added to the monitoring program. Existing State, Federal, Public Health or Municipal regulations supersede this. Wells in exceedance of those Regulations will have to comply if they occur.

AG Order 4.0 for Central Coast Region is under review and this GSP will comply with its findings.

Table 8-656. Minimum Thresholds for Degraded Groundwater Quality in Paso Robles Formation Aquifer Supply Wells Under the Current Monitoring Network [1]

Constituent of Concern	Number of Existing Supply Wells in Monitoring Network	Minimum Threshold Based on Existing Monitoring Network	Percentage of Wells with Exceedances
Agricultural Wells			
Chloride	28	4	14%
Boron	28	10	36%
Municipal Wells			
Total Dissolved Solids	34	12	35%
Chloride	34	2	6%
Sulfate	34	2	6%
Nitrate	34	2	6%
Gross Alpha Radiation	32	0	0%

1 – Data for this table were obtained from the following website: geotracker.waterboards.ca.gov/gama/gamamap/public/

8.7.2.2 Alluvial Aquifer

The minimum thresholds for degraded water quality in the Alluvial Aquifer are similarly based on the goal of fewer than 10% of additional exceedances shown in Table 8-5Table 8-45. Following the same process as the Paso Robles Formation Aquifer, the minimum thresholds for degraded water quality in the Alluvial Aquifer are shown in Table 8-7Table 8-67. All agricultural supply wells are assumed to pump from the Paso Robles Formation Aquifer, and therefore there are no agricultural well minimum thresholds set in the Alluvial Aquifer. As with the Paso Robles Formation Aquifer, as additional wells are added to the monitoring program, the percentage of wells exceeding the minimum threshold will not increase.

Table 8-~~7~~6~~7~~. Minimum Thresholds for Degraded Groundwater Quality in Alluvial Aquifer Supply Wells Under the Current Monitoring Network [1]

Constituent of Concern	Number of Existing Supply Wells in Monitoring Network	Minimum Threshold Based on Existing Monitoring Network	Percentage of Wells with Exceedances
Public Supply Wells			
Total Dissolved Solids	8	5	63%
Chloride	8	3	38%
Sulfate	8	3	38%
Nitrate	9	0	0%
Gross Alpha Radiation	7	0	0%

1 – Data for this table were obtained from the following website: geotracker.waterboards.ca.gov/gama/gamamap/public/

8.7.2.3 Information Used and Methodology for Establishing Water Quality Minimum Thresholds

The information used for establishing the degraded groundwater quality minimum thresholds included:

- Historical groundwater quality data from production wells in the Subbasin
- Federal and state drinking water quality standards
- Feedback about significant and unreasonable conditions from GSA staff members and the public

The historical groundwater quality data used to establish groundwater quality minimum thresholds are presented in Chapter 5.

Based on the review of historical and current groundwater quality data, federal and state drinking water standards, and irrigation water quality needs, GSAs agreed that these standards are appropriate to define degraded groundwater quality minimum thresholds.

8.7.2.4 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The groundwater quality minimum thresholds were set for each of six constituents that are currently found in the Subbasin above water quality standards or irrigation guidance levels. These minimum thresholds were derived from existing data measured at individual wells. There are no conflicts between the existing groundwater quality data; and therefore, the minimum thresholds represent a reasonable and realistic distribution of groundwater quality.

Because the underlying groundwater quality distribution is reasonable and realistic, there is no conflict that prevents the Subbasin from simultaneously achieving all six minimum thresholds.

Because SGMA regulations do not require projects or actions to improve groundwater quality, there will be no direct actions under the GSP associated with the groundwater quality minimum thresholds. Therefore, there are no actions that directly influence other sustainability indicators. However, preventing migration of poor groundwater quality may limit activities needed to achieve minimum thresholds for other sustainability indicators.

- **Change in groundwater levels**. Groundwater quality minimum thresholds could influence groundwater level minimum thresholds by limiting the types of water that can be used for recharge to raise groundwater levels. Water used for recharge cannot exceed any of the groundwater quality minimum thresholds.
- **Change in groundwater storage**. Nothing in the groundwater quality minimum thresholds promotes pumping in excess of the sustainable yield. Therefore, the groundwater quality minimum thresholds will not result in an exceedance of the groundwater storage minimum threshold.
- **Seawater intrusion**. This sustainability indicator is not applicable to this Subbasin
- **Subsidence**. Nothing in the groundwater quality minimum thresholds promotes a condition that will lead to additional subsidence and therefore, the groundwater quality minimum thresholds will not result in a significant or unreasonable level of subsidence.
- **Depletion of interconnected surface waters**. Nothing in the groundwater quality minimum thresholds promotes additional pumping or lower groundwater elevations in areas where interconnected surface waters may exist. ~~At this time, there are insufficient data to determine the existence in interconnected surface water in the Subbasin. This is a data gap that will be filled early in GSP implementation.~~ Therefore, the groundwater quality minimum thresholds will not result in a significant or unreasonable depletion of interconnected surface waters.

8.7.2.5 Effect of Minimum Thresholds on Neighboring Basins

The anticipated effect of the degraded groundwater quality minimum thresholds on each of the two neighboring subbasins is addressed below.

Upper Valley Subbasin of the Salinas Valley Basin. The Upper Valley Subbasin is hydrogeologically down gradient of the Paso Robles Subbasin, thus groundwater generally flows from the Paso Robles Subbasin into the Upper Valley Subbasin. Poor groundwater quality in the Paso Robles Subbasin could flow into the Upper Valley Subbasin, affecting the ability to achieve sustainability in that Subbasin. The degraded groundwater quality minimum threshold is set to prevent unreasonable movement of poor-quality groundwater that could impact overall beneficial uses of groundwater. Therefore, it is unlikely that the groundwater quality minimum thresholds established for the Paso Robles Subbasin will prevent the Upper Valley Subbasin from achieving sustainability.

Atascadero Subbasin. Groundwater generally flows from the Atascadero Subbasin into the Paso Robles Subbasin. Therefore, poor quality groundwater in the Paso Robles Subbasin is not expected flow into the Atascadero Subbasin in the future, thus the Paso Robles Subbasin groundwater quality minimum thresholds will not likely prevent the Atascadero Subbasin from achieving sustainability.

8.7.2.6 Effect on Beneficial Uses and Users

Agricultural land uses and users. The degraded groundwater quality minimum thresholds generally benefit the agricultural water users in the Subbasin. For example, limiting the number of additional agricultural supply wells that could exceed constituent of concern concentrations that could reduce crop production ensures that a supply of usable groundwater will exist for beneficial agricultural use.

Urban land uses and users. The degraded groundwater quality minimum thresholds generally benefit the urban water users in the Subbasin. Limiting the number of additional wells where constituents of concern could exceed primary or secondary MCLs ensures an adequate supply of groundwater for municipal use.

Domestic land uses and users. The degraded groundwater quality minimum thresholds generally benefit the domestic water users in the Subbasin.

Ecological land uses and users. Although the groundwater quality minimum thresholds do not directly benefit ecological uses, it can be inferred that the degraded groundwater quality minimum thresholds generally benefit the ecological water uses in the Subbasin. Preventing constituents of concern from migrating will prevent unwanted contaminants from impacting ecological groundwater supply.

8.7.2.7 Relation to State, Federal, or Local Standards

The degraded groundwater quality minimum thresholds specifically incorporate federal and state drinking water standards.

8.7.2.8 Method for Quantitative Measurement of Minimum Thresholds

Degraded groundwater quality minimum thresholds will be directly measured from existing or new municipal or agricultural supply wells. Groundwater quality will initially be measured using existing monitoring programs.

- Exceedances of primary or secondary MCLs will be monitored by reviewing annual water quality reports submitted to the California Division of Drinking water by municipalities and small water systems.
- Exceedances of crop production minimum thresholds will be monitored as part of the ILRP as presented in Chapter 7.

8.7.3 Measurable Objectives

Groundwater quality should not be degraded due to actions taken under this GSP and, therefore, the measurable objectives were set to the number of exceedances present in 2017.

8.7.3.1 Paso Robles Formation Aquifer

Based on the existing monitoring network, the measurable objectives for degraded groundwater quality in the Paso Robles Formation Aquifer are shown in Table 8-8Table 8-78.

Table 8-878. Measurable Objectives for Degraded Groundwater Quality in Paso Robles Formation Aquifer Supply Wells Under the Current Monitoring Network

Constituent of Concern	Number of Existing Supply Wells in Monitoring Network	Measurable Objective Based on Existing Monitoring Network	Percentage of Wells with Exceedances
Agricultural Wells			
Chloride	28	3	14%
Boron	28	9	36%
Municipal Wells			
Total Dissolved Solids	34	10	35%
Chloride	34	1	6%
Sulfate	34	1	6%
Nitrate	34	1	6%
Gross Alpha Radiation	32	0	0%

8.7.3.2 Alluvial Aquifer

Based on the existing monitoring network, the measurable objectives for degraded groundwater quality in the Paso Robles Formation Aquifer are shown in Table 8-9Table 8-89.

Table 8-989. Measurable Objectives for Degraded Groundwater Quality in Alluvial Aquifer Supply Wells Under the Current Monitoring Network

Constituent of Concern	Number of Existing Supply Wells in Monitoring Network	Measurable Objective Based on Existing Monitoring Network	Percentage of Wells with Exceedances
Public Supply Wells			
Total Dissolved Solids	8	4	63%
Chloride	8	2	38%
Sulfate	8	2	38%
Nitrate	9	0	0%
Gross Alpha Radiation	7	0	0%

8.7.3.3 Method for Setting Measurable Objectives

Because improving groundwater quality is not a goal under SGMA, and protecting it is important to the beneficial users and uses of the resource, the measurable objectives were set to the number of exceedances present in 2017 (as identified in Tables 8-7 and 8-8).

8.7.3.4 Interim Milestones

Interim milestones show how the GSAs anticipate moving from current conditions to meeting the measurable objectives. For water quality, measurable objectives are set at the current number of water quality exceedances. Interim milestones are set for each five-year interval following GSP adoption.

The interim milestones for degraded groundwater quality were set at the measurable objectives for 5, 10 and 15 years after GSP adoption. The interim milestones for the constituents in the Paso Robles Formation Aquifer are shown in Table 8-10Table 8-910.

Table 8-10910. Interim Milestone Groundwater Quality Exceedances in Paso Robles Formation Aquifer Supply Wells Under the Current Monitoring Network

Constituent of Concern	Five Year Number of Groundwater Quality Exceedances	Ten Year Number of Groundwater Quality Exceedances	Fifteen Year Number of Groundwater Quality Exceedances

Agricultural Supply Wells			
Chloride	3	3	3
Boron	9	9	9
Public supply wells			
Total Dissolved Solids	10	10	10
Chloride	1	1	1
Sulfate	1	1	1
Nitrate	1	1	1
Gross Alpha Radiation	0	0	0

The interim milestones for the constituents in the Alluvial Aquifer are shown in Table 8-11~~Table 8-10~~11.

Table 8-11~~10~~11. Interim Milestone Groundwater Quality Exceedances in Alluvial Aquifer Supply Wells Under the Current Monitoring Network

Constituent of Concern	5-Year Number of Groundwater Quality Exceedances	10-Year Number of Groundwater Quality Exceedances	15-Year Number of Groundwater Quality Exceedances
Public supply wells			
Total Dissolved Solids	4	4	4
Chloride	2	2	2
Sulfate	2	2	2
Nitrate	0	0	0
Gross Alpha Radiation	0	0	0

8.7.4 Undesirable Results

8.7.4.1 Criteria for Defining Undesirable Results

By SGMA regulations, the degraded groundwater quality undesirable result is a quantitative combination of groundwater quality minimum threshold exceedances. For the Subbasin, groundwater quality degradation is unacceptable only as a direct result of actions taken as part of GSP implementation. Therefore, the degraded groundwater quality undesirable result is:

On average during any one year, no groundwater quality minimum threshold shall be exceeded in any aquifer as a direct result of projects or management actions taken as part of GSP implementation.

8.7.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include the following:

- **Required Changes to Subbasin Pumping**. If the location and rates of groundwater pumping change as a result of projects implemented under the GSP, these changes could cause movement of one of the constituents of concern towards a supply well at concentrations that exceed relevant water quality standards.
- **Groundwater Recharge**. Active recharge with imported water or captured runoff could cause movement of one of the constituents of concern towards a supply well in concentrations that exceed relevant water quality standards.
- **Recharge of Poor-Quality Water**. Recharging the Subbasin with water that exceeds a primary or secondary MCL or concentration that reduces crop production could lead to an undesirable result.

8.7.4.3 Effects on Beneficial Users and Land Use

The practical effect of the degraded groundwater quality undesirable result is that it deters any significant changes to groundwater quality. Therefore, the undesirable result will not impact the use of groundwater and will not have a negative effect on the beneficial users and uses of groundwater.

8.8 Land Subsidence Sustainable Management Criteria

8.8.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions for land subsidence were assessed based on public meetings and discussions with GSA staff. Significant and unreasonable rates of land subsidence in the Subbasin are those that lead to a permanent subsidence of land surface elevations that impact infrastructure. For clarity, this Sustainable Management Criterion adopts two related concepts:

- **Land Subsidence** is a gradual settling of the land surface caused by, among other processes, compaction of subsurface materials due to lowering of groundwater elevations from groundwater pumping. Land subsidence from dewatering subsurface clay layers can be an inelastic process, and the potential decline in land surface could be permanent.

- **Land Surface Fluctuation** is the periodic or annual measurement of the ground surface elevation. Land surface may rise or fall in any one year. Declining land surface fluctuation may or may not indicate long-term permanent subsidence.

Currently, InSAR data provided by DWR shows that meaningful land subsidence did not occur during the period between June 2015 and June 2018 in the Paso Robles Subbasin.

8.8.2 Minimum Thresholds

Section 354.28(c)(5) of the SGMA regulations states that "*The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results.*"

Based on an analysis of potential errors in the InSAR data, as discussed in the following section, the subsidence minimum threshold is:

The InSAR measured subsidence between June of one year and June of the subsequent year shall be no more than 0.1 foot in any single year and a cumulative 0.5 foot in any five-year period, resulting in no long-term permanent subsidence.

8.8.2.1 Information Used and Methodology for Establishing Subsidence Minimum Thresholds

Minimum thresholds were established to protect groundwater supply, land uses and property interests from substantial subsidence that may lead to undesirable results. Changes in surface elevation are measured using InSAR data available from DWR. The general minimum threshold is the absence of long-term land subsidence due to pumping in the Subbasin. The InSAR data provided by DWR, however, are subject to measurement error. DWR has stated that, on a statewide level, for the total vertical displacement measurements between June 2015 and June 2018, the errors are as follows (Benjamin Brezing, personal communication):

1. The error between InSAR data and continuous GPS data is 16 mm (0.052 feet) with a 95% confidence level

2. The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 feet with 95% confidence level.

By simply adding errors 1 and 2, we arrive at a combined error of 0.1 foot. While this is not a robust statistical analysis, it does provide an estimate of the potential error in the InSAR maps provided by DWR. A land surface change of less than 0.1 feet is therefore within the noise of the data, and is equivalent to no subsidence in this GSP.

Additionally, the InSAR data provided by DWR reflects both elastic and inelastic subsidence. While it is difficult to compensate for elastic subsidence, visual inspection of monthly changes in ground elevations suggest that elastic subsidence is largely seasonal. ~~Figure 8-1~~Figure 8-3~~Figure 8-3~~ shows the ground level changes at a randomly selected point in the area where InSAR data are available. This figure demonstrates the general seasonality of the elastic subsidence. To minimize the influence of elastic subsidence on our assessment of long-term, permanent subsidence, changes in ground level will be measured annually from June of one year to June of the following year.

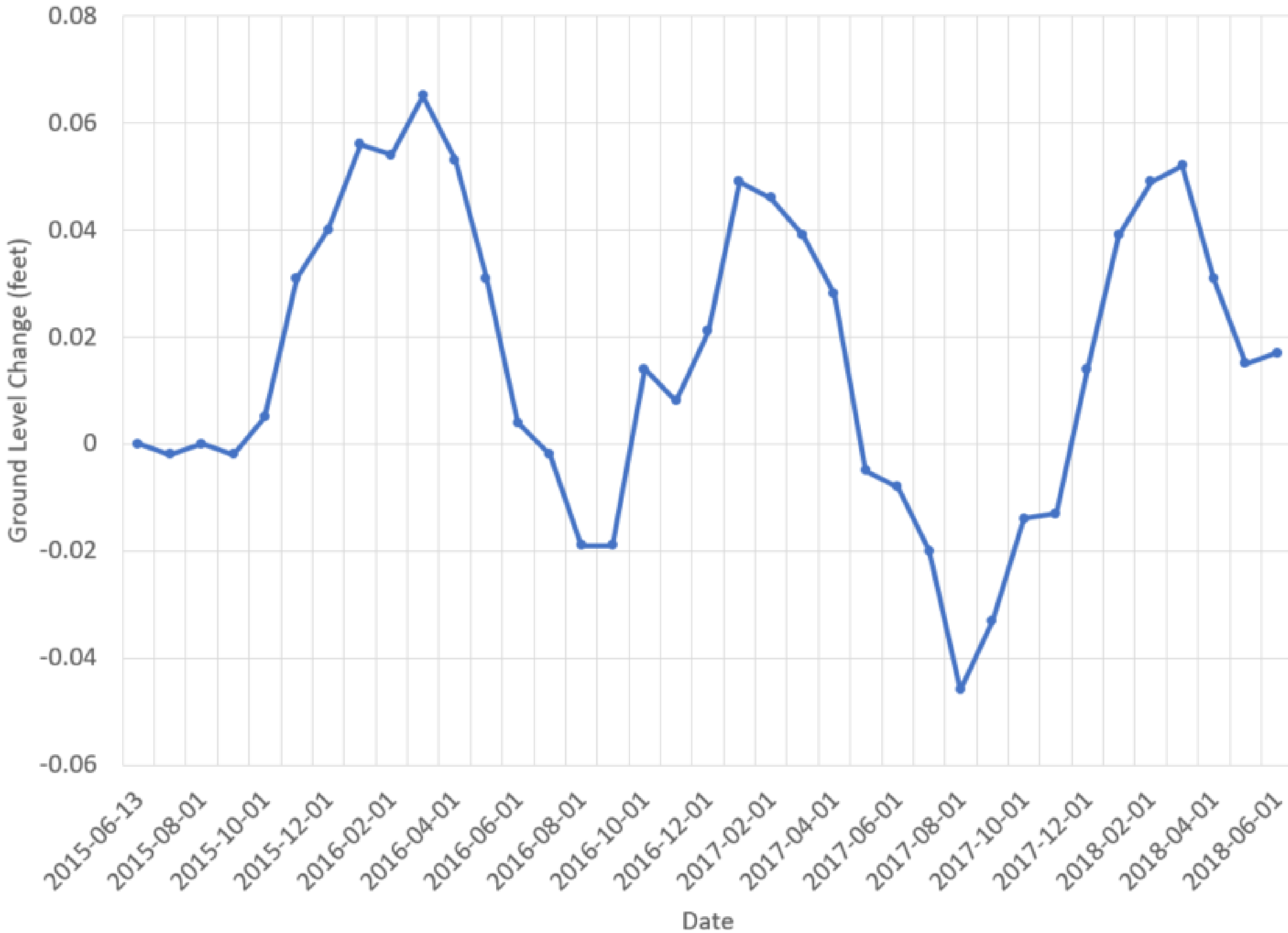


Figure 8-313: Example Seasonal Ground Surface Change

8.8.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

Subsidence minimum thresholds have little or no impact on other minimum thresholds, as described below.

- **Chronic lowering of groundwater elevations**. Subsidence minimum thresholds will not result in significant or unreasonable groundwater elevations.
- **Change in groundwater storage**. The subsidence minimum thresholds will not change the amount of pumping, and will not result in a significant or unreasonable change in groundwater storage.
- **Seawater intrusion**. This sustainability indicator is not applicable in the Paso Robles Subbasin.
- **Degraded water quality**. The subsidence minimum thresholds will not change the groundwater flow directions or rates, and therefore and will not result in a significant or unreasonable change in groundwater quality.
- **Depletion of interconnected surface waters**. The ground level subsidence minimum thresholds will not change the amount or location of pumping and will not result in a significant or unreasonable depletion of interconnected surface waters.

8.8.2.3 Effect of Minimum Thresholds on Neighboring Basins

The anticipated effect of the subsidence minimum thresholds on each of the two neighboring subbasins is addressed below.

- **Upper Valley Subbasin of the Salinas Valley Basin**. The ground surface subsidence minimum thresholds are set to prevent any long-term subsidence that could harm infrastructure. Therefore, the subsidence minimum thresholds will not prevent the Upper Valley Subbasin from achieving sustainability.
- **Atascadero Subbasin**. The subsidence minimum thresholds are set to prevent any long-term subsidence that could harm infrastructure. Therefore, the subsidence minimum thresholds will not prevent the Atascadero Subbasin from achieving sustainability.

8.8.2.4 Effects on Beneficial Uses and Users

The subsidence minimum thresholds are set to prevent subsidence that could harm infrastructure. Available data indicate that there is currently no subsidence occurring in the Subbasin that affects infrastructure, and reductions in pumping are already required by the reduction in groundwater storage sustainability indicator. Therefore, the subsidence minimum thresholds do not require any additional reductions in pumping and there is no negative impact on any beneficial user.

8.8.2.5 Relation to State, Federal, or Local Standards

There are no federal, state, or local regulations related to subsidence.

8.8.2.6 Method for Quantitative Measurement of Minimum Threshold

Minimum thresholds will be assessed using DWR supplied InSAR data.

8.8.3 Measurable Objectives

The measurable objectives for subsidence represent target subsidence rates in the Subbasin. Long-term ground surface elevation data do not suggest the occurrence of permanent subsidence in the Subbasin. Therefore, the measurable objective for subsidence is maintenance of current ground surface elevations.

8.8.3.1 Method for Setting Measurable Objectives

The measurable objectives are set based on maintaining current conditions and changes are measured by DWR-supplied InSAR data.

8.8.3.2 Interim Milestones

Interim milestones show how the GSAs anticipate moving from current conditions to meeting the measurable objectives. Interim milestones are set for each five-year interval following GSP adoption.

Subsidence measurable objectives are set at current conditions of no long-term subsidence. Therefore, there is no change between current conditions and sustainable conditions. Therefore, the interim milestones are identical to the minimum thresholds and measurable objectives.

8.8.4 Undesirable Results

8.8.4.1 Criteria for Defining Undesirable Results

By regulation, the ground surface subsidence undesirable result is a quantitative combination of subsidence minimum threshold exceedances. For the Subbasin, no long-term subsidence that impacts infrastructure is acceptable. Therefore, the ground surface subsided undesirable result is:

Pumping induced subsidence of greater than 0.1 foot in any single year and a cumulative 0.5 foot in any five-year period could, if left unchecked, substantially interfere with surface land use.

Should potential subsidence be observed, the GSAs will first assess whether the subsidence may be due to elastic processes. If the subsidence is not elastic, the GSAs will undertake a program to correlate the observed subsidence with measured groundwater levels.

8.8.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include a shift in pumping locations, which could lead to a substantial decline in groundwater levels. Shifting a significant amount of pumping and causing groundwater levels to fall in an area that is susceptible to subsidence could trigger subsidence in excess of the minimum thresholds.

8.8.4.3 Effects on Beneficial Users and Land Use

Staying above the minimum threshold will avoid the subsidence undesirable result and protect the beneficial uses and users from impacts to infrastructure and interference with surface land uses.

8.9 Depletion of Interconnected Surface Water SMC

8.9.1 Locally Defined Significant and Unreasonable Conditions

~~As described in Chapter 4, Hydrogeologic Conceptual Model and Chapter 5, Groundwater Conditions, there are insufficient data to determine whether surface water and groundwater are interconnected in the Subbasin. As described in Chapter 7, Monitoring Networks, a more expansive monitoring network will be developed during GSP implementation to improve understanding of interconnection between surface water and groundwater in the Subbasin. If in the future, data indicate that surface water and groundwater are interconnected, locally defined significant and unreasonable conditions will be assessed for those interconnected areas.~~

~~8.9.2 Minimum Thresholds~~

~~Section 354.28(c)(6) of the SGMA regulations states~~The two manifestations of depletion of interconnected surface water are reduced surface flow in streams and a lowering of the water table next to streams. The potential effects of depletion on beneficial uses of surface water and groundwater in the Subbasin are:

- Reduction in Salinas River outflow that decreases groundwater recharge in the Salinas Valley,

- Reduction in the extent, density, and health of riparian vegetation and animal species that use riparian habitat, and
- Reduction in passage opportunity for steelhead trout.

Each of these issues was considered in setting sustainable management criteria for interconnected surface water. In the case of habitat uses, the basis for the SMCs relies on the quantitative evaluation of groundwater effects on habitat presented in GSP Section 5.5.

8.9.2 Minimum Thresholds

~~"*The minimum threshold for depletions of interconnected surface water shall be*~~ The minimum threshold for interconnected surface water is a decline in the alluvial water table elevation as measured at Alluvial Aquifer RMS wells in the spring measurement round along the Salinas River, middle reach of the Estrella River (from Shedd Canyon to Martingale Circle) or San Juan Creek upstream of Spring Creek that is 1) likely caused by groundwater pumping in the Paso Robles Formation Aquifer, 2) is more than 10 feet below the spring 2017 elevation, 3) persists for more than two consecutive years, and 4) occurs along more than 15 percent of the length of any of the three stream reaches. It is noted that the potential connection along the Salinas River is between the surface water system and the adjacent alluvial deposits. There is no evidence that the Salinas River surface water flows are connected to the underlying Paso Robles Formation Aquifer. The potential connection between the surface water system along the middle reach of the Estrella River (from Shedd Canyon to Martingale Circle) and along San Juan Creek upstream of Spring Creek, and the underlying Paso Robles Formation Aquifer is unknown but sufficient evidence exists that there could potentially be a connection, and therefore further investigation in these areas is recommended.

SGMA regulations specify that the minimum threshold for interconnected surface water shall be defined as "the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results~~.~~" (Regulations §354.28(c)(6)). However, the regulations also allow the use of groundwater elevations as a reasonable proxy for the rate of flow depletion if such approach is "supported by adequate evidence" (Regulations §354.28(d)). In the Paso Robles Subbasin, depth to water is a reasonable proxy because the resource most likely to be impacted is phreatophytic riparian vegetation, which is sensitive to depth to water but not to the rate of percolation. Also, analysis of potentially impacted beneficial uses that do depend on the rate of stream flow—downstream water users and steelhead trout migration—indicates that the likely magnitude of impact is negligibly small. Finally, from a practical standpoint, induced percolation from streams is difficult to measure, particularly if it is a small percentage of total flow and varies substantially from reach to reach along a stream.

Data are insufficient to determine the existence of interconnected surface water and groundwater. Therefore, minimum thresholds were not developed for the GSP. If in the future, data from a more comprehensive monitoring program indicate that surface water and groundwater are interconnected, minimum thresholds will be developed for areas of interconnection. Since minimum thresholds were not developed for the GSP, information about the methods used to develop minimum thresholds, the quantitative metrics to track compliance with minimum thresholds, and their impact on other sustainability indicators, other Subbasins, and beneficial use and users of groundwater is not presented in this section like it was for the other sustainability indicators.

There presently are too few Alluvial Aquifer monitoring wells along the middle reach of the Estrella River and the upper reach of San Juan Creek to evaluate the minimum threshold. For the first five years of GSP implementation, the minimum threshold will be evaluated only for the Salinas River reach. New monitoring wells will be installed along the Estrella River and San Juan Creek during that period (see Section 7.6.1), allowing the minimum threshold to be applied to those reaches in subsequent implementation periods.

8.9.3 Measurable Objectives

Similar to minimum thresholds, measurable objectives were not developed for the GSP. If in the future, data from a more comprehensive monitoring program indicate that surface water and groundwater are interconnected, measurable objectives will be developed for areas of interconnection. Since measurable objectives were not developed for the GSP, information about the methods used to develop measurable objectives and interim milestones is not presented in this section like it was for the other sustainability indicators.

8.9.4 Undesirable Results

Because there are insufficient data to determine if there is an interconnection between surface water and groundwater in the Subbasin at this time, undesirable results, including impacts to beneficial uses and users of groundwater, related to interconnected surface water and groundwater are not expected to occur. If in the future, data from a more comprehensive monitoring program indicate that surface water and groundwater are interconnected, undesirable results related to interconnected surface water and groundwater will be assessed.

Measurable objectives are specific, quantifiable goals for the maintenance or improvement of groundwater conditions. They represent a desirable condition with respect to interconnected surface water. With respect to riparian vegetation, the measurable objective is a five-year moving average of spring groundwater elevations in Alluvial Aquifer wells along the Salinas River, the middle reach of the Estrella River (from Shedd Canyon to Martingale Circle) and San Juan Creek upstream of Spring Creek that are no more than 5 feet below the spring 2017 groundwater elevations. This objective is expected to maintain the extent and density of riparian vegetation at the 2017 level. It would also maintain Salinas River outflow and steelhead passage opportunity at existing levels, at least as far as they are affected by depletion from groundwater pumping.

There presently are too few Alluvial Aquifer monitoring wells along the middle reach of the Estrella River and the upper reach of San Juan Creek to evaluate the measurable objective. For the first five years of GSP implementation, the measurable objective will be evaluated only for the Salinas River reach. New monitoring wells will be installed along the Estrella River and San Juan Creek during that period (see Section 7.6.1), allowing the measurable objective to be applied to those reaches in subsequent implementation periods.

8.9.4 Relationship of Minimum Threshold to Other Sustainability Indicators

8.9.4.1 Groundwater Elevations

The measurable objective and minimum threshold for interconnected surface water involve groundwater elevations in the Alluvial Aquifer. They do not conflict with the SMCs for Alluvial Aquifer groundwater elevations because those are not yet quantified (see Sections 8.4.3.3 and 8.4.4.2). The interconnected surface water SMCs could potentially be more restrictive than the SMCs for Paso Robles Formation Aquifer groundwater elevations if the latter would allow large declines in water table elevations along protected reaches of riparian vegetation. Specifically, the Paso Robles Formation Aquifer minimum threshold allows for 30 feet of additional water-level decline below the 2017 groundwater elevation.

8.9.4.2 Groundwater Storage

Groundwater storage is inherently connected to groundwater levels. Based on the logic presented above for groundwater elevation SMCs, the interconnected surface water SMCs could potentially constrain temporary or sustained reductions in groundwater storage in some locations that would otherwise be allowed by the groundwater storage minimum threshold, which is defined as groundwater elevations averaged over the entire Subbasin that are above the groundwater elevation minimum threshold (see Section 8.5.2).

8.9.4.3 Subsidence

Subsidence is not related to Alluvial Aquifer water levels because the Alluvial Aquifer is too thin and coarse-grained to experience significant compaction of clay layers due to 10 feet of water-level decline. Subsidence is a function of Paso Robles Formation Aquifer water levels, which are not directly involved in the interconnected surface water SMCs. To the extent that the interconnected surface water SMCs constrain the permissible amount of decline in Paso Robles Formation Aquifer water-levels, they decrease the risk of subsidence.

8.9.4.4 Water Quality

The interconnected surface water SMCs would not affect groundwater gradients and recharge rates, and they would not introduce contaminants or cause changes in aquifer geochemistry. Thus, they would not affect the water quality SMCs.

8.9.5 Effect of SMCs on Neighboring Basins

The mechanism by which the interconnected surface water SMCs could affect the Upper Valley Subbasin in the Salinas Valley (adjacent to and downstream of the Paso Robles Subbasin) would be by decreased groundwater recharge resulting from decreased flow in the Salinas River. However, that effect would be negligibly small (see Section 8.9.7.1 under "Undesirable Results" below).

The interconnected surface water SMCs would not affect groundwater in the Atascadero Subbasin because any changes in Salinas River flow would not propagate upstream to that Subbasin. By maintaining GDEs in the Paso Robles Subbasin in good condition, the SMCs would support the regional maintenance of GDEs, especially animals that move up and down the river and riparian corridors.

8.9.6 Relationship of SMCs to Federal, State and Local Regulations

The only federal, state or local regulation that directly applies to stream flow gains and losses is the "live stream" requirement imposed by the State Water Resources Control Board in the water rights permit for operating Salinas Dam upstream of the Subbasin. However, that requirement reflects a concern that changes in surface flow might impact groundwater availability, not the opposite, which is the concern here.

The state and federal endangered species acts protect animal species listed as threatened or endangered against "take", which is to capture, harm, wound or kill the animal. Harm includes significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. The listed animals that appear to actually be present in the Subbasin and potentially vulnerable to depletion of interconnected surface water are steelhead trout and California red-legged frog. The SMCs for interconnected surface water are designed to sustain populations of GDE animals, including these listed species, at 2017 levels. This would avoid take.

8.9.7 Undesirable Results

Undesirable results are adverse effects on beneficial users and uses of water that reach a magnitude considered significant and unreasonable. This section defines undesirable results for surface water users, riparian vegetation and fish passage. Generally, undesirable results are defined in terms of the percent of all interconnected surface water reaches that exceed the minimum threshold.

8.9.7.1 Surface Water Users

Decreased groundwater discharge to the Salinas River would be significant and unreasonable if it prevented groundwater users in the Salinas Valley—where groundwater is primarily recharged by Salinas River percolation—from continuing their existing, economically viable agricultural or urban uses of land. This is not expected to occur because of the combined effects of the groundwater storage and interconnected surface water SMCs. A decrease in groundwater storage would be associated with lower groundwater elevations and decreased groundwater discharge to the Salinas River. The groundwater storage SMC allows for a reduction in storage to an amount associated with Paso Robles Formation Aquifer groundwater elevations 30 feet below 2017 groundwater elevations but does not allow further declines beyond that. Annual water budgets for 1981-2011 produced by the groundwater model show that groundwater discharge to the Salinas River is dominated by contributing flows from the alluvial deposits and clearly correlated with year type (it increases in wet years) but is not obviously correlated with changes in pumping and storage from the Paso Robles Formation Aquifer (see Figure 6-3), which are strongly correlated with each other (Figure 5-12). Average annual groundwater discharge to streams (7,400 AFY) equals about 1.5 percent of annual groundwater pumping downstream in the Salinas Valley. If pumping in the Paso Robles Subbasin were to change, its effect on groundwater discharge to the Salinas River would likely be small, and hence much less than 1.5 percent of downstream water use. This is because the connection along the Salinas River is between the surface water system and the adjacent alluvial deposits. There is no evidence that the Salinas River surface water flows are connected to the underlying Paso Robles Formation Aquifers. Furthermore, to achieve the groundwater level management objective it will be necessary to balance the Subbasin water budget, which means that groundwater pumping will not cause increased depletion of stream flow in the future. As stated in Section 6.5.1 "An overarching assumption is that any future increases in groundwater use within the Subbasin will be offset by equal reductions in groundwater use in other parts of the Subbasin, or in other words, groundwater use will remain neutral through implementation of the GSP." In any event, the interconnected surface water minimum threshold would tend to restrict rather than increase the amount of future storage depletion and thus be more protective of Salinas River outflow and downstream users.

8.9.7.2 Groundwater Dependent Vegetation

The qualitative undesirable result for riparian vegetation is mortality. The minimum threshold definition for interconnected surface water specifies a quantitative depth and duration of low water table conditions that are considered likely to cause riparian tree stress and potential mortality, based on observed limited mortality patterns during 2013 to 2017[1].

An exceedance of the minimum threshold at a single location would not necessarily be undesirable if riparian vegetation in other parts of the Subbasin remained in good condition. Regional ecological function would continue, and the locally impacted area would likely recover when the water table rises back to more normal elevations above the minimum threshold. However, widespread exceedance of the minimum threshold could impair regional ecological function and retard the recovery process. Accordingly, an undesirable result is when water levels along more than 15 percent of the length of any of the three stream reaches with abundant riparian vegetation exceed the minimum threshold (defined in Section 8.9.3) as a result of groundwater pumping in the Paso Robles Formation Aquifer. The three reaches are the Salinas River from Paso Robles to the Subbasin boundary below San Miguel, the middle reach of the Estrella River (Shedd Canyon to Martingale Circle), and San Juan Creek upstream of Spring Creek.

8.9.7.3 Groundwater Dependent Animals

Animals that depend on riparian vegetation are assumed to suffer population declines if the extent of riparian vegetation decreases and thus are implicitly covered by the SMCs and undesirable results for vegetation. The undesirable result for steelhead trout—which uses surface flow in the Salinas River for migration—is a long-term decrease in population as a result of flow depletion caused by groundwater pumping. As explained in section 5.5.10, groundwater pumping has little effect on passage opportunity. Because the SMCs for groundwater levels and storage preclude ongoing future increases in pumping or decreases in groundwater levels, undesirable results with respect to steelhead passage are not expected to occur.

8.10 Management Areas

Management areas have not been established in the Subbasin. For planning purposes, the concepts for future management areas are provided below.

8.10.1 Future Management Area Concept

Management areas may be developed in the future based on the existence of a geologic and geographic divide in the Subbasin. The Subbasin is dominated by two main watersheds and many smaller watersheds that drain into and recharge the Subbasin. The western portion of the Subbasin is fed by the Salinas watershed, including the Huer Huero watershed. The

[1] Results of a riparian vegetation EVI trend analysis indicate that riparian vegetation health has generally remained stable over the long term from January 2009 through present (see Section 5.5.3).

eastern portion of the Subbasin is fed by the Estrella River watershed, including Cholame Creek and San Juan Creek watersheds. These two watersheds have different geologic and climatic conditions. Both watersheds drain to the confluence of the Estrella and Salinas Rivers near San Miguel in the northern end of the Subbasin. A distinct geologic ridge divides the Huer Huero portion of the Salinas River watershed from the Shed Canyon portion of the Estrella River watershed. This uplifted ridge bisects the Subbasin and the Estrella River cuts through this ridge near Whitley Gardens. The Subbasin may be divided into western and eastern management areas along the uplifted ridge in the future.

The nature of this divide and the underlying geology within the Subbasin needs to be better understood before the GSAs can delineate and justify any management area. The GSAs will initiate and support electromagnetic resonance surveys to help delineate local geology. Reports from well owners throughout the Subbasin suggest that some areas of the Subbasin are distinctly isolated from neighboring areas. Analysis of static groundwater levels from as many wells as possible will help to define areas where groundwater conditions appear to be hydrologically connected and areas where these conditions seem to be hydrologically isolated. This will help form the basis of defining the management area. This effort will also assist in defining where future monitoring wells should be located. The GSAs in the proposed management areas may undertake distinct management approaches which would be appropriately designed to protect the local groundwater resource without adversely impacting other areas of the Subbasin or neighboring Subbasins.

Each area of the Subbasin will be managed in conjunction with all other areas using the same set of undesirable results and minimum thresholds, tied to specific RMSs as described in this chapter. The Subbasin wide monitoring networks will be used to assure compliance with the GSP. Using management areas to assure long-term sustainability protects all beneficial uses and users in all parts of the Subbasin.

8.10.2 Minimum Thresholds and Measurable Objectives

The minimum thresholds that will be established in potential management areas will use the same process and criteria described above in this chapter. The minimum thresholds and measurable objectives will be developed to ensure groundwater levels remain above historical water levels in each management area, and to maintain historical groundwater flow conditions to downstream portions of the Subbasin and other downstream basins. By managing groundwater sustainably in each management area, the groundwater resource remains available for beneficial uses and users. Groundwater quality will not be degraded due to poor quality water moving into productive aquifers.

8.10.3 Monitoring

Because of the large size and distinctly separate drainages of the watersheds draining into each of management area, there is a need for a robust network of monitoring wells that provide data representative of specific portions of each management area. Initially, existing wells with known depths and known perforated intervals will be selected and used. Where needed, dedicated new monitoring wells may be added to improve the monitoring network.

8.10.4 How Management Areas Will Avoid Undesirable Results

The undesirable results described in the sections above are applicable in any management area that may be established in the future. As long as minimum thresholds are avoided and measurable objectives continue to be met within each management area, beneficial uses and users of the groundwater resource will be assured of continued access to a sustainable groundwater resource. The projects and management actions in each management area will be proportional to the need to avoid undesirable results.

8.10.5 Management

The establishment and implementation of Management Areas would follow the agreement among the four GSAs (see GSP Chapter 12).

9 MANAGEMENT ACTIONS AND PROJECTS

9.1 Introduction

The GSAs agree herein to work together in protecting the groundwater resource and in complying with SGMA, and further agree that this GSP makes no determination of water rights. GSP management actions undertaken to achieve sustainability under SGMA shall not result in or be construed as a forfeiture of or limitation on groundwater rights under common law.

This chapter describes the management actions that will be developed and implemented in the Subbasin to attain sustainability in accordance with §354.42 and §354.44 of the SGMA regulations. Management actions described herein are non-structural programs or policies that are intended to reduce or optimize local groundwater use. Consistent with SGMA regulations §354.44, this chapter also describes projects in process and conceptual projects involving new or improved infrastructure to make new water supplies available to the Subbasin that may be implemented by willing project participants to offset pumping and lessen the degree to which the management actions would be needed. The concept projects referenced are based on previous publicly vetted feasibility studies[2]. The need for management actions (and projects if implemented) is based on the following Subbasin conditions that were described in previous chapters.

- Groundwater levels are declining in many parts of the Subbasin, indicating that the amount of groundwater pumping is more than the natural recharge (Chapter 5)
- Water budgets (Chapter 6) indicate that amount of groundwater in storage will continue to decline in the future at an estimated rate of nearly 14,000 acre-feet per year (AFY), which assumes no net increase in pumping demand on the basin. If there is a net increase in demand due to e.g., the development of currently undeveloped properties in a way that requires the use of additional groundwater, the deficit would be greater.

To stop persistent declines in groundwater levels, achieve the sustainability goal before 2040, and avoid undesirable results as required by SMGA regulations, reducing groundwater pumping will be needed. Reductions in pumping will be required in amounts and locations which will prevent groundwater level declines that would result in undesirable results. A reduction in groundwater pumping will occur as a result of management actions, except where a new water supply becomes available and is used in lieu of pumping groundwater.

[2] Paso Robles Groundwater Basin Supplemental Supply Options Feasibility Study, January 2017

SGMA regulations §354.44 require that each management action and conceptual project described in the GSP include a discussion about:

- Relevant measurable objectives it would address
- The expected benefits of the action
- The circumstances under which management actions or projects will be implemented
- How the public will be noticed
- Relevant regulatory and permitting considerations
- Implementation schedules
- Legal authority required to take the actions
- Estimated costs

The groundwater management actions are intended to stabilize groundwater elevations, avoid undesirable results, and address all other sustainability indicators described in Chapter 8. Management actions to directly reduce groundwater pumping will be implemented where necessary. If groundwater levels are stabilized and/or sustained, many of the associated undesirable results described in Chapter 8 will be avoided.

The management actions (and projects if implemented) identified in this GSP will achieve groundwater sustainability by avoiding Subbasin-specific undesirable results.

***De Minimis* Groundwater Users**

While the number of *de minimis* groundwater users in the basin is significant, they are not currently regulated under this GSP. Growth of *de minimis* groundwater extractors could warrant regulated use in this GSP in the future. Growth will be monitored and reevaluated periodically.

9.2 Implementation Approach and Criteria for Management Actions

Using authorities outlined in Sections 10725 to 10726.9 of the California Water Code, the GSAs would ensure the maximum degree of local control and flexibility consistent with this GSP to commence management actions. Because the amount of groundwater pumping in the Subbasin is more than the estimated sustainable yield of about 61,000 AFY (see Chapter 6 and Appendix E)[3] and groundwater levels are persistently declining in certain areas, the GSAs

[3] Chapter 6 and Appendix E describe the process used to estimate sustainable yield. Sustainable yield is estimated based on the groundwater budget. The updated GSP model was used to develop the water budget and sustainable yield. Appendix E provides information on why the estimate of sustainable yield in the GSP differs from previous estimates.

will begin to implement management actions as early as possible after GSP adoption. The effect of the management actions will be reviewed annually, and additional management actions will be implemented as necessary to avoid undesirable results. Management actions fall into two categories, basin-wide and area specific, as described in more detail in the subsequent sections. Appendix L describes other programs that individual GSAs, pumpers and/or other entities may choose to fund and implement if they have the authority to do so.

In general, basin-wide management actions will apply to all Subbasin areas and reflect basic GSP implementation requirements such as monitoring, reporting and outreach, including necessary studies and early planning work, monitoring and filling data gaps with additional monitoring sites, annual reports and GSP updates, and promoting voluntary limitations in groundwater pumping aimed at both keeping groundwater levels stable and avoiding undesirable results.

Area specific management actions will also be implemented in areas experiencing persistent declines after the development of an appropriate regulation. Because developing and adopting the regulation will require substantial negotiations between the GSAs, public hearings, environmental review (CEQA) and legal risks that need to be addressed, efforts to define and gain approvals for the scope and detail associated with a regulation for area specific management actions will begin soon after GSP adoption. There is a strong need for adequate information to justify area specific management actions and considering that information will be a critical part of initial GSP implementation. Regulations adopted by GSAs related to identifying the specific areas for pumping limitations would need to be substantially identical to assure a consistent methodology for identifying those areas across the Subbasin. Individual pumpers in those areas will then need to choose how to comply with the necessary pumping limitations in those areas.

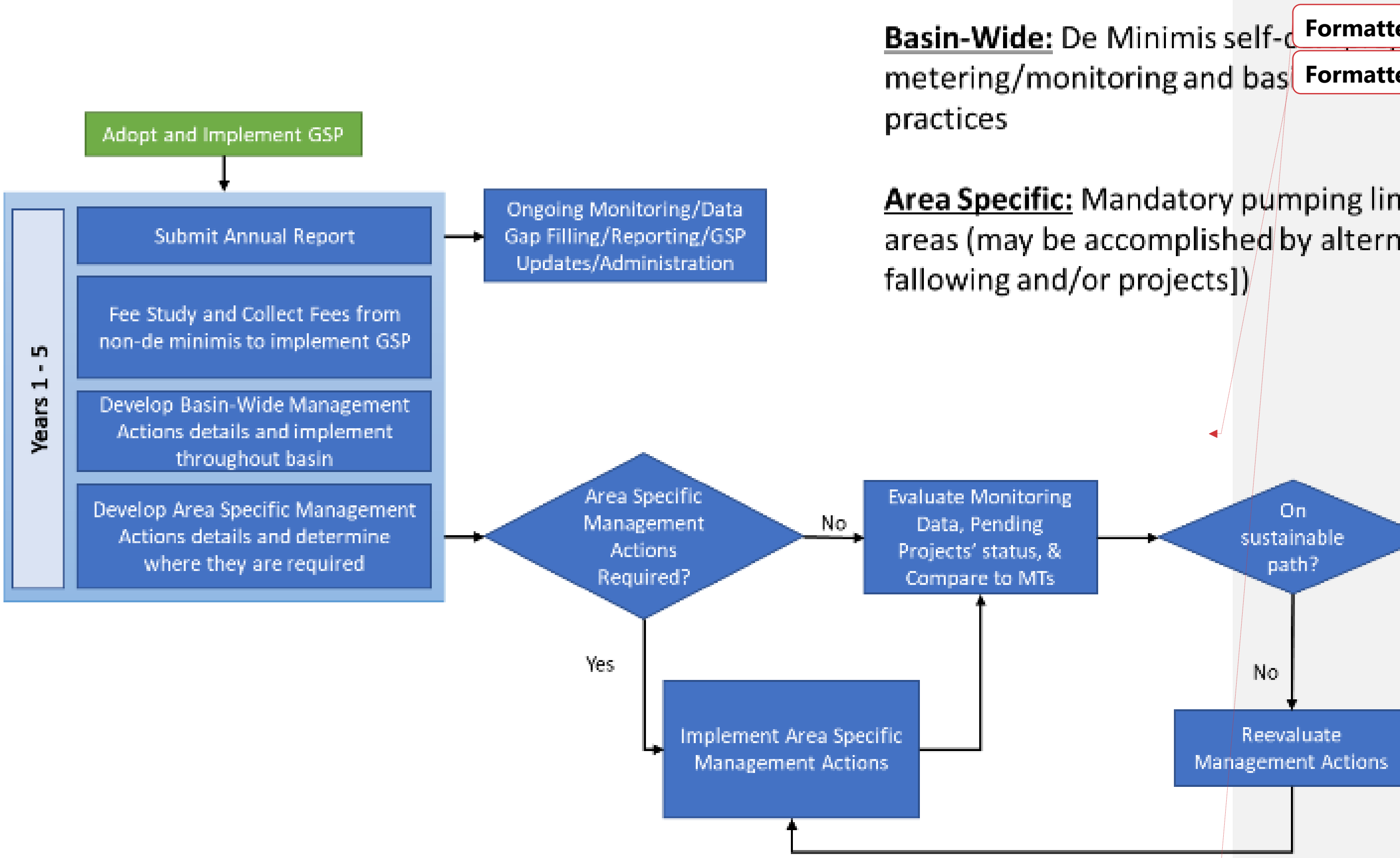


Figure 9-1~~Figure 9-1~~ shows a flowchart of the conceptual GSP implementation approach. Public meetings and hearings will be held during the process of determining when and where in the Subbasin management actions are needed. A proportional and equitable approach to funding implementation of the GSP and any optional actions will be developed in accordance with all State laws and applicable public process requirements. During these meetings and hearings, input from the public, interested stakeholders, and groundwater pumpers will be considered and incorporated into the decision-making process.

At a time in the future when the effects of management actions have stabilized groundwater levels, the GSAs will reassess the need for continuing these actions. At a minimum, the reassessment process would be done as part of the 5-year review and report to the regulatory agencies.

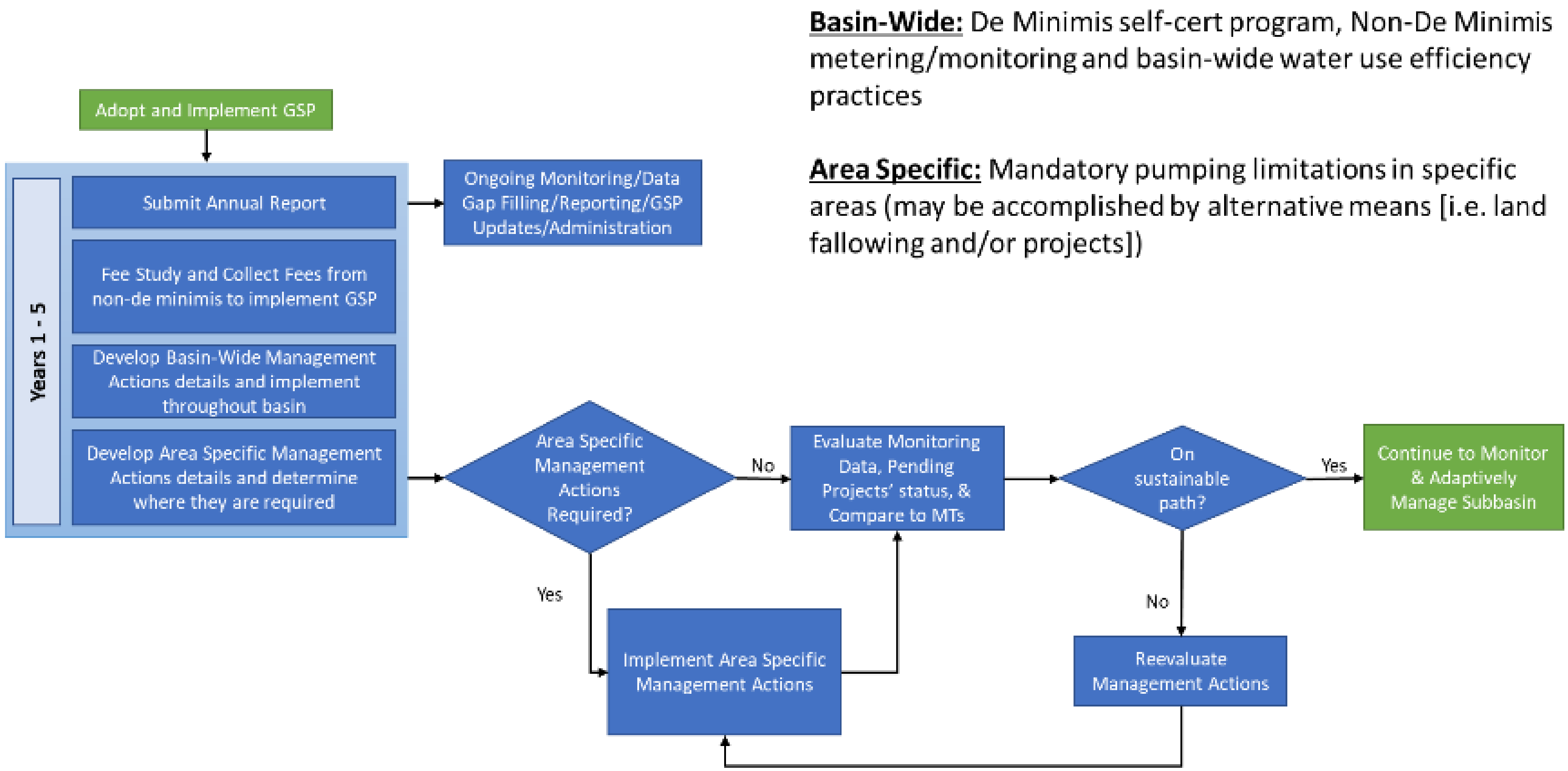


Figure 9-1: Conceptual Implementation Approach for Management Actions and Projects

9.3 Basin-Wide Management Actions

The following subsections outline the various basin-wide management actions. Basin-wide management actions will be implemented using input from stakeholders and in a data-driven process.

Basin-wide management actions include:

- Monitoring, reporting and outreach
- Promoting best water use practices
- Promoting stormwater capture
- Promoting voluntary fallowing of irrigated crop land

Sections required by SGMA regulations §354.44 follow the description of each management action below. Grant funding has been procured though the SGMA Round 1 Implementation Grant for implementation of the management actions listed above. Each management action was scored and ranked using a set of scoring criteria. The scores of individual management actions, as well as management action descriptions and justifications are included as a table in Appendix O.

9.3.1 Monitoring, Reporting and Outreach

Monitoring, reporting and outreach reflects the core functions that the GSAs need to provide to comply with SGMA regulations. The GSAs will direct the monitoring programs outlined in Chapter 7 to track Subbasin conditions related to the five applicable sustainability indicators. Data from the monitoring programs will be routinely evaluated to ensure progress is being made toward sustainability or to identify whether undesirable results are occurring. Data will be maintained in the Data Management System (DMS). Data from the monitoring program will be used by the GSAs to guide decisions on management actions and to prepare annual reports to Subbasin stakeholders and DWR and by individual entities to guide decisions on projects. SGMA regulations require that the reports comply with DWR forms and submittal requirements that will be published by DWR, and that all transmittals are signed by an authorized party. Data will be organized and available to the public to document Subbasin conditions relative to Sustainability Management Criteria (Chapter 8).

9.3.1.1 *De Minimis* Self Certification

A system for *de minimis* basin extractors to self-certify that they extract, for domestic purposes, two acre-feet or less per year will be developed in order to differentiate extractors for the purposes of implementing the GSP.

9.3.1.2 Non-*De* Minimis Metering and Reporting Program

This GSP calls for a program that will require all non-*de minimis* extractors to report extractions annually and use a water-measuring method satisfactory to the GSAs in accordance with Water Code Section 10725.8. It is anticipated that the GSAs will develop and adopt a regulation to implement this program, which is expected to include a system for reporting and accounting for land fallowing, stormwater capture projects, or other activities that individual pumpers implement. The information collected will be used to account for pumping that would have otherwise occurred, for analyzing projected Subbasin conditions and completing annual reports and five-year GSP assessment reports.

9.3.1.3 Annual Reports (SGMA Regulation §356.2)

Annual reports will be submitted to DWR starting on April 1, 2020. The purpose of the report is to provide monitoring and total groundwater use data to DWR, compare monitoring data to the sustainable management criteria, to report on management actions and projects implemented to achieve sustainability, and to promote best water use practices, stormwater capture and voluntary irrigated land fallowing. Annual reports will be available to Subbasin stakeholders.

9.3.1.4 5-Year GSP Updates and Amendments (SGMA Regulation §356.2)

In accordance with SGMA regulatory requirements (§356.4), five-year GSP assessment reports will be provided to DWR starting in 2025. The GSAs shall evaluate the GSP at least every five years to assess whether it is achieving the sustainability goal in the Subbasin. The assessment will include a description of significant new information that has been made available since GSP adoption or amendment and whether the new information or understanding warrants changes to any aspect of the plan.

Although not required by SGMA regulations, the GSAs anticipate that an amendment to the GSP will be prepared within the first five years to integrate new information. Updates may include incorporating additional monitoring data, updating the sustainable management criteria, documenting any projects that are being implemented and facilitating adaptive management of management actions.

9.3.1.5 Data Gaps

SGMA regulations require identification of data gaps and a plan for filling them (§ 354.38). Monitoring data will be collected and reported for each of the five sustainability indicators that are relevant to the Subbasin: chronic lowering of groundwater levels, reduction in groundwater storage, degraded water quality, land subsidence, and depletion of interconnected surface water. As noted in Chapter 7, the approach for establishing the monitoring networks was to leverage existing monitoring programs and, where data gaps existed, incorporate additional monitoring locations that have been made available by cooperating entities or that have been established by the GSAs. Appendix L identifies the plan for addressing data gaps in each monitoring network and the computer model of the Subbasin.

9.3.1.6 Relevant Measurable Objectives

Monitoring, Reporting, and Outreach would help achieve measurable objectives by keeping basin users informed about Subbasin conditions and the need to avoid undesirable results.

9.3.1.7 Expected Benefits and Evaluation of Benefits

The primary benefit from Monitoring, Reporting and Outreach is increasing hydrogeologic understanding of basin conditions and how management affects those conditions. Outreach, public education and associated changes in behavior improve the chances of achieving sustainability. Because it is unknown how much behavior will change as a result of Monitoring, Reporting and Outreach, it is difficult to quantify the expected benefits at this time.

Reductions in groundwater pumping will be measured directly through the metering and reporting program and recorded in the Data Management System (DMS). Changes in groundwater elevation will be measured with the groundwater level monitoring program. Subsidence will be measured using InSAR data. Changes in groundwater storage will be estimated using changes in groundwater levels (via proxy). Information about the monitoring programs is provided in Chapter 7. Isolating the effect of Monitoring, Reporting and Outreach on groundwater levels will be challenging because they are only one of several management actions that may be implemented concurrently in the Subbasin.

9.3.1.8 Circumstances for Implementation

Monitoring, Reporting and Outreach will begin upon adoption of the GSP. No other triggers are necessary or required.

9.3.1.9 Public Noticing

Public meetings will be held to inform the groundwater pumpers and other stakeholders about Subbasin conditions and the need for behavior changes. Groundwater pumpers and interested stakeholders will have the opportunity at these meetings to provide input and comments on how the Monitoring, Reporting and Outreach are being implemented in the Subbasin. Information on Monitoring, Reporting and Outreach will also be provided through annual GSP reports and links to relevant information on GSA websites.

9.3.1.10 Permitting and Regulatory Process

It is anticipated that the GSAs will adopt a regulation governing the metering and reporting program.

9.3.1.11 Implementation Schedule

Monitoring, Reporting and Outreach efforts will begin upon GSP adoption.

9.3.1.12 Legal Authority

The legal authority to conduct Monitoring, Reporting and Outreach is included in SGMA. For example, Water Code § 10725.8 authorizes GSAs to require through their GSPs that the use of every groundwater extraction facility (except those operated by *de minimis* extractors) be measured.

9.3.1.13 Estimated Cost

The total estimated cost for Monitoring, Reporting, and Outreach is $1,150,000.

9.3.2 Promoting Best Water Use Practices

This GSP calls for the GSAs to encourage pumpers to implement the most effective water use efficiency methods applicable, often referred to as Best Management Practices (BMPs). It is anticipated that industry leaders would facilitate workshops or other programs designed to communicate what the latest best water use practices are for their industry. Effective BMPs could result in:

- Efficient irrigation practices.
- A better accounting of annual precipitation and its contribution to soil moisture in all irrigation decisions and delay commencing irrigation until soil moisture levels require replenishment.
- Optimization of irrigation needs for frost control if sprinklers are used.
- More optimal irrigation practices by monitoring crop water use with soil and plant monitoring devices and tie monitoring data to evapotranspiration (ET) estimates.
- Conversion from high water demand crops to lower water demand crops.

Many growers already use BMPs, but improvements can be made. A goal of promoting BMPs is to broaden their use to more growers in the Subbasin. *De minimis* groundwater users will be encouraged to use BMPs as well. Promoting BMPs will include broad outreach to groundwater pumpers in the Subbasin to emphasize the importance of utilizing BMPs and understanding their positive benefits for mitigating declining groundwater levels and forestalling mandated limitations in groundwater extraction on their property.

9.3.2.1 Relevant Measurable Objectives

BMPs would help achieve the groundwater elevation, groundwater storage, and land subsidence measurable objectives.

9.3.2.2 Expected Benefits and Evaluation of Benefits

The primary benefit from initiating BMPs is mitigating the decline, or raising, groundwater elevations. An ancillary benefit from stable or rising groundwater levels may include avoiding pumping induced subsidence. Because it is unknown how much pumping will be reduced from promoting BMPs, it is difficult to quantify the expected benefits at this time.

Reductions in groundwater pumping will be measured directly through the metering and reporting program and recorded in the Data Management System (DMS). Changes in groundwater elevation will be measured with the groundwater level monitoring program. Subsidence will be measured with the InSAR network. Changes in groundwater storage will be estimated using the groundwater level proxy. Information about the monitoring programs is provided in Chapter 7. Isolating the effect of BMPs on groundwater levels will be challenging because they are only one of several management actions that may be implemented concurrently in the Subbasin.

9.3.2.3 Circumstances for Implementation

BMPs and related outreach will be promoted soon after adoption of the GSP. No other triggers are necessary or required.

9.3.2.4 Public Noticing

Public meetings will be held to inform the groundwater pumpers and other stakeholders about Subbasin conditions and the need for BMPs. Groundwater pumpers and interested stakeholders will have the opportunity at these meetings to provide input and comments on how the BMPs are being implemented in the Subbasin. The BMPs will also be promoted through annual GSP reports and links to relevant information on GSA websites.

9.3.2.5 Permitting and Regulatory Process

No permitting or regulatory process is needed for promoting BMPs.

9.3.2.6 Implementation Schedule

The GSAs envision that BMPs will be promoted within a year of GSP adoption.

9.3.2.7 Legal Authority

No legal authority is needed to promote BMPs.

9.3.2.8 Estimated Cost

The estimated cost for promoting BMPs and understanding the extent to which they are being implemented in the Subbasin is included in the cost of the metering and reporting program and developing annual reports.

9.3.3 Promote Stormwater Capture

Stormwater and dry weather runoff capture projects, including Low Impact Development (LID) standards for new or retrofitted construction, will be promoted as priority projects to be implemented as described in the San Luis Obispo County Stormwater Resource Plan (SWRP). The SWRP outlines an implementation strategy to ensure valuable, high-priority projects with multiple benefits. While the benefits are not easily quantified, the State is very supportive of such efforts. Stormwater capture projects in several areas of the Basin, including reaches of the Huer Huero, San Juan and Estrella drainages are likely to be pursued.

This management action covers two types of stormwater capture activities. The first stormwater capture activity involves retaining and recharging onsite runoff. Examples of this type of activity include LID and on-farm recharge of local runoff. The second stormwater capture activity involves recharge of unallocated storm flows. These actions require temporary diversions of storm flows from streams, and transport of those flows to recharge locations. State programs and grants (e.g., FLOOD-MAR, Proposition 68) and local entities (e.g., Resource Conservation Districts) can be utilized as resources to move forward on stormwater capture and percolation efforts.

9.3.3.1 Relevant Measurable Objectives

Stormwater capture would benefit the groundwater elevation, groundwater storage, and land subsidence measurable objectives.

9.3.3.2 Expected Benefits and Evaluation of Benefits

The primary benefit from promoting stormwater capture is to mitigate the decline of, or possibly raise, groundwater elevations through additional recharge. An ancillary benefit from stable or rising groundwater elevations may include avoiding pumping induced subsidence. Because the amount of recharge that could be accomplished from the program is unknown at this time, it is difficult to quantify the expected benefits.

Changes in groundwater elevation will be measured with the groundwater level monitoring program. Subsidence will be measured with the InSAR network. Changes in groundwater storage will be estimated using the groundwater level proxy. Information about the monitoring programs is provided in Chapter 7. Isolating the effect of the stormwater capture on groundwater levels will be challenging because it will be only one of several management actions that may be implemented concurrently in the Subbasin.

9.3.3.3 Circumstances for Implementation

Stormwater capture will be promoted as soon as possible after adoption of the GSP.

9.3.3.4 Public Noticing

Public meetings will be held to inform the groundwater pumpers and other stakeholders about Subbasin conditions and the need for stormwater capture. Groundwater pumpers and interested stakeholders will have the opportunity at these meetings to provide input and comments on how stormwater capture projects are being implemented in the Subbasin. Stormwater capture will also be promoted through annual GSP reports and links to relevant information on GSA websites.

9.3.3.5 Permitting and Regulatory Process

Recharge of stormwater by retaining and recharging onsite runoff does not require permits. Recharge of unallocated storm flows is currently subject to the SWRCB’s existing temporary permit for groundwater recharge program. The SWRCB is currently developing five-year permits for capturing high flow events. Recharge of unallocated storm flows will be subject to the terms of these five-year permits if and when they are enacted. Stormwater capture may also be subject to CEQA permitting. A regulation will need to be adopted by the GSAs to account for projects that recharge unallocated storm flows as a part of the metering and reporting program. Regulations are subject to CEQA.

9.3.3.6 Implementation Schedule

The GSAs envision that stormwater capture will be promoted within two years of GSP adoption.

9.3.3.7 Legal Authority

Other than acquiring required permits and the right to divert stormwater, there are no other legal authorities required to implement stormwater capture.

9.3.3.8 Estimated Cost

The estimated cost for promoting stormwater capture and understanding the extent to which it is being implemented in the Subbasin is included in the cost of the metering and reporting program and developing annual reports.

9.3.4 Promote Voluntary Fallowing of Agricultural Land

This GSP calls for the GSAs to promote voluntary fallowing of crop land to reduce overall groundwater demand. For example, the GSAs could develop a Subbasin-wide accounting system that tracks landowners who decide to voluntarily fallow their land and cease groundwater pumping or otherwise refrain from using groundwater. If given the opportunity to create a “place holder” for their ability to pump under regulations adopted by the GSAs, some property owners currently irrigating crops or that might want to irrigate in the future may choose to forego the expense of farming and extracting water if those rights can be accounted for and protected. A regulation would need to be adopted by the GSAs for the metering and reporting program, and the program could include provisions related to land fallowing.

9.3.4.1 Relevant Measurable Objectives

The voluntary fallowing of irrigated land would benefit the groundwater elevation, groundwater storage, and land subsidence measurable objectives.

9.3.4.2 Expected Benefits and Evaluation of Benefits

The primary benefit of voluntary fallowing would be mitigating the decline of groundwater elevations by reducing pumping. An ancillary benefit from stable or rising groundwater elevations may include avoiding pumping induced subsidence. Because it is unknown how many landowners will willingly fallow their land, it is difficult to quantify the expected benefits at this time.

Reductions in groundwater pumping will be measured directly through the metering and reporting program and recorded in the DMS. Changes in groundwater elevation will be measured with the groundwater level monitoring program. Subsidence will be measured with the InSAR network. Changes in groundwater storage will be estimated using the groundwater level proxy. Information about the monitoring programs is provided in Chapter 7. Isolating the effect of voluntary fallowing on sustainability metrics will be challenging because it will be only one of several management actions that may be implemented concurrently in the Subbasin.

9.3.4.3 Circumstances for Implementation

The GSAs envision that voluntary fallowing of land will be promoted as soon as possible after GSP adoption.

9.3.4.4 Public Noticing

Public meetings will be held to inform the groundwater pumpers and other stakeholders about Subbasin conditions and the need for voluntary fallowing. Landowners, groundwater pumpers and interested stakeholders will have the opportunity at these meetings to provide input and comments on how voluntary fallowing is being implemented in the Subbasin. Voluntary fallowing will also be promoted through annual GSP reports and links to relevant information on GSA websites.

9.3.4.5 Permitting and Regulatory Process

Regulations are subject to CEQA.

9.3.4.6 Implementation Schedule

The GSAs envision that voluntary fallowing will be promoted within two years of GSP adoption.

9.3.4.7 Legal Authority

California Water Code §10726.2(c) provides GSAs the authorities to provide for a program of voluntary land fallowing.

9.3.4.8 Estimated Cost

The estimated cost for promoting and accounting for land fallowing is included in the cost of the metering and reporting program and developing annual reports.

9.4 Area Specific Management Actions

Implementation of area specific management actions may be necessary to address areas of persistent groundwater level decline (

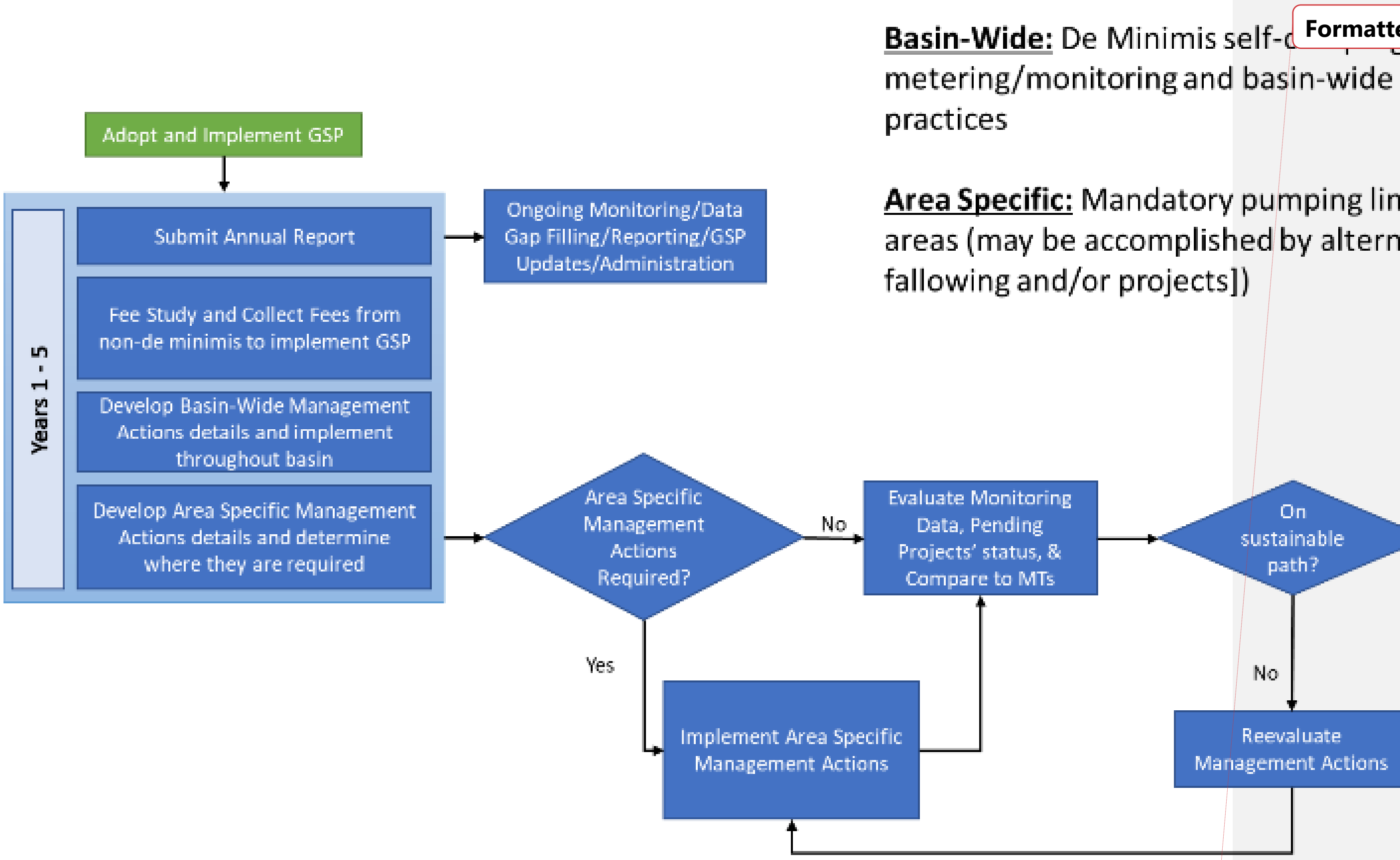


Figure 9-1~~Figure 9-1~~). Through a regulatory program, GSAs will conduct extensive data analysis to delineate where pumping needs to be limited to stabilize levels. With this information, affected pumpers will need to decide how to achieve these limitations. This may include land fallowing/retirement or paying for projects and/or programs that can be effectively implemented proportional to the recognized volume of groundwater necessary to avoid undesirable results in each area of the Subbasin. Sections required by SGMA regulations §354.44 follow the description of each management action below.

9.4.1 Mandatory pumping limitations in specific areas

The GSAs will establish a regulatory program to identify and enforce required pumping limitation as necessary to arrest persistent groundwater level declines in specific areas. The amount of mandatory pumping limitations is uncertain and will depend on the effectiveness and timeliness of voluntary actions by pumpers and the success of other measures outlined in the GSP. The water budget presented in Chapter 6 suggests that an estimated shortfall of

13,700 AFY will need to be addressed by a combination of increased water supply, conservation and reduction in pumping in order to achieve sustainability. After GSP adoption, developing the program would likely require the following steps:

5. Establishing a methodology for determining baseline pumping in specific areas considering:
    a. Groundwater level trends in areas of decline and estimated available volume of water in those areas
    b. Land uses and corresponding irrigation requirements
6. Establishing a methodology to determine whose use must be limited and by how much considering, though not limited to, water rights and evaluation of anticipated benefits from projects bringing in supplemental water or other relevant actions individual pumpers take.
7. A timeline for limitations on pumping ("ramp down") in specific areas as required to avoid undesirable results
8. Approving a formal regulation to enact the program

Determination of baseline pumping in specific areas will need to be established and guidance developed by DWR in response to legislative directives for consistent implementation of the Water Conservation Act of 2009, as is used in Urban Water Management Plans, may be helpful. Baseline pumping would be ramped down to meet water use targets in specific areas until it is projected that groundwater levels will stabilize. Analyses will be updated periodically as new data are developed. The ramp down schedule would be developed during program development; the rate of ramp down would depend on when the program starts, and projections of how long lower pumping rates are required in specific areas in order to avoid undesirable results. The specific ramp down amounts and timing would be reassessed periodically by the GSAs as needed to achieve sustainability. These adjustments would occur when additional data and analyses are available.

9.4.1.1 Relevant Measurable Objectives

Mandatory limitations to groundwater pumping in specific areas would benefit the groundwater elevation, groundwater storage, and land subsidence measurable objectives in those areas.

9.4.1.2 Expected Benefits and Evaluation of Benefits

The primary benefit from the mandatory pumping limitations is mitigating the decline of groundwater levels through reduced total pumping. An ancillary benefit from stable or increasing groundwater elevations may include avoiding pumping induced subsidence. The program is designed to ramp down total pumping to the sustainable yield; therefore, the quantifiable goal is to maintain pumping within the sustainable yield.

Limitations on groundwater pumping will be measured directly through the metering and reporting program and recorded in the DMS. Changes in groundwater elevation are an important metric for the mandatory pumping limitation program and will be measured with the groundwater level monitoring program. Subsidence will be measured using InSAR data. Changes in groundwater storage will be estimated using the groundwater level proxy. Information about the monitoring programs is provided in Chapter 7. Isolating the effect of the mandatory pumping limitation program on sustainability metrics will be challenging because it will be only one of several management actions that may be implemented concurrently in the Subbasin. However, as the pumping ramp down is initiated, the correlation between reduced pumping and higher groundwater levels may become more apparent.

9.4.1.3 Circumstances for Implementation

Because there are areas where groundwater levels are persistently declining and undesirable results could occur, the mandatory pumping limitation program will be implemented after the GSAs adopt the regulation governing the program.

9.4.1.4 Public Noticing

Public meetings will be held to inform groundwater pumpers and other stakeholders that the mandatory pumping limitation program is being developed. The mandatory pumping limitation program will be developed in an open and transparent process. Landowners, groundwater pumpers and other stakeholders will have the opportunity at these meetings to provide input and comments on the process and the program elements.

9.4.1.5 Permitting and Regulatory Process

The mandatory pumping limitation program is subject to CEQA. The mandatory pumping limitation program would be developed in accordance with all applicable groundwater laws and respect all groundwater rights.

9.4.1.6 Implementation Schedule

Developing the mandatory pumping limitation program and adopting the regulation would likely take up to five years. Once the regulation is adopted, the program will be implemented.

9.4.1.7 Legal Authority

California Water Code §10726.4 (a)(2) provides GSAs the authorities to control groundwater extractions by regulating, limiting, or suspending extractions from individual groundwater wells or extractions from groundwater wells in the aggregate.

9.4.1.8 Estimated Cost

The cost to develop and implement the mandatory pumping limitation program is estimated to be $350,000. This does not include the cost of the CEQA permitting or any ongoing program oversight.

9.5 Projects

Projects involve new or improved infrastructure to make new water supplies available to the Subbasin. Best Management Practices and developing projects that will enhance supply will mitigate groundwater level decline. Several potential projects are described in this GSP that may be implemented by willing entities to offset pumping and lessen the degree to which the management actions would be needed. The implementation of projects depends on willing participants and/or successful funding votes.

There are six potential sources of water for projects:

1. Tertiary treated wastewater supplied and sold by City of Paso Robles and the San Miguel CSD to private groundwater extractors to use in lieu of groundwater. This water is commonly referred to as recycled water (RW).
2. State Water Project (SWP) water
3. Nacimiento Water Project (NWP) water
4. Salinas Dam/Santa Margarita Reservoir water
5. Local recycled water
6. Flood flows/stormwater from local rivers and streams

These six water sources are described in more detail in Appendix I. Of these six sources, only RW, SWP, NWP, and Salinas Dam currently have sufficiently reliable volumes of unused water to justify the expense of new infrastructure to be used on a regular basis for supplementing water supplies in the Subbasin. Since there are uncertainties associated with securing agreements to utilize SWP and related infrastructure, descriptions of concept projects associated with the use of this water supply are included in Appendix L. Capturing flood flows/stormwater from streams in permitted projects will be pursued. Specific elements of these projects will be developed in the near future. Use of the Salinas Dam to capture flood flows/stormwater is presently the only conceptual project included in the GSP. In summary, the initial focus of new supply is on developing RW, NWP, and Salinas Dam projects in the Subbasin. Grant funding has been procured though the SGMA Round 1 Implementation Grant for implementation of the projects listed above. Each project was scored and ranked using a set of scoring criteria. The scores of individual projects, as well as project descriptions and justifications are included as a table in Appendix O.

9.5.1 General Project Provisions

Many of the priority projects listed below are subject to similar requirements. These general provisions that are applicable to all projects include certain permitting and regulatory requirements, public notice requirements, and the legal authority to initiate and complete the projects. This section assumes the development of projects are led by one or more GSAs in order to complete the sections below that are required by SGMA regulations §354.44.

9.5.1.1 Summary of Permitting and Regulatory Processes

Although the provisions of this GSP do not require projects to be subject to a particular set of requirements, projects envisioned in the GSP may require an environmental review process via CEQA and may require an Environmental Impact Report, a Negative Declaration, or a Mitigated Negative Declaration.

There will be a number of local, county and state permits, right of ways, and easements required depending on pipeline alignments, stream crossings, and project type.

Projects must adhere to the Salt/Nutrient Management Plan for the Paso Robles Groundwater Basin (RMC 2015).

9.5.1.2 Public Noticing

All projects are subject to the public noticing requirements per CEQA.

9.5.1.3 Legal Authority Required for Projects and Basis for That Authority within the Agency

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges. Additionally, an assessment of the legal rights to acquire and use various water sources is included in Appendix I.

9.5.2 Conceptual Projects

Six conceptual projects are included in this GSP and have been identified after many public meetings and studies over the last decade and currently ongoing. All six projects will not necessarily be implemented, but they represent six reasonable projects that could help achieve sustainability throughout the Subbasin. Conceptual projects were developed for different regions in the Subbasin to address localized declines in groundwater elevations. Projects were sized based on the locations of available supplies and pumping demands in different areas of the Subbasin. Actual projects will be highly dependent on the ability of the GSAs and/or individual entities to negotiate with water suppliers and purchase the surface waters described in Appendix I. Four other conceptual projects that are not being developed currently are included in Appendix L for future consideration.

Table 9-1. Conceptual Projects

Project Name	Water Supply	Project Type	Approximate Location	Average Volume (AFY)
City Recycled Water Delivery	RW	Direct Delivery	Near City of Paso Robles	2,200
San Miguel Recycled Water Delivery	RW	Direct Delivery	Near San Miguel	200 [a]
NWP Delivery at Salinas and Estrella River Confluence	NWP	Direct Delivery	Near the confluence of the Salinas and Estrella Rivers	2,800
NWP Delivery North of City of Paso Robles	NWP	Direct Delivery	North of Huer Huero Creek, due west of the airport	1,000
NWP Delivery East of City of Paso Robles	NWP	Direct Delivery	East of the City of Paso Robles	2,000
Expansion of Salinas Dam	Salinas River	River Recharge	Along the Salinas River	1,000

Notes: (a) Average volume amounts may be updated in final GSA based on more recent information
(b) Approximate locations are assumed to establish the benefit calculations required by SGMA

Short descriptions of each concept project are included below, along with a map showing general project locations. Sections required by SGMA regulations §354.44 follow the description of each project. Generalized costs are also included for planning purposes. Components of these projects including facility locations, pipeline routes, recharge mechanisms, and other details may change in future analyses. Therefore, each of the projects listed below should be treated as a generalized project that represents a number of potential detailed projects.

9.5.2.1 Assumptions Used in Developing Projects

Assumptions that were used to develop projects and cost estimates are provided in Appendix J. Assumptions and issues for each project need to be carefully reviewed and revised during the pre-design phase of each project. Project designs, and therefore costs, could change considerably as more information is gathered.

The cost estimates included below are class 5, order of magnitude estimates. These estimates were made with little to no detailed engineering data. The expected accuracy range for such an estimate is within +50 percent or –30 percent. The cost estimates are based on the engineering assessment of current conditions at the project location. They reflect a professional opinion of costs at this time and are subject to change as project designs mature.

Capital costs include major infrastructure including pipelines, pump stations, customer connections, turnouts and storage tanks. Capital costs also include 30% contingency for plumbing appurtenances, 15% increase for general conditions, 15% for contractor overhead and profit, and 8% for sales tax. Engineering, legal, administrative, and project contingencies was assumed as 30% of the total construction cost and included within the capital cost. Land acquisition at $30,000/acre was also included within capital costs.

Annual operations and maintenance (O&M) fees include the costs to operate and maintain new project infrastructure. O&M costs also include any pumping costs associated with new infrastructure. O&M costs do not include O&M or pumping costs associated with existing infrastructure, such as existing NWP O&M costs because these are assumed to be part of water purchase costs. Water purchase costs were assumed to include repayment of loans for existing infrastructure; however, these purchase costs will need to be negotiated. The terms of such a negotiation could vary widely.

Capital costs were annualized over thirty years and added with annual O&M costs and water purchase costs to determine an annualized dollar per acre-foot ($/AF) cost for each project. This $/AF value might not always represent the $/AF of basin benefit ($/AF-benefit).

9.5.2.2 Preferred Project 1: City Recycled Water Delivery

This project will use up to 2,200 AFY of disinfected tertiary effluent for in-lieu recharge in the central portion of the basin near and inside the City of Paso Robles. Water that is not used for recycled water purposes will be discharged to Huer Huero Creek with the potential for additional recharge benefits. The general layout of this project and relevant monitoring wells are shown on Figure 9-2~~Figure 9-2~~. Infrastructure includes upgraded wastewater treatment plant and pump station, 5.8 miles of pipeline, a storage tank, numerous turnouts, and a discharge to Huer Huero Creek. Additionally, a conceptual pipeline to the north of the main line will deliver recycled water to a larger geographical area. The cost to upgrade the wastewater treatment plant is also not included in the cost estimate, since the upgrades were required per the NPDES permit regardless of use for recycled water. Since this project is already in the predesign phase, the predesign project cost estimate is provided for this GSP.

9.5.2.2.1 RELEVANT MEASURABLE OBJECTIVES

The measurable objectives benefiting from this groundwater project include:

- Groundwater elevation measurable objectives in the central portion of the Subbasin
- The groundwater storage measurable objective

- Land subsidence measurable objectives in the central portion of the Subbasin

9.5.2.2.2 Expected Benefits and Evaluation of Benefits

The primary benefit from the Paso Robles RW project is higher groundwater elevations in the Central portion of the Subbasin due to in-lieu recharge from the direct use of the RW and recharge through Huer Huero Creek. Ancillary benefits of shallower groundwater elevations may include an increase in groundwater storage, improved groundwater quality from recharge of high-quality water, and avoiding pumping induced subsidence. The GSP model was used to quantify the expected benefit from this project. Figure 9-3~~Figure 9-3~~ shows the expected groundwater level benefit predicted by the GSP model after 10 years of project operation. Figure 9-3~~Figure 9-3~~ expresses the benefit as feet of groundwater. The groundwater level benefit shown on Figure 9-3~~Figure 9-3~~ is a measure of how much higher groundwater elevations are expected to be with the project rather than without the project.

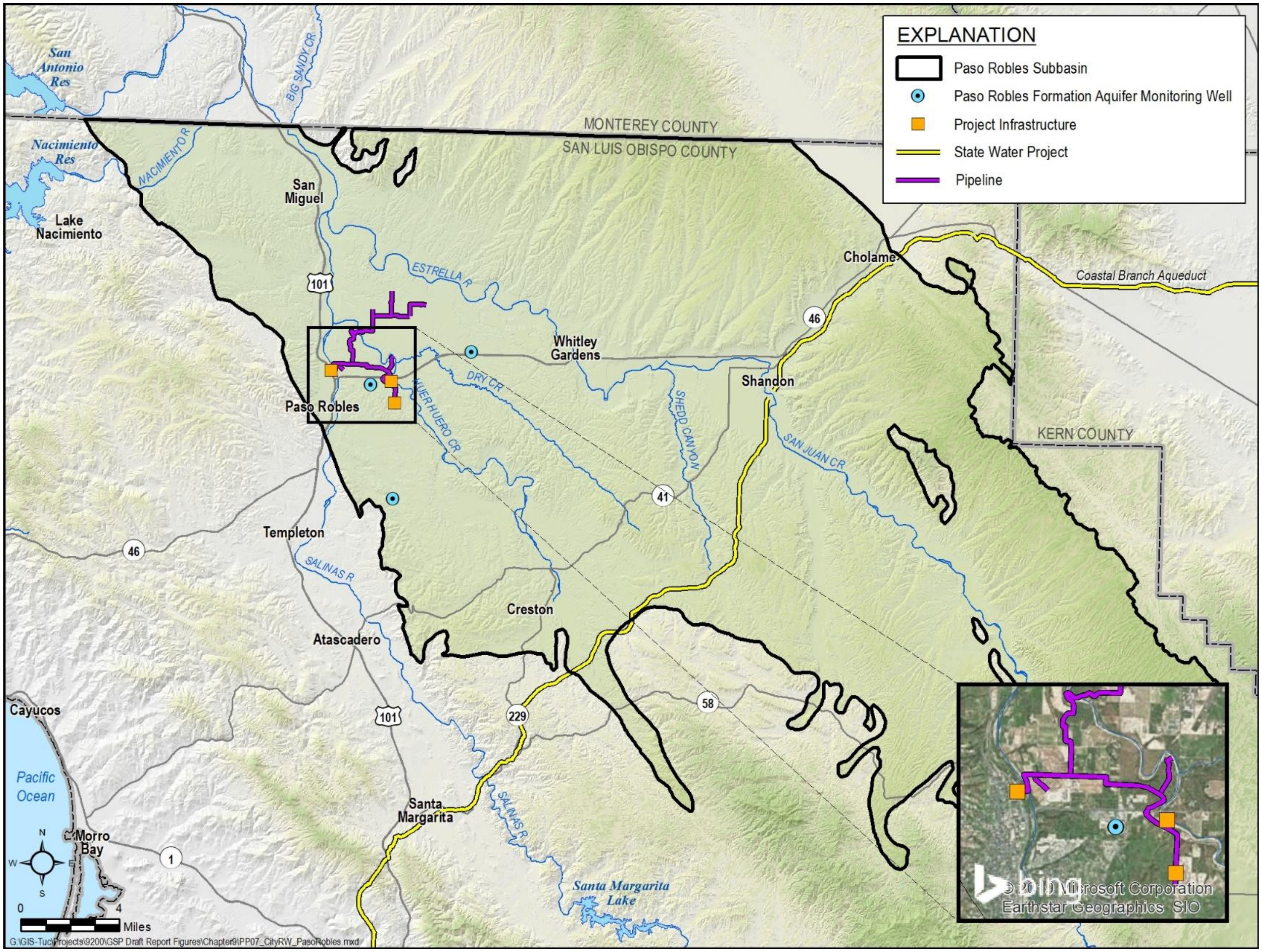


Figure 9-2. Paso Robles RW Project Layout

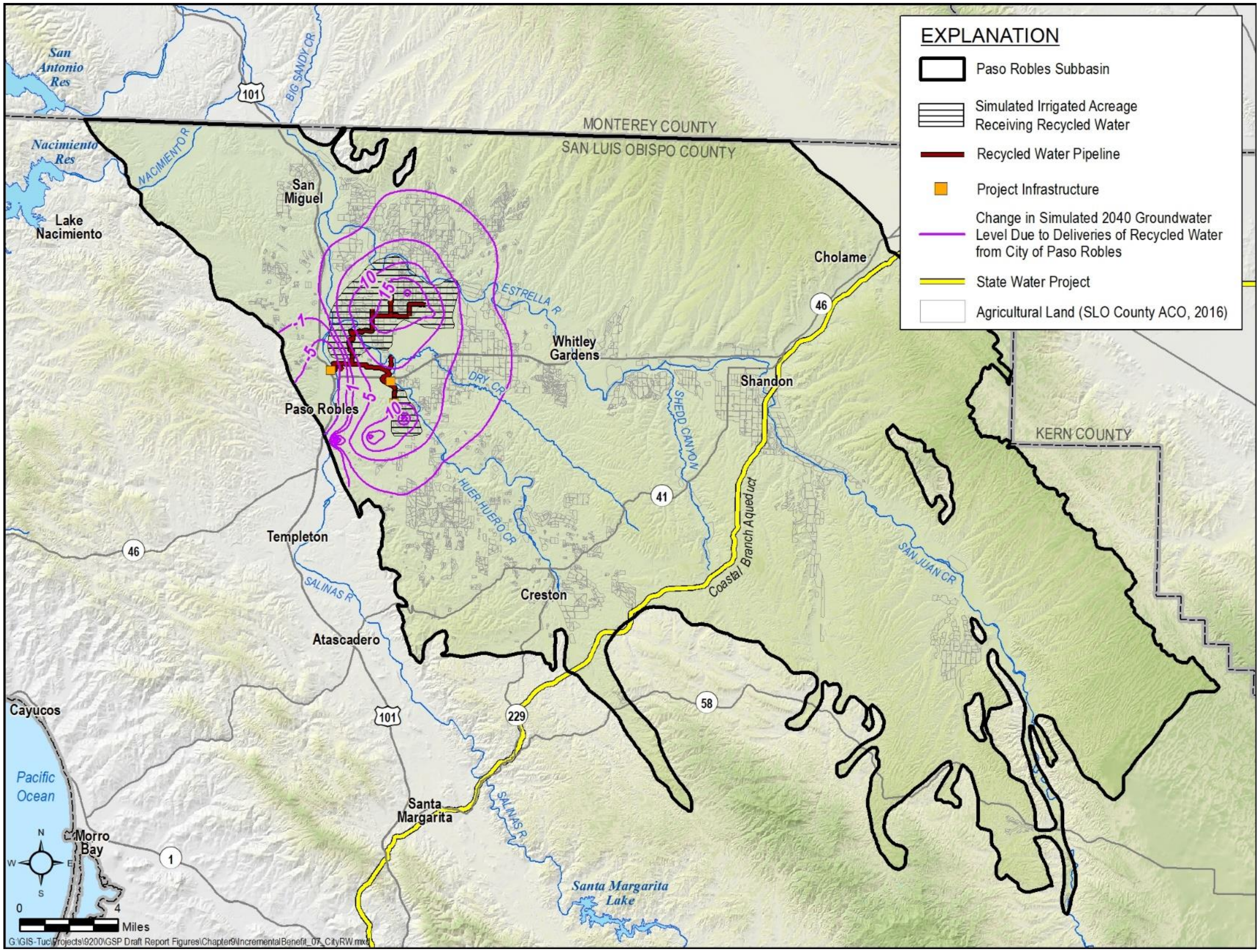


Figure 9-3. Groundwater Level Benefit of Paso Robles RW Project in Central Subbasin

Changes in groundwater elevation will be measured with the groundwater level monitoring program detailed in Chapter 7. Subsidence will be measured with the InSAR network detailed in Chapter 7. A direct correlation between the Paso Robles RW project and changes in groundwater levels may not be possible because this is only one among many management actions and projects that might be implemented in the Subbasin.

9.5.2.2.3 Circumstances for Implementation

This project is already being implemented by the City of Paso Robles. The monitoring wells 26S/12E-26E07, 26S/13E-16N01, and 27S/12E-13N01 will likely be positively impacted by this project.

9.5.2.2.4 Implementation Schedule

The project is underway. The phase design is expected to be complete by 2019 and construction complete by 2021. The implementation schedule is presented on Figure 9-4~~Figure 9-4~~.

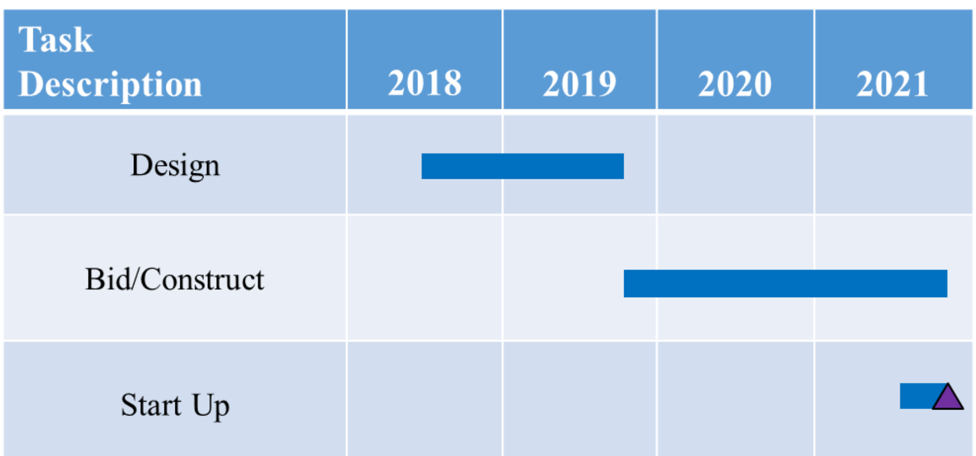


Figure 9-4. Implementation Schedule for Paso Robles RW in Central Subbasin

9.5.2.2.5 Estimated Cost

The estimated total project cost for this project is $22M. The cost and financing for the project is being determined by the City of Paso Robles. Annual O&M costs are not provided in this GSP. The cost ($/AF) of this water will be set by the City of Paso Robles and is not included in this GSP.

9.5.2.3 Preferred Project 2: San Miguel CSD Recycled Water Delivery

The San Miguel RW project is currently in the planning and preliminary design phases; therefore, the project concepts presented herein are preliminary.

This project is a planned project that involves the upgrade of San Miguel Community Services District (CSD) wastewater treatment plant to meet California Code of Regulations (CCR) Title 22 criteria for disinfected secondary recycled water for irrigation use by vineyards. Potential customers include a group of agricultural customers on the east side of the Salinas River, and a group of agricultural customers northwest of the wastewater treatment plant. The project might include the utilization of process discharge from a nearby processing facility for additional water recycling. The project could provide between 200 and 450 AFY of additional water supplies. The general layout of this project and relevant monitoring wells are shown on Figure 9-5~~Figure 9-5~~. The infrastructure shown here includes a treatment plant upgrade, a recycled water pumping station and pipeline infrastructure to provide for delivering water to customers. The actual project size and infrastructure will be determined based on project feasibility and negotiations with suppliers and customers. For more information on technical assumptions and cost assumptions, refer to Appendix J.

9.5.2.3.1 Relevant Measurable Objectives

The measurable objectives benefiting from this groundwater project include:

- Groundwater elevation measurable objectives in the northern portion of the Subbasin
- The groundwater storage measurable objective
- Land subsidence measurable objectives in the northern portion of the Subbasin

9.5.2.3.2 Expected Benefits and Evaluation of Benefits

The primary benefit from RW use for irrigation is higher groundwater elevations in the northern portion of the Subbasin due to in-lieu recharge from the direct use of the RW. Ancillary benefits may include an increase in groundwater storage and avoiding pumping induced subsidence. The GSP model was used to quantify the expected benefit from this project. Figure 9-6~~Figure 9-6~~ shows the expected groundwater level benefit predicted by the GSP model after 10 years of project operation. Figure 9-6~~Figure 9-6~~ expresses the benefit as feet of groundwater. The groundwater level benefit shown on Figure 9-6~~Figure 9-6~~ is a measure of how much higher groundwater elevations are expected to be with the project rather than without the project.

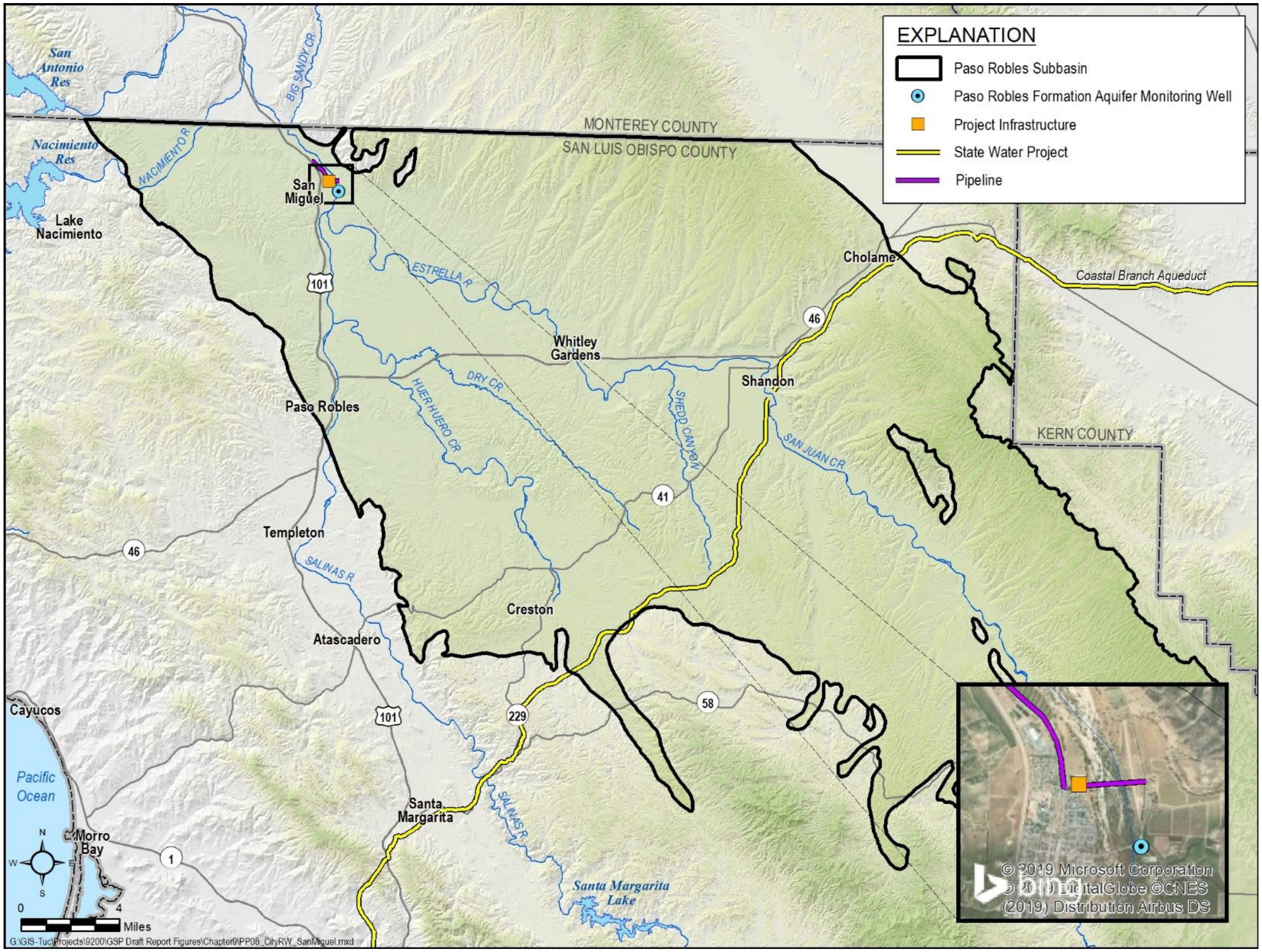


Figure 9-5. Conceptual San Miguel CSD RW Project Layout

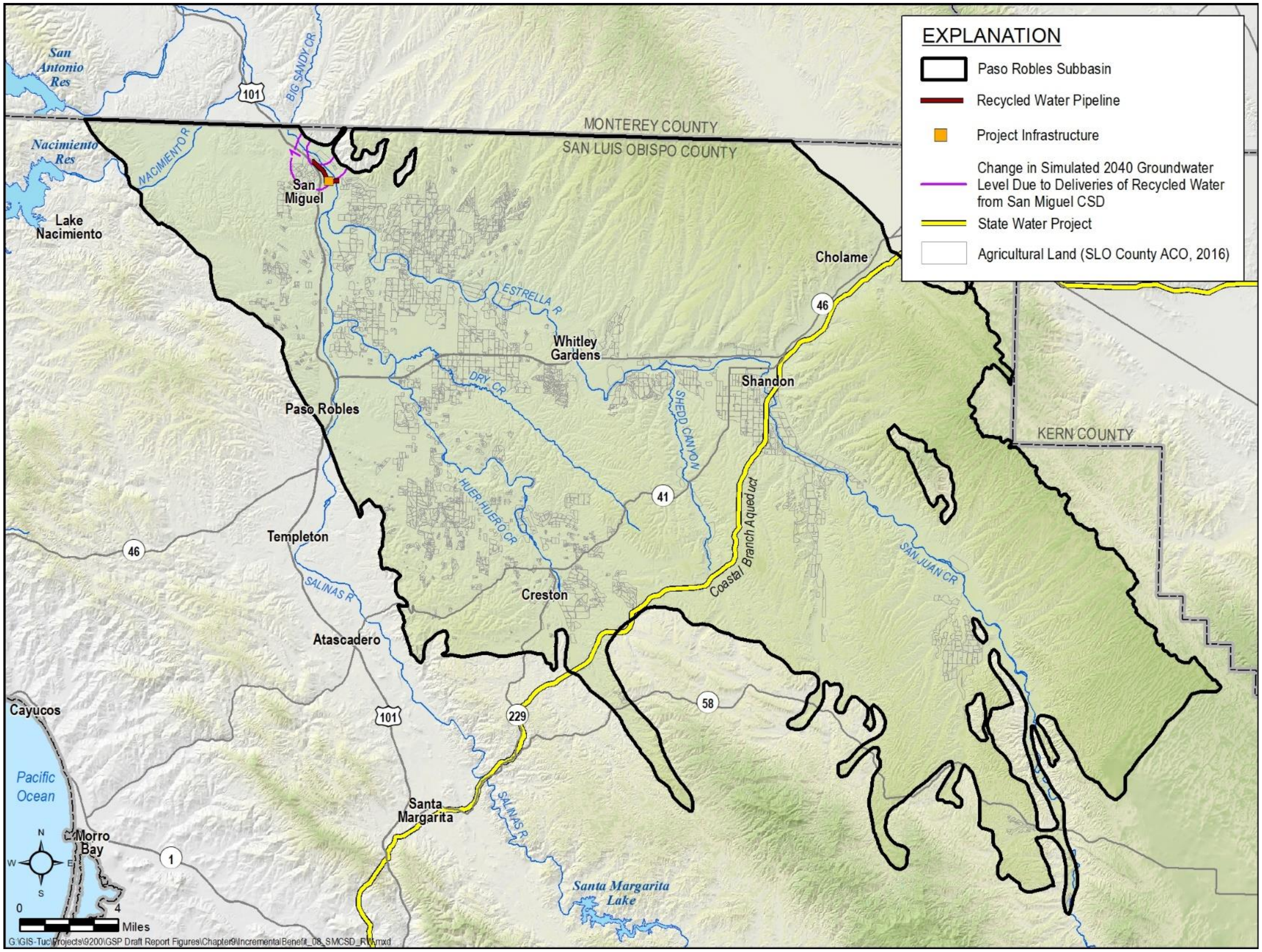


Figure 9-6. Groundwater Level Benefit of San Miguel CSD RW Project

Changes in groundwater elevation will be measured with the groundwater level monitoring program detailed in Chapter 7. Subsidence will be measured with the InSAR network detailed in Chapter 7. A direct correlation between the San Miguel CSD RW Project and changes in groundwater levels may not be possible because this is only one among many management actions and projects that might be implemented in the Subbasin.

9.5.2.3.3 Circumstances for Implementation

Willing parties will plan, design and raise funds to initiate projects. San Miguel CSD Staff has completed the planning phase and is currently in the design development phase of the project. The initial phase of the San Miguel CSD RW Project is currently planned for completion in mid-2021 with subsequent phases to be initiated if, after five years, groundwater levels in the northern portion of the monitoring network continue to decline at unsustainable rates. In particular, continued unsustainable groundwater level declines in monitoring well 25S/12E-16K05 will trigger implementation of this project. Additional triggers will be added as the monitoring well network expands.

This project is a planned project being undertaken by San Miguel CSD and may be implemented regardless of the triggered implementation framework presented herein.

9.5.2.3.4 Implementation Schedule

The implementation schedule is presented on Figure 9-7~~Figure 9-7~~. The project will take 4 to 6 years to implement. The actual project start date is to be determined on an as-needed basis or by San Miguel CSD.

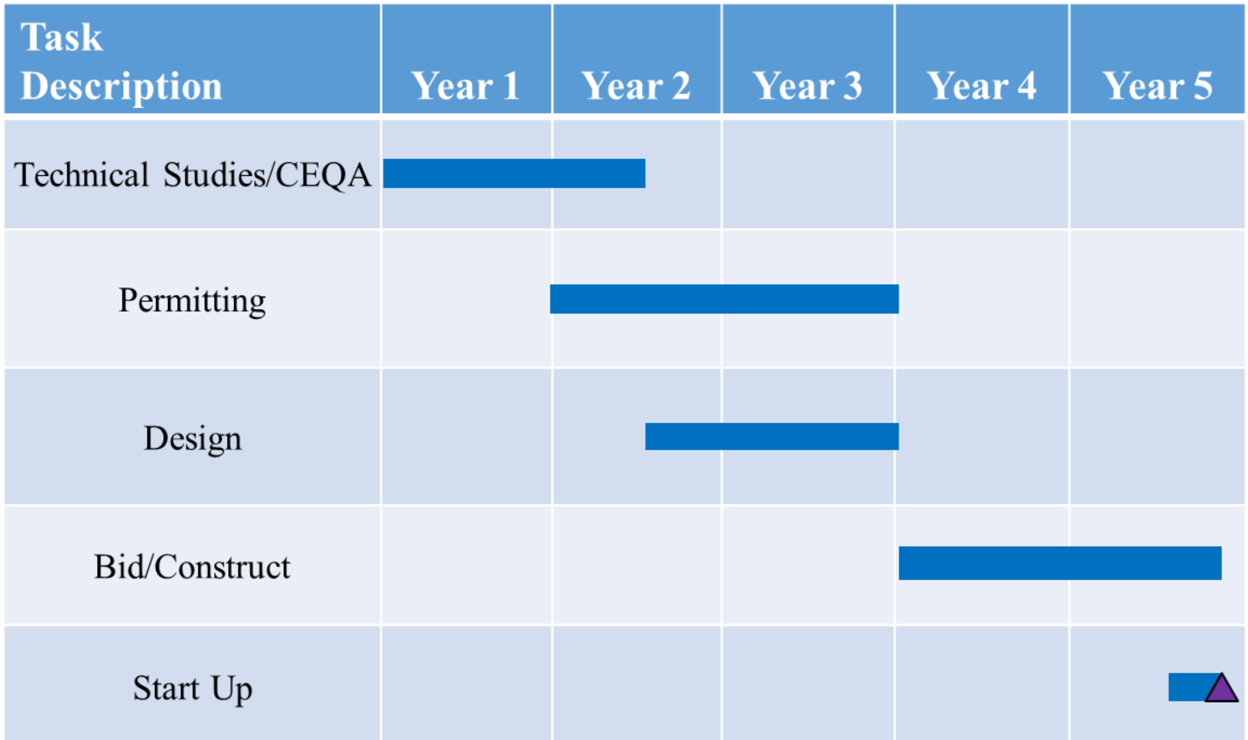


Figure 9-7. Implementation Schedule for San Miguel RW

9.5.2.3.5 Estimated Cost

This project is currently in the planning phases, and the San Miguel RW project presented herein might not accurately reflect the most current design concept. The cost of the potential project that is described herein was estimated for the purposes of the GSP. The estimated total project cost for this project is $15M, not including wastewater treatment plant upgrades. Cost can be covered by the bonding capacity developed through the groundwater conservation program. Annual O&M costs are estimated at $340,000. O&M costs would be covered by the overproduction surcharges. Based on a 30-year loan at a 5% interest rate, the cost of water for this project would be approximately $2,900/AF. Additional details regarding how costs were developed are included in Appendix J.

9.5.2.4 Preferred Project 3: NWP Delivery at Salinas and Estrella River Confluence

This conceptual project directly delivers up to 3,500 AFY of NWP water to agricultural water users near the confluence of the Salinas and Estrella Rivers, and an area north of the Estrella River. On average, this project will provide 2,800 AFY of water for use in lieu of groundwater pumping in the region. Before implementing this project, additional outreach and meetings with property owners and interested stakeholders will be conducted to inform them about the project details and acquire necessary approvals.

The general layout of this project and relevant monitoring wells are shown on **Error! Reference source not found.**~~Figure 9-8~~. Infrastructure includes a new NWP turnout, 13 miles of pipeline, a 700 horsepower (hp) pump station, and two river crossings: one crossing of the Salinas River and one crossing of the Estrella River. For more information on technical assumptions and cost assumptions, refer to Appendix J.

9.5.2.4.1 RELEVANT MEASURABLE OBJECTIVES

The measurable objectives benefiting from this project include:

- Groundwater elevation measurable objectives in the central portion of the Subbasin
- The groundwater storage measurable objective
- Land subsidence measurable objectives in the central portion of the Subbasin

9.5.2.4.2 EXPECTED BENEFITS AND EVALUATION OF BENEFITS

The primary benefit from in-lieu recharge using NWP water is higher groundwater elevations in the central portion of the Subbasin. Ancillary benefits of shallower groundwater elevations may include an increase in groundwater storage and avoiding pumping induced subsidence. The GSP model was used to quantify the expected benefit from this project. **Error! Reference source not found.**~~Figure 9-9~~ shows the expected groundwater level benefit predicted by the GSP model after 10 years of project operation. **Error! Reference source not found.**~~Figure 9-9~~ expresses the benefit as feet of groundwater. The groundwater level benefit shown on **Error! Reference source not found.**~~Figure 9-9~~ is a measure of how much higher groundwater elevations are expected to be with the project rather than without the project.

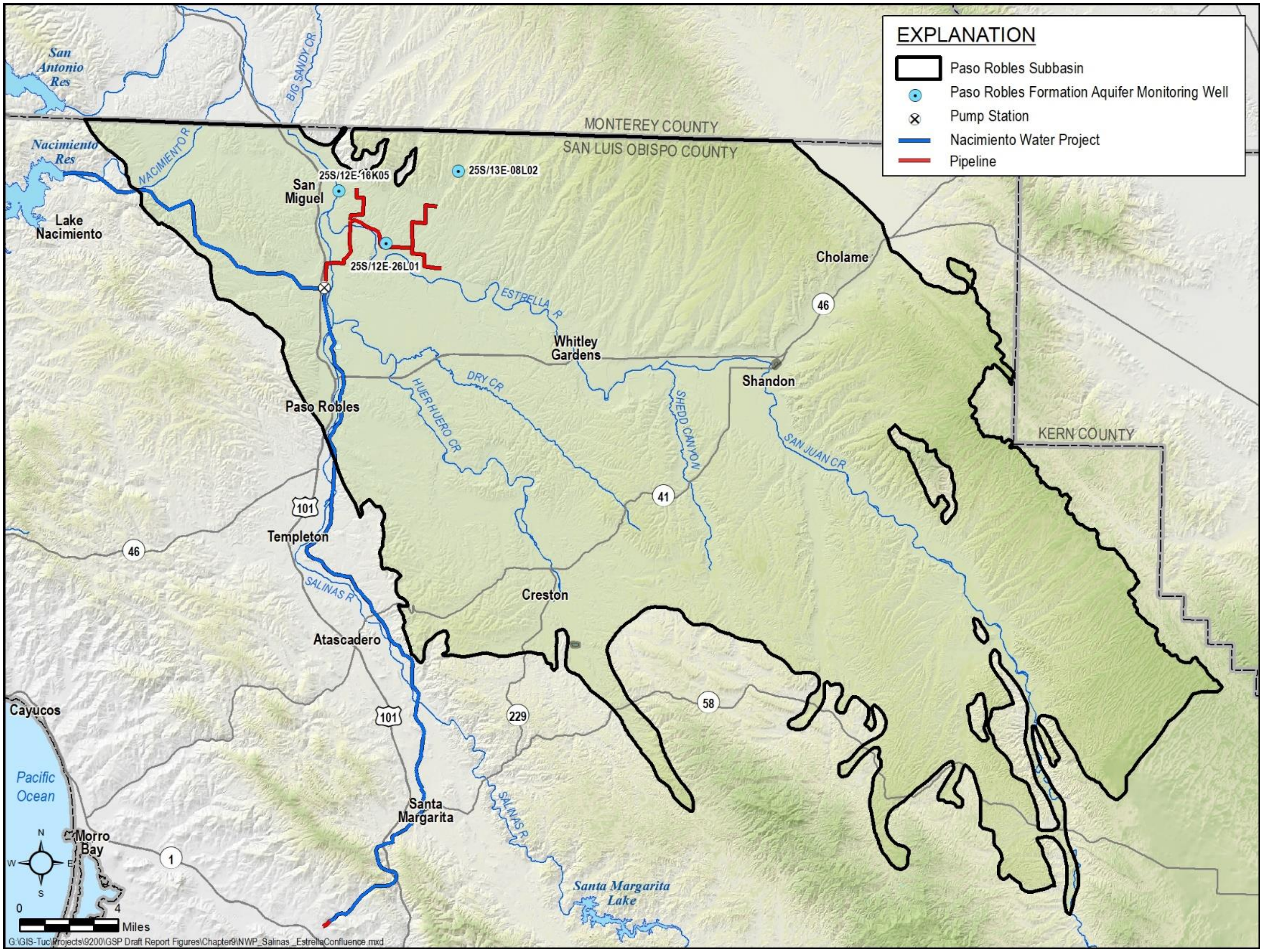


Figure 9-8. Conceptual NWP Delivery at Salinas and Estrella River Confluence Project Layout

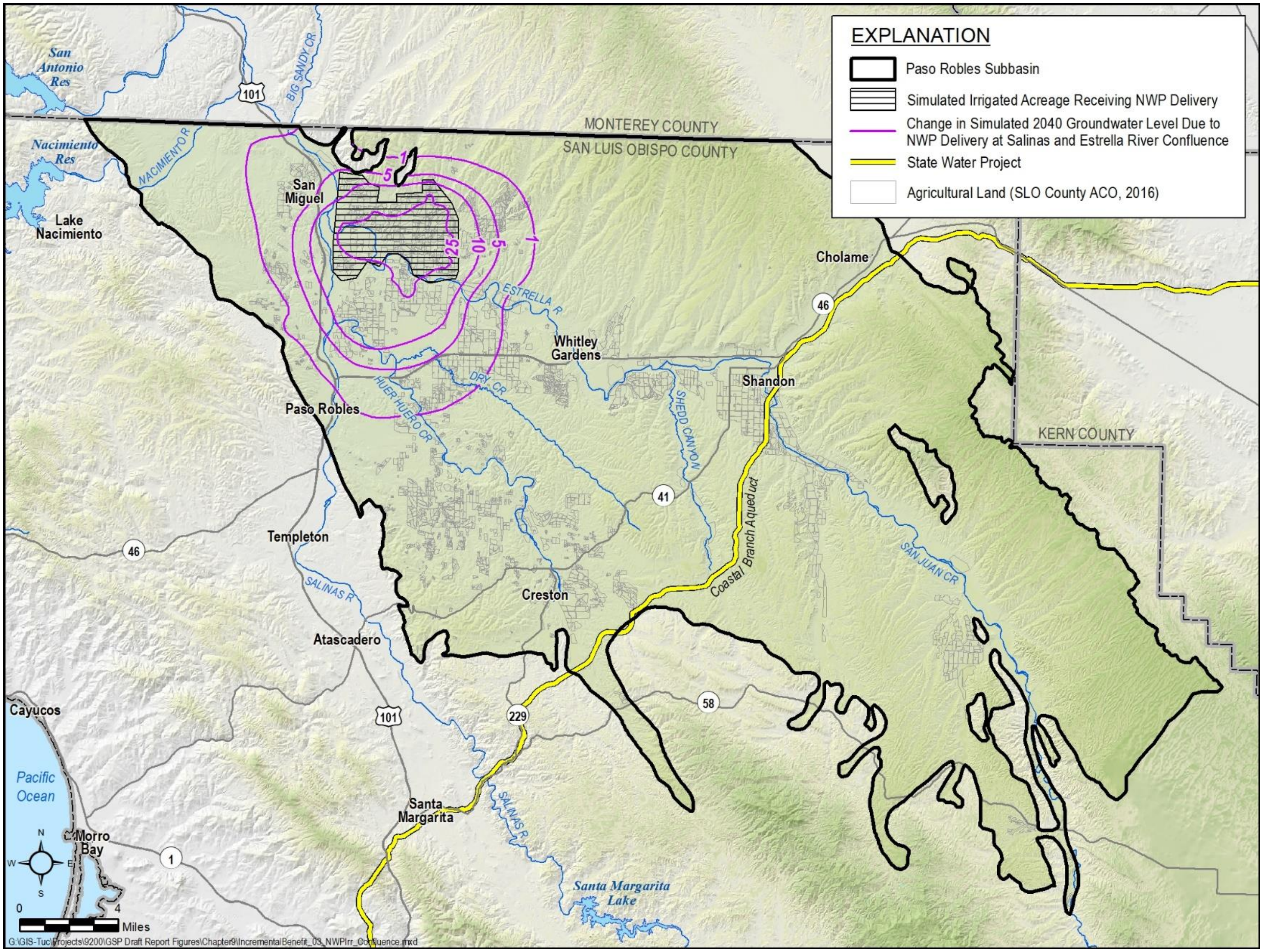


Figure 9-9. Groundwater Level Benefit of NWP Delivery at Salinas and Estrella River Confluence

Changes in groundwater elevation will be measured with the groundwater level monitoring program detailed in Chapter 7. Subsidence will be measured with InSAR data as detailed in Chapter 7. A direct correlation between in-lieu recharge and changes in groundwater levels may not be possible because this is only one among many management actions and projects that may be implemented in the Subbasin.

9.5.2.4.3 CIRCUMSTANCES FOR IMPLEMENTATION

All projects are implemented based on need, cost benefit studies and willing participants. The project to deliver water for in-lieu recharge near the Salinas and Estrella confluence will be initiated if, after five years, groundwater levels in the northern portion of the monitoring network continue to decline at unsustainable rates and willing participants agree to participate in the project. In particular, continued unsustainable groundwater level declines in monitoring wells 25S/12E-16K05, 25S/12E-26L01, and 25S/13E-08L02 will trigger implementation of this project. Additional triggers will be added as the monitoring well network expands.

9.5.2.4.4 IMPLEMENTATION SCHEDULE

The implementation schedule is presented on Figure 9-10~~Figure 9-10~~. The project will take 4 to 6 years to implement depending on the time required to negotiate procurement of NWP water. Conceptually, project implementation would occur in years 6 through 12 after GSP adoption.

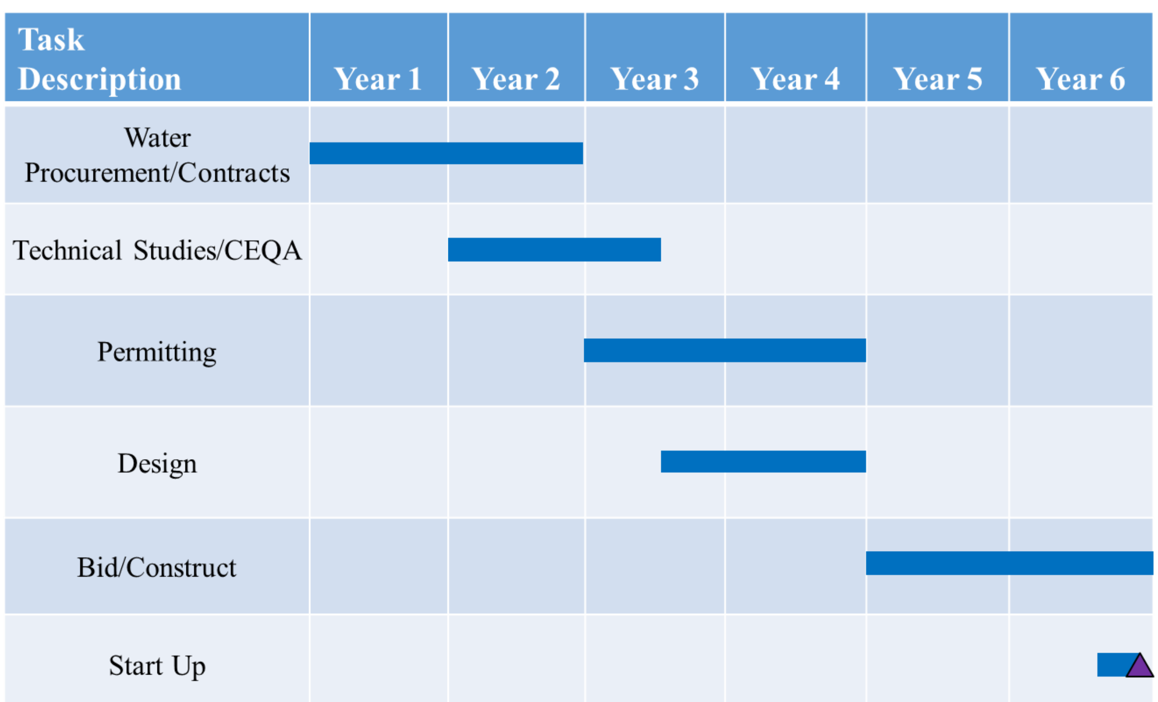


Figure 9-10. Implementation Schedule for NWP Delivery at Salinas and Estrella River Confluence

9.5.2.4.5 ESTIMATED COST

The estimated total project cost for this project is $50M. Annual O&M costs are estimated at $740,000. The average annual cost of NWP purchased water is estimated at $2.4M based on an average year delivery of 2,800 AFY. However, the unit price would need to be negotiated, and the actual amount of water available will vary year to year thereby affecting the actual annual purchase cost. O&M and water purchase costs would be covered by the overproduction surcharges. Based on a 30-year loan at a 5% interest rate, the cost of water for this project would be approximately $3,200/AF. Additional details regarding how costs were developed are included in Appendix J.

9.5.2.5 Preferred Project 4: NWP Delivery North of City of Paso Robles

This project provides up to 1,250 AFY of NWP water for direct delivery to agricultural water users north of the Paso Robles airport. On average, this project will provide 1,000 AFY of water for use in lieu of groundwater pumping in the region.

The general layout of this project and relevant monitoring wells are shown on Figure 9-11~~Figure 9-11~~. Infrastructure includes a new NWP turnout, 5.6 miles of pipeline, a 130 hp pump station, and one river crossing for the Salinas River. For more information on technical assumptions and cost assumptions, refer to Appendix J.

9.5.2.5.1 RELEVANT MEASURABLE OBJECTIVES

The measurable objectives benefiting from this project include:

- Groundwater elevation measurable objectives in the central portion of the Subbasin
- The groundwater storage measurable objective
- Land subsidence measurable objectives in the central portion of the Subbasin

9.5.2.5.2 EXPECTED BENEFITS AND EVALUATION OF BENEFITS

The primary benefit from in-lieu recharge using NWP water is higher groundwater elevations in the central portion of the Subbasin. Ancillary benefits of shallower groundwater elevations may include an increase in groundwater storage and avoiding pumping induced subsidence. The GSP model was used to quantify the expected benefit from this project. Figure 9-12~~Figure 9-12~~ shows the expected groundwater level benefit predicted by the GSP model after 10 years of project operation. Figure 9-12~~Figure 9-12~~ expresses the benefit as feet of groundwater. The groundwater level benefit shown on Figure 9-12~~Figure 9-12~~ is a measure of how much higher groundwater elevations are expected to be with the project rather than without the project.

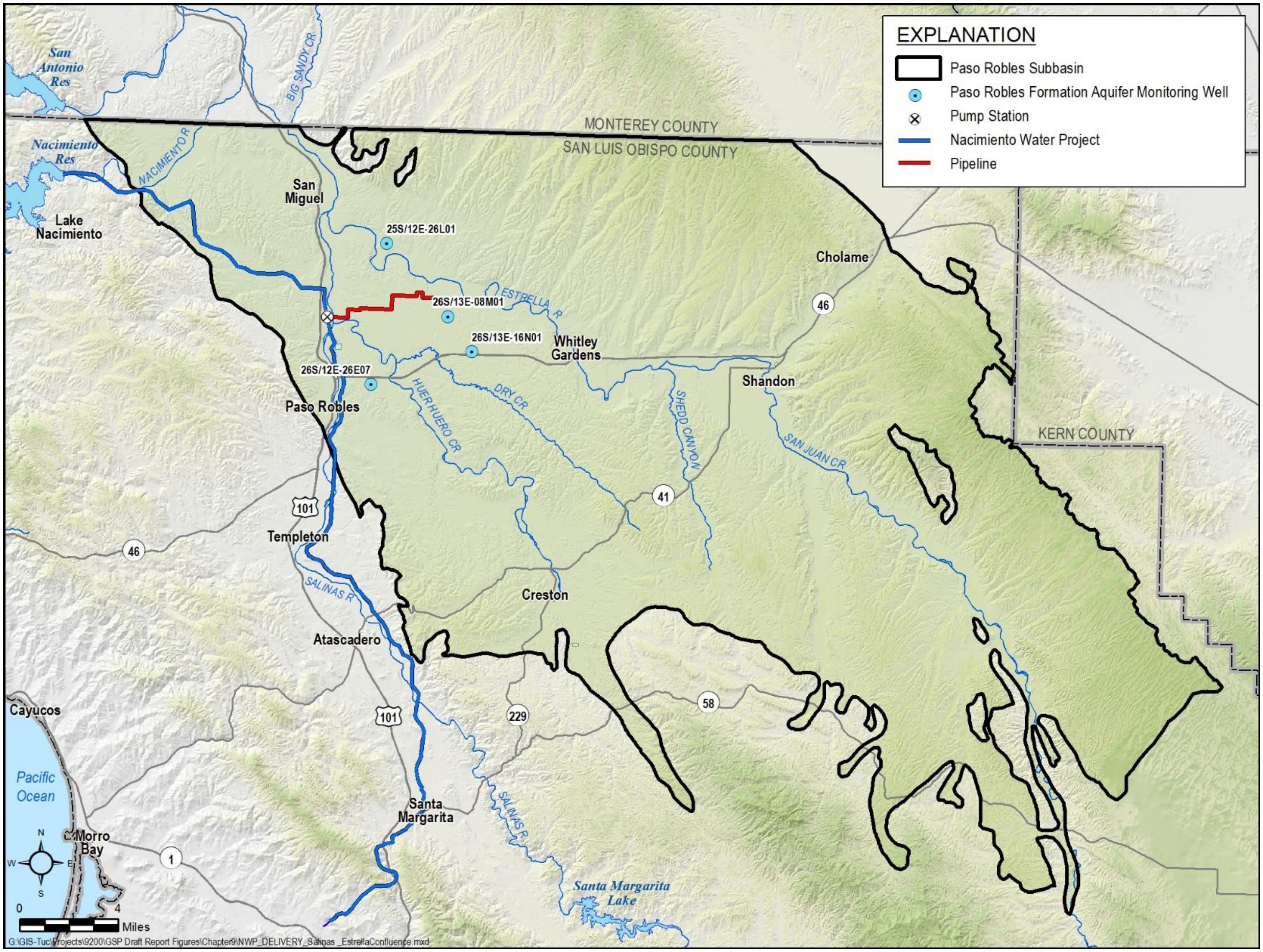


Figure 9-11. Conceptual NWP Delivery North of City of Paso Robles Project Layout

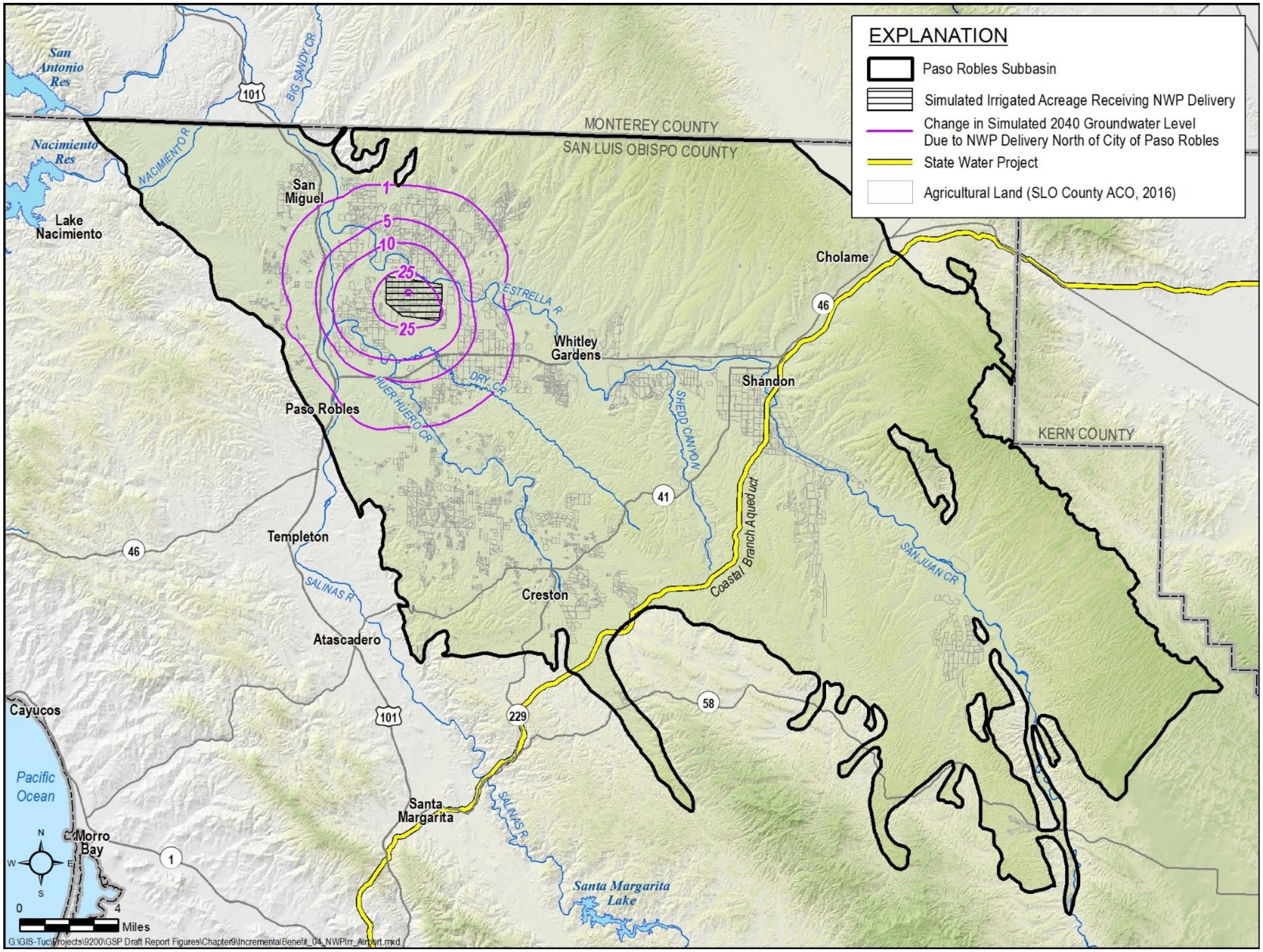


Figure 9-12. Groundwater Level Benefit from NWP Delivery North of City of Paso Robles

Changes in groundwater elevation will be measured with the groundwater level monitoring program detailed in Chapter 7. Subsidence will be measured with the InSAR network detailed in Chapter 7. A direct correlation between in-lieu recharge and changes in groundwater levels may not be possible because this is only one among many management actions and projects that may be implemented in the Subbasin.

9.5.2.5.3 CIRCUMSTANCES FOR IMPLEMENTATION

All projects are implemented based on need, cost benefit studies and willing participants. The project to deliver water for in-lieu recharge north of the airport will be initiated if, after five years, groundwater levels in the northern portion of the monitoring network continue to decline at unsustainable rates. In particular, continued unsustainable groundwater level declines in monitoring wells 26S/13E-08M01, 26S/13E-16N01, 25S/12E-26L01, and 26S/12E-26E07 will trigger implementation of this project. Additional triggers will be added as the monitoring well network expands.

9.5.2.5.4 IMPLEMENTATION SCHEDULE

The implementation schedule is presented on Figure 9-13~~Figure 9-13~~. The project will take 4 to 6 years to implement depending on the time required to negotiate procurement of NWP water. Conceptually, project implementation would occur in years 6 through 12 after GSP adoption.

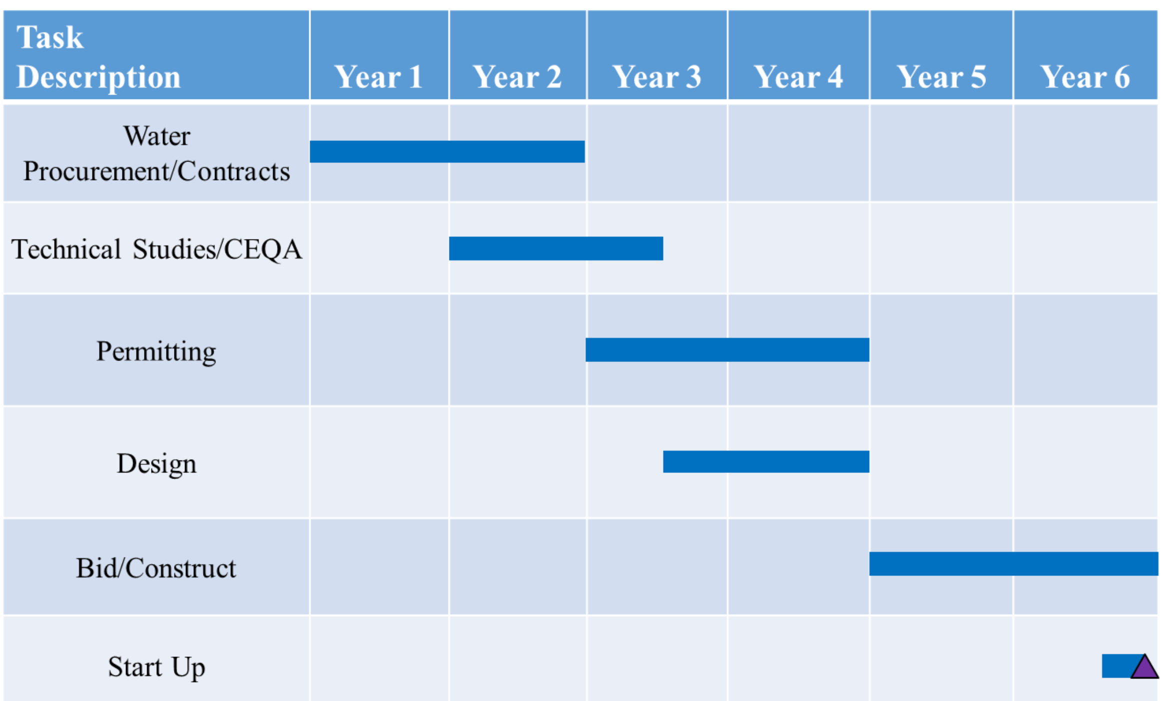


Figure 9-13. Implementation Schedule for NWP Delivery North of City of Paso Robles

9.5.2.5.5 Estimated Cost

The estimated total project cost for this project is $22M. Annual O&M costs are estimated at $150,000. The average annual cost of NWP purchased water is estimated at $1.2M based on an average year delivery of 1,000 AFY. However, the unit price would need to be negotiated, and the actual amount of water available will vary year to year thereby affecting the actual annual purchase cost. O&M and water purchase costs would be covered by the overproduction surcharges. Based on a 30-year loan at a 5% interest rate, the cost of water for this project would be approximately $2,800/AF. Additional details regarding how costs were developed are included in Appendix J.

9.5.2.6 Preferred Project 5: NWP Delivery East of City of Paso Robles

This project provides up to 2,500 AFY of NWP water to for direct delivery to agricultural water users east of the City of Paso Robles. On average, this project will provide 2,000 AFY of water for use in lieu of groundwater pumping in the region.

The general layout of this project and relevant monitoring wells are shown on Figure 9-Figure 9-14. Infrastructure includes a new NWP turnout, 5.6 miles of pipeline, a 130 hp pump station, and two river crossings one crossing of the Estrella River and one crossing of a tributary to the Estrella River. For more information on technical assumptions and cost assumptions, refer to Appendix J.

9.5.2.6.1 Relevant Measurable Objectives

The measurable objectives benefiting from this project include:

- Groundwater elevation measurable objectives in the central portion of the Subbasin
- The groundwater storage measurable objective
- Land subsidence measurable objectives in the central portion of the Subbasin

9.5.2.6.2 Expected Benefits and Evaluation of Benefits

The primary benefit from in-lieu recharge using NWP water is higher groundwater elevations in the central portion of the Subbasin. Ancillary benefits of shallower groundwater elevations may include an increase in groundwater storage and avoiding pumping induced subsidence. The GSP model was used to quantify the expected benefit from this project. Figure 9-Figure 9-15 shows the expected groundwater level benefit predicted by the GSP model after 10 years of project operation. Figure 9-Figure 9-15 expresses the benefit as feet of groundwater. The groundwater level benefit shown on Figure 9-Figure 9-15 is a measure of how much higher groundwater elevations are expected to be with the project rather than without the project.

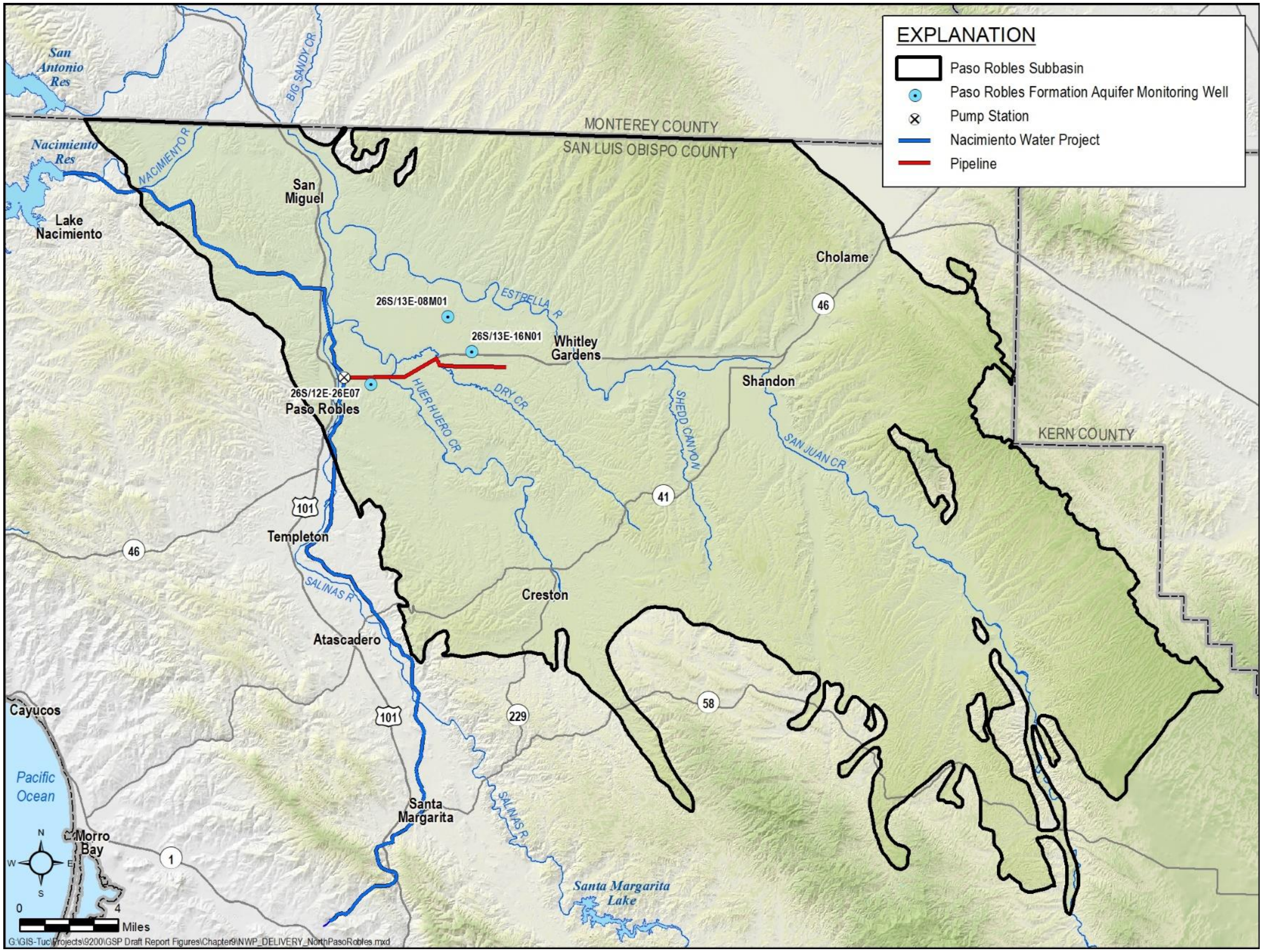


Figure 9-14. Conceptual NWP Delivery East of City of Paso Robles Project Layout

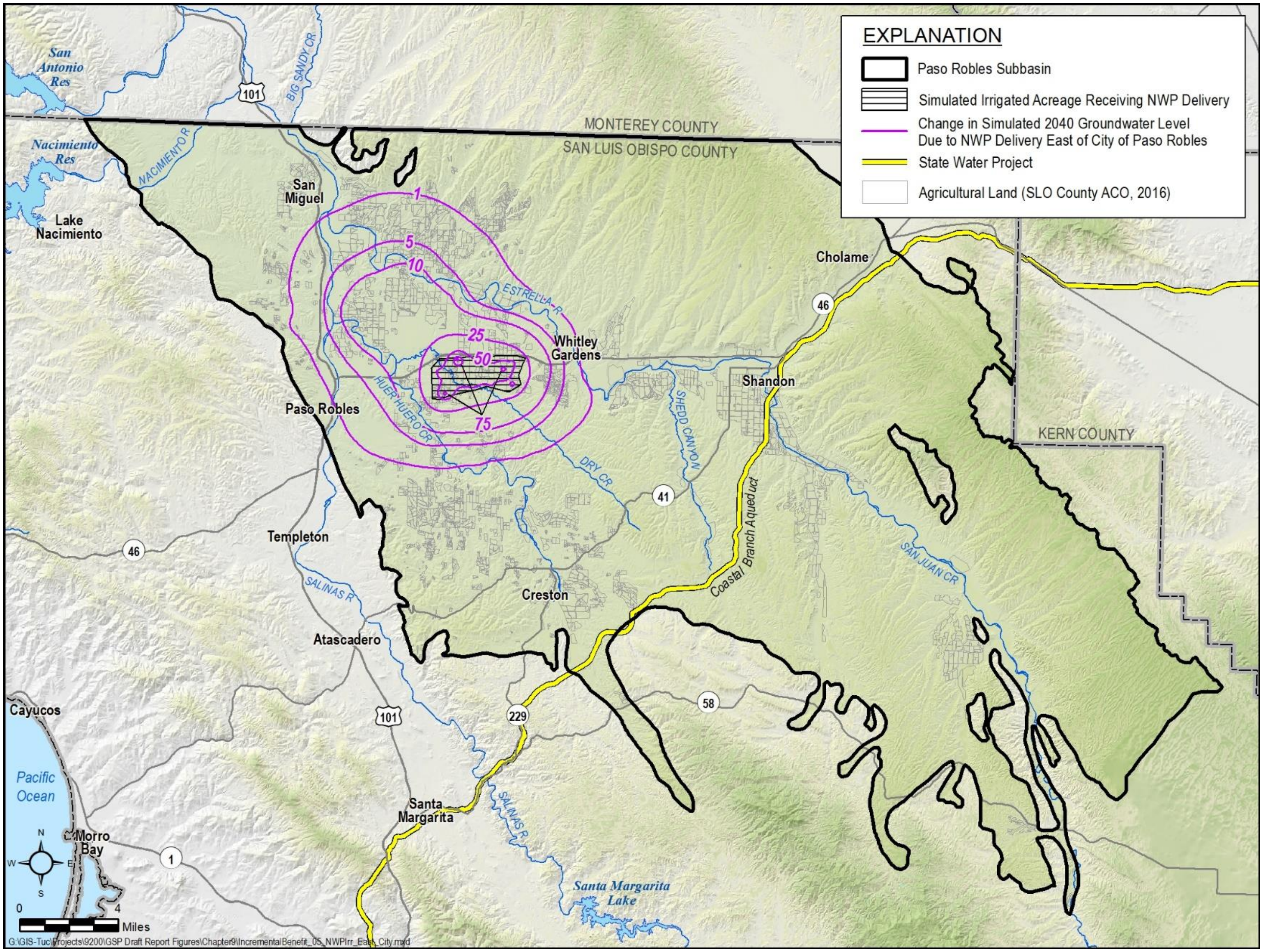


Figure 9-15. Groundwater Level Benefit from NWP Delivery East of City of Paso Robles

Changes in groundwater elevation will be measured with the groundwater level monitoring program detailed in Chapter 7. Subsidence will be measured with the InSAR network detailed in Chapter 7. A direct correlation between in-lieu recharge and changes in groundwater levels may not be possible because this is only one among many management actions and projects that may be implemented in the Subbasin.

9.5.2.6.3 Circumstances for Implementation

All projects are implemented based on need, cost benefit studies and willing participants. The project to deliver water for in-lieu recharge east of the City of Paso Robles will be initiated if, after five years, groundwater levels in the central portion of the monitoring network continue to decline at unsustainable rates. In particular, continued unsustainable groundwater level declines in monitoring wells 26S/13E-16N01, 26S/13E-08M01 and 26S/12E-26E07 will trigger implementation of this project. Additional triggers will be added as the monitoring well network expands.

9.5.2.6.4 Implementation Schedule

The implementation schedule is presented on Figure 9-~~Figure 9-16~~. The project will take 4 to 6 years to implement depending on the time required to negotiate procurement of NWP water. Conceptually, project implementation would occur in years 6 through 12 after GSP adoption.

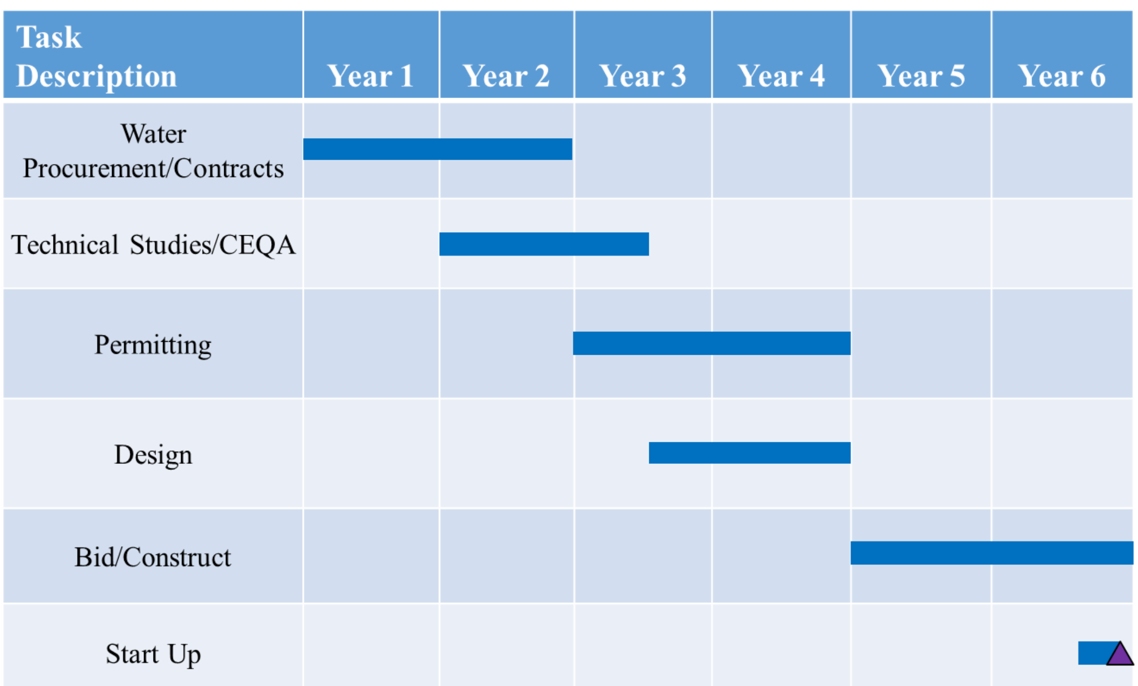


Figure 9-16. Implementation Schedule for NWP Delivery East of City of Paso Robles

9.5.2.6.5 ESTIMATED COST

The estimated total project cost for this project is $32M. Annual O&M costs are estimated at $380,000. The average annual cost of NWP purchased water is estimated at $2.4M based on an average year delivery of 2,000 AFY. However, the unit price would need to be negotiated, and the actual amount of water available will vary year to year thereby affecting the actual annual purchase cost. O&M and water purchase costs would be covered by the overproduction surcharges. Based on a 30-year loan at a 5% interest rate, the cost of water for this project would be approximately $2,400/AF. Additional details regarding how costs were developed are included in Appendix J.

9.5.2.7 Preferred Project 6: Expansion of Salinas Dam

SLOCFCWCD operates the Salinas Dam to provide water to the City of San Luis Obispo. The storage capacity of the lake is 23,843 AF; however, the City has existing water rights of 45,000 AF of storage. It is anticipated that funding would be sought to help the cost of retrofitting the dam and expanding the storage capacity by installing gates along the spillway in order to retain flood flow/stormwater for beneficial use. A risk assessment for the Dam is scheduled for the summer of 2019.

There may be opportunities to use the water from the expanded reservoir storage to benefit the Subbasin. One possibility would be to schedule summer releases from the storage to the Salinas River, which would benefit the Subbasin by recharging the basin through the Salinas River. Another way this project might indirectly benefit the Subbasin is if the City of San Luis Obispo were to use more of their Salinas River water allocation, thereby freeing up the NWP water for purchase by the GSAs.

9.5.2.7.1 RELEVANT MEASURABLE OBJECTIVES

The measurable objectives benefiting from this project include:

- Groundwater elevation measurable objectives in the central portion of the Subbasin
- The groundwater storage measurable objective
- Land subsidence measurable objectives in the central portion of the Subbasin

9.5.2.7.2 EXPECTED BENEFITS AND EVALUATION OF BENEFITS

The primary benefit from releasing additional water to the Salinas River during the summer is higher groundwater elevations along the Salinas River. Ancillary benefits of shallower groundwater elevations may include an increase in groundwater storage and avoiding pumping induced subsidence. The GSP model was used to quantify the expected benefit from this project. Figure 9-~~Figure 9-17~~ shows the expected groundwater level benefit predicted by the GSP model after 10 years of project operation. Figure 9-Figure 9-17 expresses the benefit as feet of groundwater. The groundwater level benefit shown on Figure 9-Figure 9-17 is a measure of how much higher groundwater elevations are expected to be with the project rather than without the project.

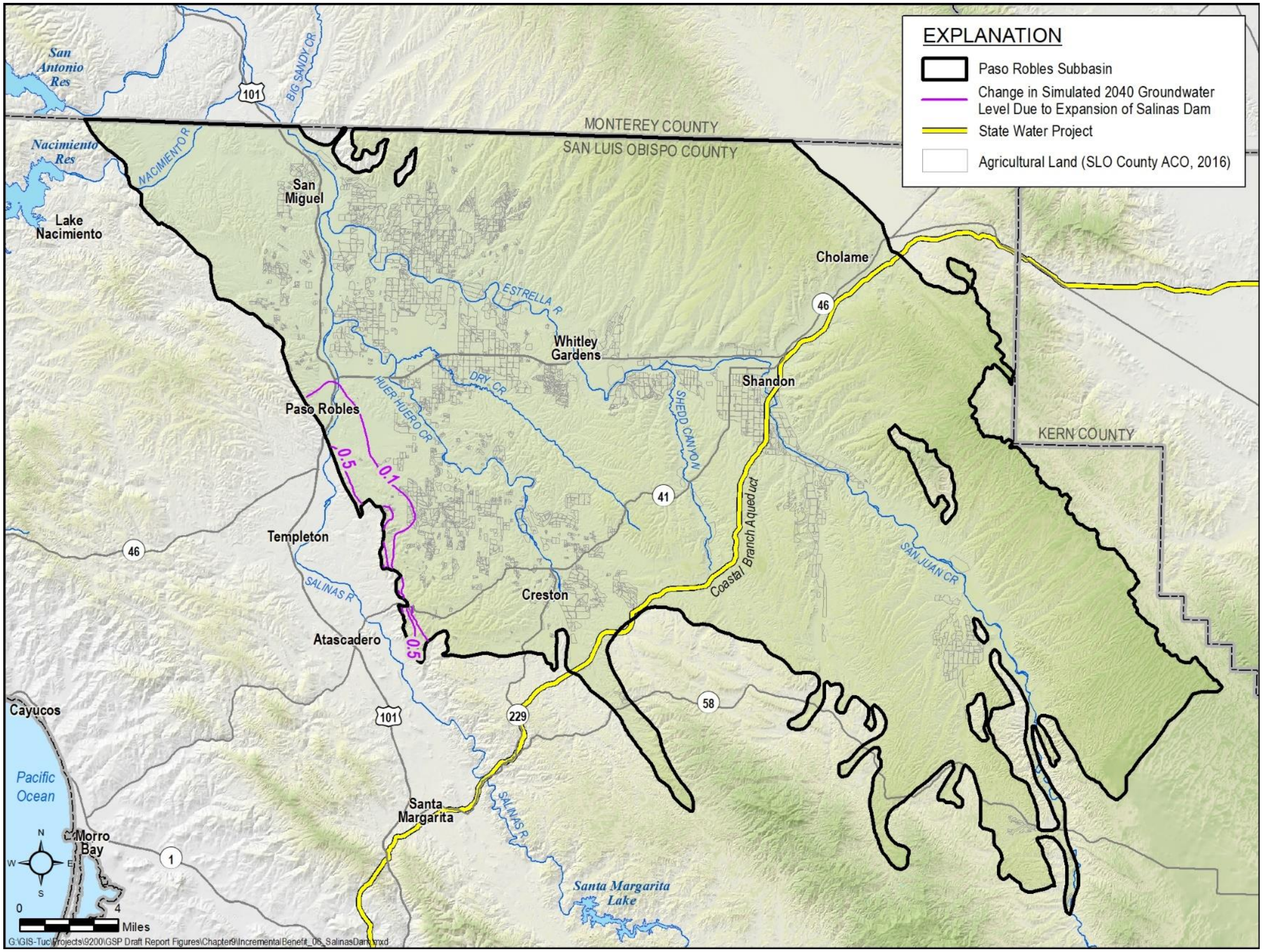


Figure 9-17. Groundwater Level Benefit from Salinas River Summer Releases

9.5.2.7.3 Circumstances for Implementation

All projects are implemented based on need, cost benefit studies and willing participants. The project to release Salinas River water during the summer will be initiated if, after two years, groundwater levels near the Salinas River continue to decline at unsustainable rates. In particular, continued unsustainable groundwater level declines in monitoring wells 25S/12E-16K05, 26S/13E-16N01, 27S/12E-13N01 and 27S/13E-30N01 will trigger implementation of this project. Additional triggers will be added as the monitoring well network expands.

9.5.2.7.4 Implementation Schedule

The implementation schedule is presented on Figure 9-Figure 9-18. The project will take 4 to 5 years to implement. Conceptually, project implementation would occur in years 3 through 8 after GSP adoption.

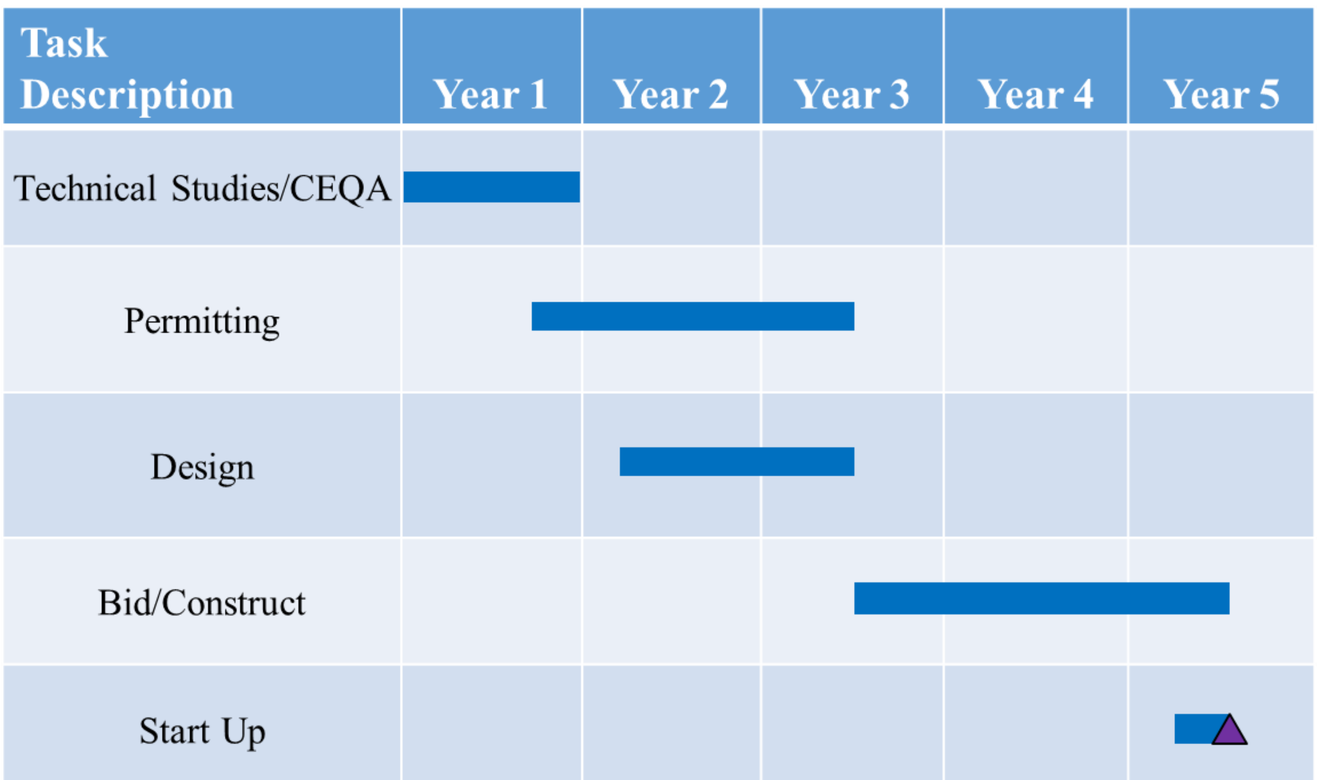


Figure 9-18. Implementation Schedule for Expansion of Salinas Dam

9.5.2.7.5 Estimated Cost

The cost to increase the storage capacity behind the Salinas Dam has been estimated at between $30M and $50M. O&M costs have not been estimated at this time. Some of these costs may be available from federal sources. No additional capital cost would be required to release water to the Salinas River for recharge during the summer months.

9.6 Other Groundwater Management Activities

Although not specifically funded or managed as part of implementing this GSP, a number of associated groundwater management activities will be promoted and encouraged by the GSAs as part of general good groundwater management practices.

9.6.1 Continue Urban and Rural Residential Conservation

Existing water conservation measures should be continued, and new water conservation measures promoted for residential users. Conservation measures may include the use of low flow toilet fixtures, or laundry-to-landscape greywater reuse systems. Conservation projects can reduce demand for groundwater pumping, thereby acting as in-lieu recharge.

9.6.2 Watershed Protection and Management

Watershed restoration and management can reduce stormwater runoff and improving stormwater recharge into the groundwater basin. While not easily quantified and therefore not included as projects in this document, watershed management activities may be worthwhile and benefit the basin.

9.6.3 Retain and Enforce the Existing Water Export Ordinance

This GSP recommends that San Luis Obispo County's existing groundwater export ordinance should be enforced and retained. With limited exception, the ordinance requires a permit for the movement of groundwater across the county or Subbasin line. To obtain a permit, the movement of groundwater cannot negatively impact a nearby overlying groundwater user, result in seawater intrusion, or result in a cone of depression greater than the landowner's property line. This ordinance will continue to protect the county's water supplies.

9.7 Demonstrated Ability to Attain Sustainability

To demonstrate the ability to attain sustainability, a groundwater management scenario that included both projects and management actions was modeled. The scenario included all of the conceptual projects listed in Section 9.5.2~~9.5.3~~. In addition to the conceptual projects, pumping was reduced to bring groundwater elevations to the measurable objectives before 2040 and maintain the same groundwater elevations through 2070.

The GSP model was adapted to simulate the scenario described above over the GSP implementation period from 2020 through 2040. The ability to achieve sustainability was quantified by comparing 2040 simulated groundwater levels under each of the two scenarios against the Measurable Objective surface – as described in Chapter 8 – for both the Paso Robles formation aquifer and the Alluvial aquifer.

Individual hydrographs comparing the predicted groundwater elevations to the measurable objectives at each representative monitoring site are included in Appendix K.

9.8 Management of Groundwater Extractions and Recharge and Mitigation of Overdraft

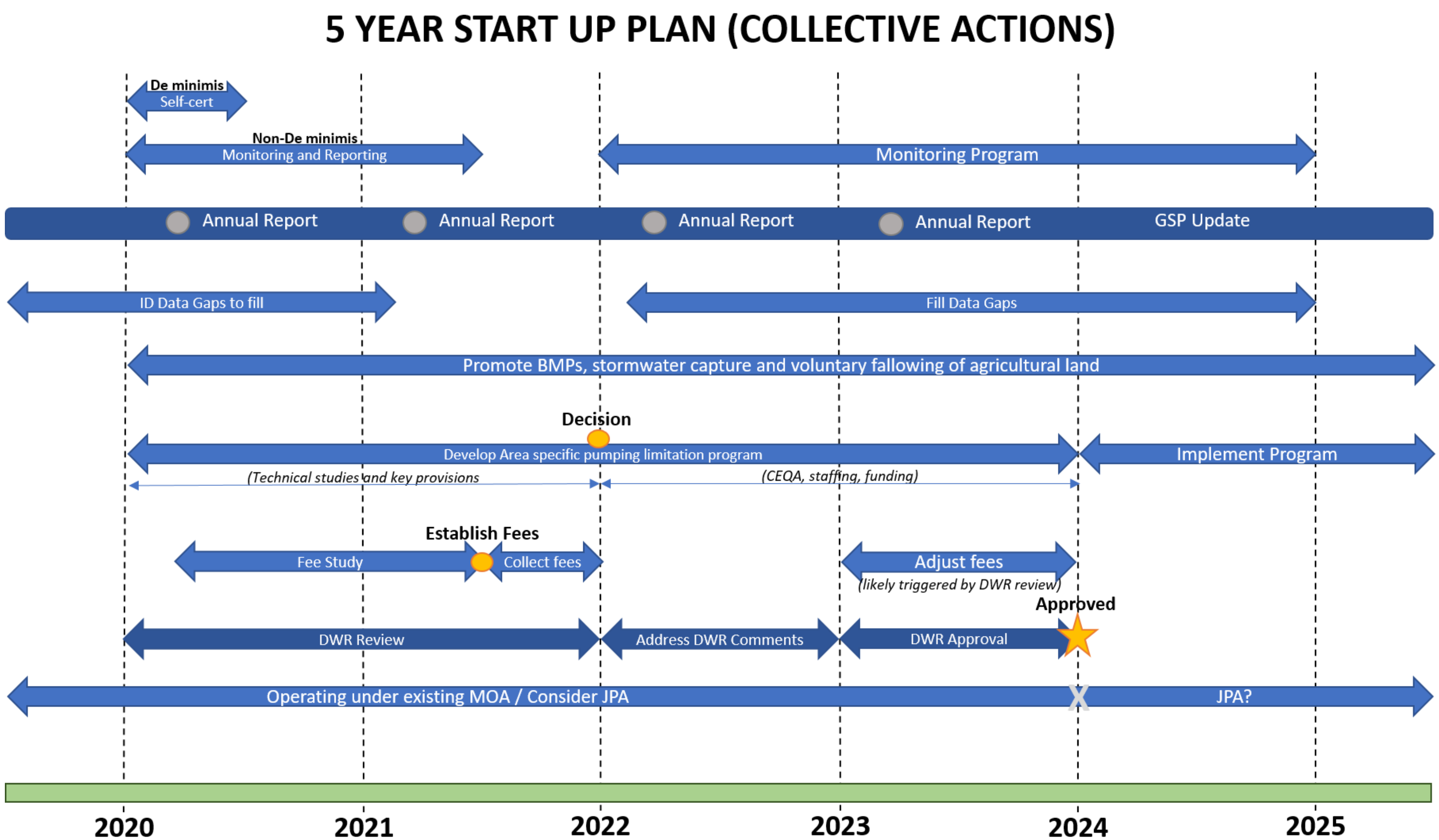
This GSP is specifically designed to mitigate the decline in groundwater storage and persistent groundwater level declines in certain areas with a combined program of management actions designed to promote voluntary reductions in pumping and provide authority for mandatory pumping limitations where necessary. Individual GSAs are also proceeding on projects designed to use recycled water, any available Nacimiento Project water and flood flow/stormwater in the Salinas River to use in lieu of pumping groundwater and/or to supplement groundwater supplies.

10 GROUNDWATER SUSTAINABILITY PLAN IMPLEMENTATION

This chapter is intended to serve as a conceptual roadmap for efforts to start implementing the GSP over the first five years and discusses implementation effects in accordance with SGMA regulations sections 354.8(f)(2) and (3). A general schedule showing the major tasks and estimated timeline is provided in **Error! Reference source not found.**~~Figure 10-1~~. Specific regulations guiding the content of this chapter were not developed by DWR.

The implementation plan provided in this chapter is based on current understanding of Subbasin conditions and anticipated administrative considerations that affect the management actions described in Chapter 9. Understanding of Subbasin conditions and administrative considerations will evolve over time based on future refinement of the hydrogeologic setting, groundwater flow conditions, and input from Subbasin stakeholders.

Implementation of the GSP requires robust administrative and financing structures, with adequate staff and funding to ensure compliance with SGMA. The GSP calls for GSAs to routinely provide information to the public about GSP implementation and progress towards sustainability and the need to use groundwater efficiently. The GSP calls for a website to be maintained as a communication tool for posting data, reports and meeting information. The website may also include forms for on-line reporting of information needed by the GSAs (e.g., annual pumping amounts) and an interactive mapping function for viewing Subbasin features and monitoring information.



JPA: Joint Powers Authority

Figure 10-1. General Schedule of 5-Year Start-Up Plan

10.1 Administrative Approach

GSAs will likely hire consultant(s) or hire staff to implement the GSP. If consultants are hired, it is anticipated that qualified professionals will be identified and hired through a competitive selection process. It is also anticipated that the lead GSA for a particular task will keep the other GSAs informed via periodic updates to the Cooperative Committee and the public. As needed, the GSAs would likely coordinate on the specific studies and analyses necessary to improve understanding of Subbasin conditions. The GSAs would likely then use new information on Subbasin conditions and projects to identify, evaluate, and/or improve management actions to achieve sustainability. This GSP calls for actions considered by the GSAs to be vetted through a public outreach process whereby groundwater pumpers and other stakeholders will have opportunities to provide input to the decision-making process.

10.2 Funding GSP Implementation

As summarized in **Error! Reference source not found.**~~Table 10-1~~, a conceptual planning-level cost of about $7,800,000 was estimated for planned activities during the first five years of implementation, or an estimated cost of $1,560,000 per year. This cost estimate reflects routine administrative operations, monitoring, public outreach, and the basin wide and area specific management actions outlined in Chapter 9. This estimate assumes a centralized approach to implementation and staffing, it does not include CEQA, legal staff costs, individual GSA staff costs or responding to DWR comments, nor does it include costs associated with any projects undertaken by willing entities.

The GSP calls for implementation to be covered under the terms of the existing MOA (see Chapter 12) among the four GSAs until DWR approves the GSP and a new or renewed GSA cooperative agreement is established. Consistent with current practice under the MOA, it is anticipated that an annual operating budget will be established that is considered for approval by each GSA. This budget information and management action details would be used to conduct a fee study for purposes of developing a groundwater pumping fee to cover the costs of implementing the regulatory program described in the GSP including, but not limited to, costs related to monitoring and reporting, hydrogeologic studies, pumping reduction enforcement where necessary, and public outreach.

The GSAs plan to conduct focused public outreach and hold meetings to educate and solicit input on the proposed fee structure and plan to begin developing the fee structure as soon as administratively feasible after GSP adoption. Establishing a funding structure is estimated to cost $250,000.

California Water Code Sections 10730 and 10730.2 provide GSAs with the authority to impose certain fees, including fees on groundwater pumping. Any imposition of fees, taxes or other charges would need to follow the applicable protocols outlined in the above sections and all applicable Constitutional requirements based on the nature of the fee. Such protocols would likely include public outreach, notification of all property owners, and at least one public hearing where the opinions and concerns of all parties are heard and considered before the GSAs make a determination to proceed with a fee or other charge. It is assumed that any fee structure adopted by the individual GSAs would be adopted by resolution or ordinance and would be identical in all material respects, i.e. with respect to levels and classes of uses. As part of or in conjunction with the feasibility study and in order to reduce the risk of a legal challenge, the GSAs plan to obtain the legal advice necessary to ensure that the proposed fee is consistent with all applicable legal requirements and rights.

With respect to those pumpers that are not anticipated to be subject to the fee, the GSAs plan to develop a program pursuant to which such pumpers will be required to self-certify that they only pump for domestic purposes and use less than 2 AFY.

Table 10-1. Estimated Planning-Level Costs for First Five Years of Implementation[1]

GSP Implementation Activity	Description	Estimated Costs	Cost Unit	Anticipated Timeframe	Estimated Costs During Startup (2020-2025)
Administration and Finance					
Administration development	Update agreements; hire staff (GSP manager and staff); update website; conduct public outreach and meeting protocols	$ 100,000	lump sum	Quarters 1-2, 2020	$ 100,000
Ongoing GSP implementation administration	Routine operating costs (salaries, office space, equipment, etc.)	$ 500,000	annual	Starting in 2020	$ 2,500,000
Fee study for GSP implementation	Study to develop and justify funding mechanism for GSP implementation	$ 250,000	lump Sum	Quarter 2, 2020 through Quarter 2, 2021	$ 250,000
Basin-wide Management Actions					
Monitoring, reporting & outreach					
De minimis self certification	Evaluate existing programs; develop new program for GSP	$ 30,000	lump sum	Quarters 1-2, 2020	$ 30,000
Non-de minimis metering & reporting program	Develop new metering and reporting program, land fallowing/project accounting	$ 100,000	lump sum	Quarters 1-2, 2020	$ 100,000
Annual reports	Collect and analyze groundwater level data; apply groundwater lelvel - storage proxy, evaluate water quality data, download and evaluate land subsidence data; update data management system (DMS); maintain monitoring network infrastructure; prepare and submit annual report to DWR	$ 250,000	annual	Starting in 2020	$ 1,250,000
Data gaps					
Supplemental hydrogeologic study	Refine hydrologeologic conceptual model; address data gaps	$ 300,000	lump sum	2020 to 2024	$ 300,000
Monitoring networks - groundwater levels					
Verify network	Verify proposed network	$ 30,000	lump sum	Quarters 1-2, 2020	$ 30,000
Expand network - add existing wells	Identify/inspect wells, video-logging, access agreements	$ 100,000	lump sum	Quarters 1-2, 2020	$ 100,000
Expand network - drill new wells	Add new wells in key data gap areas	$ 100,000	per well	Quarters 1-2, 2020	$ 500,000
Monitoring networks - groundwater storage					
Develop groundwater level - storage proxy	Quantiative relationship between changes in groundwater level, changes in storage, and amount of groundwater pumping	$ 50,000	lump sum	Quarters 3-4, 2020	$ 50,000
Monitoring networks - water quality					
Verify network	Verify proposed network	$ 20,000	lump sum	2020 to 2024	$ 20,000
Monitoring networks - land subsidence					
Verify network	Verify proposed network	$ 20,000	lump sum	2020 to 2024	$ 20,000
Monitoring networks - interconnected surface water					
Conduct surface water/groundwater investigation	Focused surface and groundwater investigations in areas of ptentailly interconnectivity; conduct monitoring; cost depends on avaailabiltiy of existing wells and number of new wells needed; cost assumes 5 new wells needed	$ 400,000	lump sum	2020 to 2024	$ 400,000
5-year GSP updates & amendments					
GSP assessment and reporting	Prepare report/amend GSP	$ 300,000	lump sum	2023 to 2024	$ 300,000
Groundwater modeling	Refine, update, and recalibrate groundwater model	$ 250,000	lump sum	2023	$ 250,000
Promoting					
Best water use practices	Costs included in monitoring, reporting and outreach for ongoing GSP implementation				
Stormwater capture					
Voluntary fallowing of agricultural land					
Area Specific Management Actions					
Mandatory pumping limitations in specific areas					
Baseline pumping determination	Develop structure; public outreach; meetings; legal fees	$ 350,000	lump sum	2020 to 2022	$ 350,000
Pumping limitations determination					
Timeline established for pumping limitations					
Pumping limitations regulations approval process					
Regulation implementation	Oversight and enforcement	$ 250,000	annual	Starting in 2020	$ 1,250,000
				Total Estimated Costs during Startup (2020-2025)	**$ 7,800,000**
				Average Annual Estimated Costs during Startup (2020-2025)	**$ 1,560,000**

[1] This estimate assumes a centralized approach to implementation and staffing, it does not include CEQA, legal staff costs, individual GSA staff costs or responding to DWR comments, nor does it include costs associated with any projects undertaken by willing entities.

10.3 Plan Implementation Effects on Existing Land Use

Given that implementation of the GSP will likely result in the adoption of regulations limiting or suspending extractions pursuant to the authority granted by SGMA, implementation of the GSP is likely to have an impact on land uses. However, all such regulations will need to be consistent with the applicable statutory constraints, including those described in Water Code Section 10726.4(a)(2) which provides that such regulations shall be consistent with the applicable elements of the city or county general plan, unless there is insufficient sustainable yield in the basin to serve a land use designated in the city or county general plan and Water Code Section 10726.8(f) which states that nothing contained in SGMA or in a GSP shall be interpreted as superseding the land use authority of cities and counties.

10.4 Plan Implementation Effects on Water Supply

Plan implementation will not significantly alter the existing water supply of the Subbasin. If entities opt to develop optional water supply projects as outlined in Chapter 9, the Subbasin's water supply could increase.

10.5 Plan Implementation Effects on Local and Regional Economy

Plan implementation will potentially limit economic growth due to pumping reductions outlined in Chapter 9. Pumping reductions could limit or reduce agricultural output, thereby reducing regional income.

11 NOTICE AND COMMUNICATION

This chapter and the Communications and Engagement (C&E) Plan in Appendix M describe the notification and communication with interested parties and stakeholders in the Subbasin regarding the GSP. The information presented is prepared in accordance with the SGMA Regulations §354.10 to provide a description of beneficial uses, a list of public meetings, and comments and a summary of responses. It also contains a communication section with an explanation of the decision-making process, identification of opportunities for public engagement, a description of outreach to diverse populations, and the method for keeping the public updated about the plan and related activities. These requirements are met by the Communications and Engagement (C&E) Plan that is included in Appendix M. Public comments received and provided by the GSAs are listed in Appendix N. Table 11-1~~Table 11-1~~ lists the specific regulatory and statutory requirements for notice and communication and refers to sections of the C&E Plan.

The plan was written early in the process of GSP development as a stand-alone document to guide notice and communication throughout GSP development. The C&E Plan was presented to and accepted as "receive and file" by the Cooperative Committee on July 25, 2018. Table 11-1

Table 11-2Table 11-2 lists public meetings that were held after July 2018.

Table 11-1. Requirements of Statutes and Regulations Pertaining to Notice and Communications

Legislative / Regulatory Requirement	Legislative / Regulatory Section Reference	C&E Plan Section
Publish public notices and conduct public meetings when establishing a GSA, adopting or amending a GSP, or imposing or increasing a fee.	SGMA Sections 10723(b), 10728.4, and 10730(b)(1).	**7.0**
Maintain a list of, and communicate directly with, interested parties.	SGMA Sections 10723.4, 10730(b)(2), and 10723.8(a)	**4.0**
Consider the interests of all beneficial uses and users of groundwater.	SGMA Section 10723.2	**4.0**
Provide a written statement describing how interested parties may participate in plan [GSP] development and implementation, as well as a list of interested parties, at the time of GSA formation.	SGMA Sections 10723.8(a) and 10727.8(a)	**4.0**
Encourage active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin.	SGMA Section 10727.8(a)	**7.0**
Understand that any federally recognized Indian Tribe may voluntarily agree to participate in the planning, financing, and management of groundwater basins – refer to DWR's Engagement with Tribal Governments Guidance Document for Tribal recommended communication procedures.	SGMA 10720.3(c)	**7.0**
Description of beneficial uses and users of groundwater in the basin	GSP Regulations §354.10	**3.0**
List of public meetings at which the Plan [GSP] was discussed or considered	GSP Regulations §354.10	**Error! Not a valid result for table.~~Table 11-2~~**
Comments regarding the Plan [GSP] received by the Agency and a summary of responses	GSP Regulations §354.10	**N/A at time of publication**
A communication section that includes the following:	GSP Regulations §354.10	
Explanation of the Agency's decision-making process	GSP Regulations §354.10	**4.0**
Identification of opportunities for public engagement and discussion of how public input and response will be used	GSP Regulations §354.10	**7.0**
Description of how the Agency encourages active involvement of diverse social, cultural, and economic elements of the population within the basin	GSP Regulations §354.10	**7.0**
The method the Agency will follow to inform the public about progress implementing the Plan [GSP], including the status of projects and actions	**GSP Regulations §354.10**	**7.0**

Table 11-2. Public Meetings at which the GSP Was Discussed

Type of Meeting	Location	Date
City of Paso Robles		
GSA Formation Public Hearing	Paso Robles City Hall	**Jan 17, 2017**
Todd Groundwater Contract for Pre-GSP Planning	Paso Robles City Hall	**April 4, 2017**
GSA/GSP Funding	Paso Robles City Hall	**June 6, 2017**
Paso Basin MOA	Paso Robles City Hall	**Aug 15, 2017**
Paso Basin MOA Appointments	Paso Robles City Hall	**Sept 7, 2017**
Paso Basin Prop 1 Grant Application	Paso Robles City Hall	**Oct 17, 2017**
GSA Notice of Intent to Prepare GSP	Paso Robles City Hall	**Jan 6, 2018**
GSP Contract Award to HydroMetrics	Paso Robles City Hall	**March 20, 2018**
GSA Review of GSP Draft Chapters 1-4 and 11	Paso Robles City Hall	**Oct 16, 2018**
GSA Review of GSP Draft Chapters 5-8	Paso Robles City Hall	**April 16, 2019**
GSA Review of GSP Draft Chapters 9-12	Paso Robles City Hall	**June 18, 2019**
GSA Increase to GSP Budget	Paso Robles City Hall	**Aug 6, 2019**
Adoption of GSP Public Hearing	Paso Robles City Hall	**Dec 17, 2019**
Adoption of Revised GSP Public Hearing	Paso Robles City Hall and Zoom	**Jun 21, 2022**
County of San Luis Obispo		
County Board of Supervisors	County Government Center	**May 16, 2017**
County Board of Supervisors	County Government Center	**Aug 22, 2017**
County Board of Supervisors	County Government Center	**Feb 6, 2018**
County Board of Supervisors	County Government Center	**March 6, 2018**
County Board of Supervisors	County Government Center	**June 19, 2018**
County Board of Supervisors	County Government Center	**Oct 2, 2018**
County Board of Supervisors	County Government Center	**Dec 4, 2018**
County Board of Supervisors	County Government Center	**Feb 26, 2019**
County Board of Supervisors	County Government Center	**April 9, 2019**
County Board of Supervisors	County Government Center	**June 18, 2019**
County Board of Supervisors	County Government Center	**Aug 20, 2019**
County Board of Supervisors	County Government Center	**Oct 22, 2019**
County Board of Supervisors	County Government Center	**Nov 5, 2019**
County Board of Supervisors	County Government Center	**Nov 19, 2019**
County Board of Supervisors	County Government Center	**Dec 17, 2019**
County Board of Supervisors	County Government Center and Zoom	**Jul 20, 2022**
Paso Robles Subbasin Cooperative Committee		
Cooperative Committee Meeting	EOC Main Conference Room	**Oct 18, 2017**
Cooperative Committee Meeting	Courtyard by Marriott	**Oct 25, 2017**
Cooperative Committee Meeting	EOC Main Conference Room	**Dec 6, 2017**
Cooperative Committee Meeting	Hampton Inn & Suites	**Feb 14, 2018**
Cooperative Committee Meeting	Paso Robles City Hall	**March 7, 2018**
Cooperative Committee Meeting	Paso Robles City Hall	**April 25, 2018**
Cooperative Committee Meeting	Paso Robles City Hall	**July 25, 2018**
Cooperative Committee Special Meeting	Paso Robles City Hall	**Sept 12, 2018**

Type of Meeting	Location	Date
~~Public Workshop: Sustainable Management Criteria~~	~~Kermit King Elementary School~~	~~Oct 4, 2018~~
~~Public Workshop: Sustainable Management Criteria~~	~~Creston Elementary School~~	~~Oct 8, 2018~~
Paso Robles Subbasin Cooperative Committee (continued)		
Public Workshop: Sustainable Management Criteria	Kermit King Elementary School	**Oct 4, 2018**
Public Workshop: Sustainable Management Criteria	Creston Elementary School	**Oct 8, 2018**
Cooperative Committee Regular Meeting	Paso Robles City Hall	**Oct 17, 2018**
Cooperative Committee Special Meeting	Paso Robles City Hall	**March 6, 2019**
Cooperative Committee Regular Meeting	Paso Robles City Hall	**April 24, 2019**
Cooperative Committee Special Meeting	Paso Robles City Hall	**May 22, 2019**
Cooperative Committee Regular Meeting	Paso Robles City Hall	**July 24, 2019**
Cooperative Committee Special Meeting	Paso Robles City Hall	**Aug 21, 2019**
Cooperative Committee Regular Meeting	Paso Robles City Hall	**Oct 23, 2019**
Cooperative Committee Special Meeting	Paso Robles City Hall	**Nov 20, 2019**
Cooperative Committee Special Meeting	Zoom	**Sep 23, 2020**
Cooperative Committee Special Meeting	Zoom	**Nov 18, 2020**
Cooperative Committee Special Meeting	Zoom	**Jan 27, 2021**
Cooperative Committee Special Meeting	Zoom	**Mar 17, 2021**
Cooperative Committee Special Meeting	Zoom	**Apr 28, 2021**
Cooperative Committee Special Meeting	Zoom	**Jul 21, 2021**
Cooperative Committee Special Meeting	Zoom	**Jul 27, 2021**
Cooperative Committee Special Meeting	Zoom	**Oct 27, 2021**
Cooperative Committee Special Meeting	Zoom	**Jan 26, 2022**
Cooperative Committee Special Meeting	Zoom	**Mar 4, 2022**
Cooperative Committee Special Meeting	Paso Robles City Hall and Zoom	**Mar 17, 2022**
Cooperative Committee Special Meeting	Paso Robles City Hall and Zoom	**Apr 27, 2022**
San Miguel Community Services District		
2018 GSP Meeting	SMCS District office	**June 28, 2018**
2018 GSP Meeting	SMCS District office	**Aug 23, 2018**
2018 GSP Meeting	SMCS District office	**Sept 27, 2018**
2018 GSP Meeting	SMCS District office	**Oct 25, 2018**
2019 GSP Meeting	SMCS District office	**Jan 24, 2019**
2019 GSP Meeting	SMCS District office	**March 28, 2019**
2019 GSP Meeting	SMCS District office	**April 25, 2019**
2019 GSP Meeting	SMCS District office	**May 21, 2019**
2019 GSP Meeting	SMCS District office	**July 25, 2019**
2019 GSP Meeting	SMCS District office	**Aug 22, 2019**
2019 GSP Meeting	SMCS District office	**Sept 26, 2019**
2019 GSP Meeting	SMCS District office	**Oct 24, 2019**
2019 GSP Meeting	SMCS District office	**Nov 21, 2019**
2019 GSP Meeting	SMCS District office	**Dec 19, 2019**
Revised GSP Adoption Hearing	SMCS District office	**Jun 23, 2022**
Shandon-San Juan Water District		

Type of Meeting	Location	Date
SSJWD Board Meeting	Shandon High School Library	**Aug 15, 2017**
SSJWD Board Meeting	Shandon High School Library	**Sept 19, 2017**
Shandon-San Juan Water District (continued)		
Shandon Advisory Groundwater Update	Shandon Park	**Oct 4, 2017**
SSJWD Board Meeting	Shandon High School Library	**Oct 17, 2017**
SSJWD Board Meeting	Shandon High School Library	**Nov 15, 2017**
Shandon Advisory Groundwater Update	Shandon Park	**Feb 7, 2018**
SSJ GSA GSP Board meeting	Shandon High School Library	**Feb 20, 2018**
Shandon Advisory Groundwater Update	Shandon Park	**March 7, 2018**
SSJ GSA GSP Board meeting	Shandon High School Library	**March 27, 2018**
SSJ GSA GSP Board meeting	Shandon High School Library	**May 15, 2018**
SSJ GSA GSP Board meeting	Shandon High School Library	**June 19, 2018**
SSJ GSA GSP Board meeting	Shandon High School Library	**July 17, 2018**
Shandon Advisory Groundwater Update	Shandon Park	**Aug 1, 2018**
SSJ GSA GSP Board meeting	Shandon High School Library	**Aug 21, 2018**
Shandon Advisory Groundwater Update	Shandon Park	**Sept 5, 2018**
SSJ GSA GSP Special Board meeting	Windfall Farms Creston	**Sept 18, 2018**
Shandon Advisory Groundwater Update	Shandon Park	**Oct 3, 2018**
SSJ GSA GSP Board meeting	Shandon High School Library	**Oct 16, 2018**
~~Shandon-San Juan Water District (continued)~~		
Shandon Advisory Groundwater Update	Shandon Park	**Nov 7, 2018**
SSJ GSA GSP Board meeting	Shandon High School Library	**Nov 14, 2018**
SSJ GSA GSP Board meeting	Shandon High School Library	**Dec 11, 2018**
SSJ GSA GSP Board meeting	Shandon High School Library	**Jan 15, 2019**
SSJ GSA GSP Board meeting	Shandon High School Library	**Feb 19, 2019**
SSJ GSA GSP Special Board meeting	J Lohr Wine Center Paso Robles	**March 19, 2019**
SSJ GSA GSP Special Board meeting	J Lohr Wine Center Paso Robles	**April 9, 2019**
Shandon Advisory Groundwater Update	Shandon Park	**May 1, 2019**
SSJ GSA GSP Special Board meeting	J Lohr Wine Center Paso Robles	**May 7, 2019**
SSJ GSA GSP Board meeting	Shandon High School Library	**June 18, 2019**
SSJ GSA GSP Special Board meeting	Paso Robles Wine Services Paso Robles	**July 8, 2019**
SSJ GSA GSP Board meeting	Paso Robles Wine Services Paso Robles	**Aug 27, 2019**
SSJ GSA GSP Special Board meeting	Sunny Slope Lodge Shandon	**Sept 5, 2019**
SSJ GSA GSP Board meeting	Sunny Slope Lodge Shandon	**Sept 17, 2019**
SSJ GSA GSP Board meeting	Sunny Slope Lodge Shandon	**Oct 15, 2019**
SSJ GSA GSP Board meeting	Sunny Slope Lodge Shandon	**Nov 21, 2019**
SSJ GSA GSP Adoption Hearing	Sunny Slope Lodge Shandon	**Jun 22, 2022**

12 MEMORANDUM OF AGREEMENT

The GSAs will operate under the existing MOA until DWR approves the GSP. The existing MOA is included in Appendix A. During DWR's review process, the GSAs will consider developing a refined governance structure to implement the GSP. The governance structure would be established in a new agreement between the GSAs. The agreement would outline details and responsibilities for GSP administration among the participating entities and may include provisions to establish a new governing body to oversee GSP implementation.

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